

z/VM



CP Planning and Administration

Version 6 Release 3

Note:

Before using this information and the product it supports, read the information in "Notices" on page 871.

This edition applies to version 6, release 3, modification 0 of IBM z/VM (product number 5741-A07) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About This Document

This document tells you how to plan and administer the IBM® z/VM® Control Program (CP). It describes the following tasks:

- System configuration planning and administration
- User planning and administration
- Storage planning and administration

Note: For information about planning your hardware and software I/O configuration, see *z/VM: I/O Configuration*. For information about planning and using saved segments, see *z/VM: Saved Segments Planning and Administration*.

Planning and administration are tasks that overlap. Before you install z/VM, you need to plan:

- What the processor and device configuration will be
- What z/VM functions the system will use
- Which guest operating systems will be used
- How much storage will be required
- What sort of user environments will be available.

During system generation, you will set the proper parameters in the system to implement your plan. Later, after the system is running, you will want to change some of these parameters as conditions change; for example, when new users are allowed access to the system and new devices are brought online. You will also want to monitor the performance of the system and perhaps change tuning parameters to make it run more efficiently.

A good example of the overlap between planning and administration is the user directory. The user directory is a file that identifies each user on the system and contains directory statements that define the environment each user works under. Initially, you will set up this directory for the known users of the system. Later, as new users are given access to the system and others are removed, you will have to update the directory.

Some information provided here is based on the experiences of IBM customers. The recommendations in this document are meant to help installations run operating systems efficiently under z/VM.

Intended Audience

This document is for anyone responsible for planning, installing, and updating a z/VM system.

The reader is expected to have a general understanding of data processing and teleprocessing techniques. This document assumes you have thought about:

- What z/VM functions your site requires.
- What connections you need to other sites and the implications for coordination.
- What your hardware and physical requirements are and the implications for coordination.
- Which guest operating systems you will be running.

- How many users you are going to have and under what sort of environment they will be running their applications.





Syntax, Message, and Response Conventions

The following topics provide information on the conventions used in syntax diagrams and in examples of messages and responses.



How to Read Syntax Diagrams




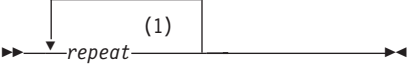






Special diagrams (often called *railroad tracks*) are used to show the syntax of external interfaces.

To read a syntax diagram, follow the path of the line. Read from left to right and top to bottom.

- The  symbol indicates the beginning of the syntax diagram.
- The  symbol, at the end of a line, indicates that the syntax diagram is continued on the next line.
- The  symbol, at the beginning of a line, indicates that the syntax diagram is continued from the previous line.
- The  symbol indicates the end of the syntax diagram.

Within the syntax diagram, items on the line are required, items below the line are optional, and items above the line are defaults. See the following examples.

Syntax Diagram Convention	Example														
Keywords and Constants: A keyword or constant appears in uppercase letters. In this example, you must specify the item KEYWORD as shown. In most cases, you can specify a keyword or constant in uppercase letters, lowercase letters, or any combination. However, some applications may have additional conventions for using all-uppercase or all-lowercase.															
Abbreviations: Uppercase letters denote the shortest acceptable abbreviation of an item, and lowercase letters denote the part that can be omitted. If an item appears entirely in uppercase letters, it cannot be abbreviated. In this example, you can specify KEYWO, KEYWOR, or KEYWORD.															
Symbols: You must specify these symbols exactly as they appear in the syntax diagram.	<table> <tr> <td>*</td><td>Asterisk</td></tr> <tr> <td>:</td><td>Colon</td></tr> <tr> <td>,</td><td>Comma</td></tr> <tr> <td>=</td><td>Equal Sign</td></tr> <tr> <td>-</td><td>Hyphen</td></tr> <tr> <td>()</td><td>Parentheses</td></tr> <tr> <td>.</td><td>Period</td></tr> </table>	*	Asterisk	:	Colon	,	Comma	=	Equal Sign	-	Hyphen	()	Parentheses	.	Period
*	Asterisk														
:	Colon														
,	Comma														
=	Equal Sign														
-	Hyphen														
()	Parentheses														
.	Period														

Syntax Diagram Convention	Example
Variables: A variable appears in highlighted lowercase, usually italics. In this example, <i>var_name</i> represents a variable that you must specify following KEYWORD.	
Repetitions: An arrow returning to the left means that the item can be repeated. A character within the arrow means that you must separate each repetition of the item with that character. A number (1) by the arrow references a syntax note at the bottom of the diagram. The syntax note tells you how many times the item can be repeated. Syntax notes may also be used to explain other special aspects of the syntax.	   Notes: 1 Specify <i>repeat</i> up to 5 times.
Required Item or Choice: When an item is on the line, it is required. In this example, you must specify A. When two or more items are in a stack and one of them is on the line, you must specify one item. In this example, you must choose A, B, or C.	 
Optional Item or Choice: When an item is below the line, it is optional. In this example, you can choose A or nothing at all. When two or more items are in a stack below the line, all of them are optional. In this example, you can choose A, B, C, or nothing at all.	 
Defaults: When an item is above the line, it is the default. The system will use the default unless you override it. You can override the default by specifying an option from the stack below the line. In this example, A is the default. You can override A by choosing B or C.	
Repeatable Choice: A stack of items followed by an arrow returning to the left means that you can select more than one item or, in some cases, repeat a single item. In this example, you can choose any combination of A, B, or C.	

Syntax Diagram Convention

Example

Syntax Fragment:

Some diagrams, because of their length, must fragment the syntax. The fragment name appears between vertical bars in the diagram. The expanded fragment appears in the diagram after a heading with the same fragment name.

In this example, the fragment is named “A Fragment.”

»—| A Fragment |—————«

A Fragment:



Examples of Messages and Responses

Although most examples of messages and responses are shown exactly as they would appear, some content might depend on the specific situation. The following notation is used to show variable, optional, or alternative content:

- xxx Highlighted text (usually italics) indicates a variable that represents the data that will be displayed.
- [] Brackets enclose optional text that might be displayed.
- { } Braces enclose alternative versions of text, one of which will be displayed.
- | The vertical bar separates items within brackets or braces.
- ... The ellipsis indicates that the preceding item might be repeated. A vertical ellipsis indicates that the preceding line, or a variation of that line, might be repeated.

Message and Response Notation

This document might include examples of messages or responses. Although most examples are shown exactly as they would appear, some content may depend on the specific situation. The following notation is used to show variable, optional, or alternative content:

- xxx Highlighted text (usually italics) indicates a variable that represents the data that will be displayed.
- [] Brackets enclose an optional item that might be displayed.
- { } Braces enclose alternative items, one of which will be displayed.
- | The vertical bar separates items within brackets or braces.
- ... The ellipsis indicates that the preceding item might be repeated. A vertical ellipsis indicates that the preceding line, or a variation of that line, might be repeated.

Where to Find More Information

For more information about z/VM functions, see the books listed in the “Bibliography” on page 877.

If you plan to deploy Linux on z/VM, read *z/VM: Getting Started with Linux on System z* for important planning information about Linux virtual servers.

Links to Other Documents and Web Sites

The PDF version of this document contains links to other documents and web sites. A link from this document to another document works only when both documents are in the same directory or database, and a link to a web site works only if you have access to the Internet. A document link is to a specific edition. If a new edition of a linked document has been published since the publication of this document, the linked document might not be the latest edition.

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SC24-6178-05
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Do not use the feedback methods listed above. Instead, do one of the following:

- Contact your IBM service representative.
- Contact IBM technical support.
- See IBM: z/VM Service Resources (www.ibm.com/vm/service/).
- Go to IBM Support Portal (www.ibm.com/support/entry/portal/Overview/).

Summary of Changes

This document contains terminology, maintenance, and editorial changes. Technical changes are indicated by a vertical line to the left of the change. Some product changes might be provided through service and might be available for some prior releases.

SC24-6178-05, z/VM Version 6 Release 3

This edition includes changes to support the general availability of z/VM V6.3.

Large Memory Dump Support

z/VM's dump capability is increased to support real memory size up to a maximum of 1 TB in size.

The following configuration statement has been updated for this support:

- CP_OWNED statement

Information is added providing recommendations for "Allocating Space for CP Hard Abend Dumps" on page 654.

Chapter 12, "The Stand-Alone Dump Utility," on page 401 contains new information.

Information previously located in Chapter 12, "The Stand-Alone Dump Utility," on page 401 is moved to Appendix C, "Stand-Alone Dump Program (Uses Tapes)," on page 845.

Multiple Subchannel Set Support for Mirrored DASD

The multiple subchannel set support for mirrored DASD provides a subset of host support for the Multiple Subchannel Set (MSS) facility to allow using an alternate subchannel set for Peer-to-Peer Remote Copy (PPRC) secondary volumes.

Cross-System Highest Release Level Program Handling

In an SSI cluster in which members have different levels of z/VM installed, certain programs that manage shared resources are required to be at the highest release level that is running in the cluster. These programs must be on all members in the cluster regardless of the release level running on each member. Handling the highest release level program is accomplished by having a common test/production build disk set, where programs that must be at the highest release level are shipped and maintained. For more information, see "Cross-System Highest Release Level Programs" on page 713.

Support for New DS8000 Series Functions

z/VM provides support for the Storage Controller Health Message and the PPRC Suspend Summary Unit Check on the DS8700 and later devices. The CU system configuration statement has been updated.

Cross System Extensions (CSE) Support Removed

Support for the cross system extensions (CSE) environment has been removed. z/VM single system image (SSI) clusters provide the new technology for clustering z/VM systems. For information about the z/VM SSI environment, see Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.

The following functions have been removed:

- XSPPOOL_SYSTEM configuration statement
- XSPPOOL_TRACE configuration statement
- XSPPOOL_XLIST_INPUT configuration statement
- XSPPOOL_XLIST_OUTPUT configuration statement
- CSESYS macro
- CSETRACE macro
- CSEUSER macro

The cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems, and “CSE” is still used in some function and object names, command responses, and messages related to XLINK. For more information, see Appendix D, “Using Cross-System Link (XLINK),” on page 859.

Documentation of System Definition Macros Removed

Documentation of the HCPSYS ASSEMBLE and HCPRIO ASSEMBLE files and the associated system definition macros has been removed. The system configuration file is the recommended method for defining a z/VM system. Only the system configuration file is enhanced to support new system functions and capabilities.

For information on converting HCPSYS and HCPRIO definitions to system configuration file statements, see *z/VM: Migration Guide*. If you need the documentation of the system definition macros, see the previous editions of this document.

HiperDispatch Support

Documentation for the SRM system configuration statement has been added in support of HiperDispatch.

Additionally, the system-defined limit for the FEATURES MAXUSERS NOLIMIT configuration statement is 99,999 logged on users.

Live Guest Relocation Support for Port Based Virtual Switches

Additional relocation eligibility checks have been added for this support. Documented are virtual switch and port attributes for which a relocation can fail.

User Class Restructure (UCR) Support Removed

Support for the user class restructure (UCR) function and the OVERRIDE utility have been removed. Privilege classes for CP commands, DIAGNOSE codes, and other CP functions can be redefined by using MODIFY system configuration statements and MODIFY commands.

If any UCR files exist on the system, the contents of those files will not be processed by CP.

The following system configuration statements have been updated:

- MODIFY COMMAND / CMD statement

- MODIFY DIAGNOSE statement
- MODIFY PRIV_CLASSES statement

The following directory statements have been updated:

- CLASS statement
- IDENTITY statement
- USER statement

DASD Volume Real Device Address

The real device address can be specified for a DASD volume to be included in the CP-owned list or the user volume list. An RDEV option has been added to the CP_OWNED system configuration statement, and there is a new USER_VOLUME_RDEV system configuration statement.

Unified Resource Manager Support Withdrawn

The IBM zEnterprise Unified Resource Manager, first supported in z/VM V6.1, is no longer supported in z/VM V6.3. Therefore z/VM V6.3 cannot participate as a member of a zEnterprise® ensemble.

SC24-6178-04, z/VM Version 6 Release 2 (Additional Updated Edition)

This edition includes miscellaneous changes and updates.

SC24-6178-03, z/VM Version 6 Release 2 (Updated Edition)

This edition includes changes to support product changes provided or announced after the general availability of z/VM V6.2.

Virtual Switch HiperSockets Bridge

The z/VM virtual switch has been enhanced to transparently bridge a guest virtual machine network connection on a HiperSockets™ LAN segment. This bridge allows a single HiperSockets guest virtual machine network connection to also directly communicate with the following:

- Other guest virtual machines on the z/VM virtual switch
- External network hosts through the virtual switch OSA UPLINK port.

The following configuration statements have been updated for this support:

- DEFINE VSWITCH statement
- MODIFY VSWITCH statement

Guest Support for High Performance FICON for System z (zHPF)

z/VM V6.2 provides guest support for High Performance FICON® for System z® (zHPF). zHPF is a performance and reliability, availability, and serviceability (RAS) enhancement of the z/Architecture® and the FICON channel architecture implemented in the zEnterprise 196, zEnterprise 114, and System z10® servers, and the System Storage® DS8000® series. Exploitation of zHPF by the FICON channel, the operating system, and the control unit is designed to help reduce the FICON channel overhead. When both the FICON channel and the control unit indicate support for zHPF, transport mode I/O is supported in addition to command mode

I/O. Use of zHPF requires the function to be installed on the machine (processor complex and channels) and the storage controller, and requires support in z/VM and the exploiting guest.

SSI Cloning Procedure Revised

The procedure for adding a new member to an SSI cluster by cloning an existing member has been revised, particularly in the steps where the DirMaint™ configuration is updated, and where DirMaint is used to update the directory. See Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775.

Added Relocation Domain Information

Additional information about relocation domains and how to use them has been added. In some cases, z/HPF has been used as an example of a hardware feature. See “Using Relocation Domains” on page 750.

Procedure for Processing EREP Records

An example procedure has been added for using the CPEREPA utility to process EREP records that have been collected by the EREP virtual machine. See “Processing EREP Records Collected by the EREP Virtual Machine” on page 357.

SC24-6178-02, z/VM Version 6 Release 2

This edition includes changes to support the general availability of z/VM V6.2.

Support for z/VM Single System Image Clusters

A z/VM single system image (SSI) cluster is a multisystem environment in which the z/VM member systems can be managed as a single resource pool and running virtual servers (guests) can be relocated from one member to another.

To support SSI clusters, many functions described in this document have been updated and new functions have been added. The following new chapters have been added to the document:

- Chapter 21, “How the CP-Owned List Is Processed,” on page 661
- Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709
- Chapter 26, “Cross-System Spool in a z/VM SSI Cluster,” on page 743
- Chapter 27, “Preparing for Guest Relocations in a z/VM SSI Cluster,” on page 749
- Chapter 28, “Converting a z/VM System to a Single-Member z/VM SSI Cluster,” on page 759
- Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775
- Chapter 30, “Decommissioning a Member of a z/VM SSI Cluster,” on page 803
- Chapter 31, “Moving a Second-Level z/VM SSI Cluster to First-Level,” on page 821
- Chapter 32, “Combining Two Non-SSI z/VM Systems to Create a z/VM SSI Cluster,” on page 827
- Chapter 33, “Converting a CSE Complex to a z/VM SSI Cluster,” on page 835

To use the functions that define and maintain an SSI cluster, the IBM z/VM Single System Image Feature must be licensed and enabled.

Configuration and Management in an SSI Cluster

Changes have been made to information for SSI cluster configuration and management. Descriptions have been changed or added for:

- REPAIR IPL parameter (new)
- BEGIN/END system configuration statements (new)
- DISTRIBUTE system configuration statement
- SSI system configuration statement (new)
- SYSTEM_IDENTIFIER system configuration statement
- SYSTEM_IDENTIFIER_DEFAULT system configuration statement

Inter-System Facility for Communications (ISFC) Infrastructure Enhancements

The ISFC SSI infrastructure provides tools that will be used for cross-system communication. This enhances the ISFC subsystem to improve the transport mechanism and provide convenient interfaces for exploitation by other subsystems with the CP nucleus.

The following statement has been added for this support:

- “ACTIVATE ISLINK Statement” on page 55.

Live Guest Relocation Support

The live guest relocation function allows a running guest virtual machine to be moved from one member to another in an SSI cluster. The following statements have been added for this support:

- RELOCATION_DOMAIN configuration statement.
- VMRELOCATE directory statement.

Multiple Access Ports per Guest

Multiple access ports per guest provides the ability for a guest to have multiple unique access ports connected to the same virtual switch instance. Each access port has its own attributes (promiscuous and OSDSIM authority) and VLAN id. It also provides a way to associate guest NICs and VSWITCH ports. This new configuration capability will require explicit enabling by the system administrator so existing configurations will continue to operate as expected.

The following statements have been updated for this support:

- DEFINE VSWITCH
- MODIFY VSWITCH

Real Device Mapping

Real device mapping provides a means of identifying a device either by a customer-generated equivalency ID (EQID) or by a CP-generated EQID. This mapping is used to ensure virtual machines relocated by live guest relocation continue to use the same or equivalent devices following a relocation.

The following configuration statements were updated for this support:

- EDEVICE Statement
- RDEVICE Statement (Advanced Function Printers)
- RDEVICE Statement (Card Punches)
- RDEVICE Statement (Card Readers)
- RDEVICE Statement (Communication Controllers)
- RDEVICE Statement (DASD)

- RDEVICE Statement (Graphic Display Devices)
- RDEVICE Statement (Impact Printers)
- RDEVICE Statement (Special Devices)
- RDEVICE Statement (Tape Units)
- RDEVICE Statement (Terminals)
- RDEVICE Statement (Unsupported Devices)
- RDEVICE Statement (3800 Printers)

Shared Disk Enhancements

The shared disk enhancements improve the support for sharing real DASD among multiple z/VM images and simplifies the management of minidisk links and minidisk cache for minidisks shared by multiple images.

The following statements have been updated for this support:

- CP_OWNED system configuration statement
- DASDOPT directory statement
- LINK directory statement
- MDISK directory statement
- MINIOPT directory statement
- RDEVICE configuration statement (DASD)

User Identity and Configuration

Changes have been made to information for multiconfiguration virtual machine support. Descriptions have been added for new directory statements, IDENTITY, BUILD, and SUBCONFIG, which enable the definition of multiconfiguration virtual machines, and for changes to user directory processing and logon processing to support the creation of these users.

Virtual Networking Support for an SSI Cluster

This support extends the z/VM Ethernet virtual switch logic to coordinate its automatic MAC address assignment with all active members of an SSI cluster.

The MODIFY LAN, MODIFY VSWITCH, and VMLAN statements have been updated for this support.

Dynamic Discovery of FCP Disks

Dynamic discovery of FCP disks formalizes the SCSIDISC sample utility to be a fully supported z/VM tool. SCSIDISC provides CMS users with the ability to recognize any worldwide port numbers (WWPNs) and associated logical unit numbers (LUNs) accessible from some specified FCP subchannel. The use of this DASD in both emulated devices and directly attached FCP devices requires specific knowledge of the storage area networking topology. The SCSIDISC utility provides a means to analyze this topology with no prior knowledge of it.

LIMITHARD Default Change

The default for the LIMITHARD option of the SET SRM command has changed and is now CONSUMPTION. In most workloads, the CONSUMPTION method will give more accurate results than DEADLINE.

SC24-6178-01, z/VM Version 6 Release 1 (Updated Edition)

This edition includes changes to support product changes provided or announced after the general availability of z/VM V6.1.

Support for IBM zEnterprise 196

z/VM V6.1 provides support for the IBM zEnterprise 196 (z196). The following function has been updated for this support:

- Accounting record for CPU capability (Record Type D)

Alternate Method for Hard Limiting of Scheduled System Resources

z/VM V6.1 supports the CP scheduler enforcing hard limiting of scheduled system resources using a new consumption method. The LIMITHARD setting only affects users with absolute maximum shares defined with the LIMITHARD option on their SHARE setting. See the SET SRM LIMITHARD command in the *z/VM: CP Commands and Utilities Reference* for details on setting the method that the CP scheduler will use to enforce the limit on a guest's CPU usage.

The CP SHARE directory statement has been updated for this support.

IBM Extended Address Volumes Support

z/VM now supports DASD 28-bit extended address volumes used as dedicated devices.

The MDISK directory statement has been updated for this support.

IBM XIV Storage Systems Direct Attachment Support

z/VM V6.1 supports the direct attachment of IBM XIV[®] Storage Systems for system use (such as paging, spooling, and IPL). This support provides the ability to define system and guest volumes as emulated devices on XIV devices. The EDEVICE system configuration statement has been updated.

Support for IBM zEnterprise System Networks

Networking support for the IBM zEnterprise Unified Resource Manager enhances z/VM's virtual and real networking components to provide integrated management of these resources within an ensemble. z/VM's hypervisor provides the foundation for this management for both the intraensemble data network (IEDN) and the intranode management networks (INMN).

- The NICDEF directory statement includes new TYPE options for defining a NIC adapter.
- The following configuration statements are updated for this support:
 - The VMLAN statement contains the following new keywords: USERPREFIX and MACPROTECT.
 - The DEFINE VSWITCH statement contains the following new keywords: TYPE, NOUPLINK, VLAN AWARE, and NATIVE NONE.
 - The MODIFY LAN statement contains the new MACPROTECT keyword.
 - The MODIFY VSWITCH statement contains the following new keywords: UPLINK_PORT, MACPROTECT, and OSDSIM.

SC24-6178-00, z/VM Version 6 Release 1

This edition includes changes to support the general availability of z/VM V6.1.

Architecture Level Set to System z10

z/VM Version 6 requires a new architecture level set (ALS) from z/VM version 5 and supports the IBM System z10 Enterprise Class (z10[™] EC) and System z10 Business Class (z10 BC).

The following functions have been disabled or removed from the documentation:

- The CSU, KEYENTRY, SPECIAL, and MODIFY operands in the CRYPTO directory statement.
- The CRYPTO operand in the CPU directory statement.

DEFINE VSWITCH NATIVE Option

The default value for the DEFINE VSWITCH NATIVE *natvid* option has changed and is now 1.

OSA-ICC 3215 Support

z/VM provides support for the 3215 function of the OSA-ICC adapter card. The RDEVICE statement was updated for this support.

Part 1. Overview

Chapter 1. Planning and Administration Overview

This topic summarizes planning and administration tasks for the z/VM licensed program. Planning involves deciding how your system will be organized, configured, and used. Administration involves setting up, configuring, and modifying the system. Planning tasks and administration tasks are discussed together because the tasks are interrelated.

When planning for users, for example, it is useful to know how user IDs are added after the system is installed and running. You might then decide to define a minimal set of user IDs initially (perhaps those needed for key personnel, service machines, and guest operating systems), and add other user IDs later.

User IDs and many other aspects of the system configuration are defined by statements in z/VM files. Many administration tasks involve changing those files and then processing the files in some way to activate the changes. This topic contains overviews of the following files:

- System configuration file
- Logo configuration file
- User directory

These files are used in the planning and administration tasks for:

- The system
- Users
- Storage
- Performance

Although this topic does not describe how to perform any planning or administration tasks, it tells you where to find information that does.

This manual covers planning and administration for the base CP system. The complete set of manuals is listed under the “Planning and Administration” section of the “Bibliography” on page 877. Other manuals focus on topics such as connectivity, security, the Shared File System (SFS), and the Group Control System.

Migration Planning

If you are migrating from a previous VM release, see the *z/VM: Migration Guide*.

Major z/VM Files

The following z/VM files are used to define and tailor many characteristics of your installation's z/VM system:

- The system configuration file (SYSTEM CONFIG) defines real I/O devices in your system's I/O configuration and operating characteristics such as the layout of the CP system residence disk, lists of DASD volumes that CP uses, the real storage configuration, and information CP requires to determine the correct offset from Coordinated Universal Time (UTC).

For more information, see Chapter 2, “Configuring Your System,” on page 17, Chapter 5, “Defining I/O Devices,” on page 41, and Chapter 6, “The System Configuration File,” on page 47.

- The logo configuration file (LOGO CONFIG) defines where CP can find:
 - Logos for local, logical, and VTAM®-attached devices
 - Status area definition
 - Online message and input area definition information
 - Print separator pages for printers.

For more information, see Chapter 2, “Configuring Your System,” on page 17 and Chapter 7, “The Logo Configuration File,” on page 319.

- The user directory (USER DIRECT) defines the users of the system, their authority to enter various commands, and the resources they can use in the system. Each user who can log on to z/VM must have a virtual machine definition in the z/VM user directory. (You do not need to name your directory USER DIRECT.)

For more information, see Chapter 17, “Creating and Updating a User Directory,” on page 453.

System Configuration Planning and Administration

The following list briefly describes system configuration planning and administration tasks and where to find detailed information about each task:

- **Define operating characteristics of your system** by coding the system configuration file. Information on the system configuration file can be found in Chapter 2, “Configuring Your System,” on page 17 and Chapter 6, “The System Configuration File,” on page 47.
- **Specify the local time** to provide CP with the information it needs to determine the correct offset from Coordinated Universal Time (UTC). Specify the local time on the TIMEZONE_BOUNDARY and TIMEZONE_DEFINITION statements in the system configuration file. For more information on TIMEZONE_BOUNDARY and TIMEZONE_DEFINITION, see “TIMEZONE_BOUNDARY Statement” on page 281 and “TIMEZONE_DEFINITION Statement” on page 283.
- **Create a system name for the processor on which you run.** Code the SYSTEM_IDENTIFIER and SYSTEM_IDENTIFIER_DEFAULT statements in the system configuration file to create a system name for each processor on which you run z/VM. The system name appears on printed output separator pages and in the status area of the display screen. For more information, see “SYSTEM_IDENTIFIER Statement” on page 268 and “SYSTEM_IDENTIFIER_DEFAULT Statement” on page 271.
- **Set up service virtual machines** for accounting, error recording, symptom record recording, communication controller support for the emulator program, service spool support, Print Services Facility™/VM (PSF™/VM), and data storage management. Details on setting up these virtual machines can be found in Chapter 8, “Setting Up Service Virtual Machines,” on page 335.

To use the CMS shared file system, set up file pool service and file pool administration virtual machines. Details on how to do this are in *z/VM: CMS File Pool Planning, Administration, and Operation*.

- **Use SNA communication products to use SNA terminals as virtual machine consoles.** Systems Network Architecture/Console Communications Services (SNA/CCS) provides a total communication structure for transmitting

information through a communications network. For details on SNA/CCS, refer to Chapter 9, “Planning for SNA Console Communication Services (SNA/CCS),” on page 369.

- **Plan for security facilities.** Facilities are available in z/VM to help protect the system from security and integrity exposures. For descriptions and use of these facilities, see Chapter 11, “Security and Integrity in z/VM,” on page 379.
- **Improve system availability by defining and saving multiple copies of the CP module.** For more information, see Chapter 4, “Using the Stand-Alone Program Loader,” on page 31.
- **Create the stand-alone dump utility program.** Refer to Chapter 12, “The Stand-Alone Dump Utility,” on page 401.

Additional system configuration planning and administration tasks are required for multisystem environments. See “Planning for Multisystem Environments” on page 13.

User Planning and Administration

The following list describes user planning and administration tasks and where to find information on each task:

- **Plan for any changes to command privilege classes.** You can extend the privilege class structure of CP commands, DIAGNOSE codes, and certain CP system functions from eight classes to as many as 32 classes. For detailed information on how to extend the privilege class structure, refer to Chapter 16, “Redefining Command Privilege Classes,” on page 443.
- **Create a z/VM user directory.** As mentioned under “Major z/VM Files” on page 3, each user who can log on to z/VM must have a virtual machine definition in the z/VM user directory. You can create your own user directory or update the sample that z/VM provides. See Chapter 17, “Creating and Updating a User Directory,” on page 453 which contains detailed descriptions of the directory statements you can code in the user directory.
- **Define virtual machine modes and processor configurations.** Coding the MACHINE statement in a user or identity entry allows you to specify:
 1. The virtual machine mode (ESA, XA, or XC), which indicates the architecture the virtual machine simulates (ESA/390 or ESA/XC).

Note: XA mode is supported for compatibility and is functionally equivalent to ESA mode. Some CMS applications may require the virtual machine to be in XA mode.
 2. The maximum number of virtual processors the virtual machine can define. To define virtual processors, the virtual machine user must enter the DEFINE CPU command.

For information on the MACHINE directory statement, see “MACHINE Directory Statement” on page 535.

As an alternative to including a MACHINE statement in each user or identity entry, you can define the virtual machine mode and virtual processor capabilities for a group of virtual machines by including the MACHINE directory statement in a profile entry. See “Creating Directory Profiles” on page 465.

If the MACHINE statement is not included in the user or identity entry, or included in a profile, the default virtual machine mode is XA and the maximum number of virtual processors the virtual machine can define is determined by the number of CPU statements included in the user or identity entry, or in a

profile. If no CPU statements are included in the user or identity entry, or a profile, the virtual machine has no virtual multiprocessor capabilities.

The MACHINE operand on the GLOBALOPTS directory statement allows you to specify a global virtual machine mode for all virtual machines that do not have a MACHINE statement in their user or identity entry and are not included in a profile entry that contains a MACHINE statement. For more information, see the “GLOBALOPTS Directory Statement” on page 501.

- **Determine how you want real processor resources dedicated.** The system operator can use the DEDICATE command to dedicate virtual CPUs to real processors.
To dedicate specific virtual CPUs to real processors at logon, add a DEDICATE operand for each CPU directory statement that is to have automatic dedication. For information on coding the CPU directory statement, see Chapter 17, “Creating and Updating a User Directory,” on page 453.
- **Make sure that the user IDs specified in the system configuration file have virtual machine definitions.** The sample system configuration file that is shipped on the z/VM System DDR tapes or DVD defines the following user IDs (on the SYSTEM_USERIDS statement), and the sample directories contain virtual machine definitions for them:
 - OPERATOR as the user ID for the primary system operator
 - DISKACNT as the user ID for the accounting virtual machine
 - EREP as the user ID for an error recording virtual machine
 - OPERATNS as the user ID for a virtual machine that receives system dumps.If you change these or other user IDs specified in the system configuration file, make sure you change the user directory.
- **Decide which users are to be enrolled in a file pool.** Detailed instructions on enrolling users in a file pool can be found in *z/VM: CMS File Pool Planning, Administration, and Operation*.
- **Create a PROFILE EXEC for the system bring-up virtual machine.** The system bring-up machine (which, by default, has a user ID of AUTOLOG1) provides an optional way to automatically log on virtual machines during system initialization. As part of system initialization, CP automatically logs on AUTOLOG1. AUTOLOG1, in turn, can automatically log on other virtual machines, assuming that:
 - A PROFILE EXEC for AUTOLOG1 issues the XAUTOLOG command for each virtual machine AUTOLOG1 is to log on. (The XAUTOLOG command is asynchronous.) The system, however, automatically logs on the error recording, accounting, and symptom record recording virtual machines without receiving a command from AUTOLOG1's PROFILE EXEC. For information on creating CMS PROFILE EXEC files, see *z/VM: CMS User's Guide*. For information on the XAUTOLOG command, see *z/VM: CP Commands and Utilities Reference*. For information on the XAUTOLOG directory statement, see “XAUTOLOG Directory Statement” on page 617.
- **Determine which operating system will be in each virtual machine.** *z/VM: Running Guest Operating Systems* contains information on various operating systems as guests running in virtual machines.
- **Decide what the default POSIX authorizations should be.** The USER_DEFAULTS system configuration file statement determines what the defaults will be for querying other users' POSIX database information and having their POSIX security values changed. For more information, see “USER_DEFAULTS Statement” on page 292.

Real and Virtual Storage Planning and Administration

The following list describes real and virtual storage tasks and where to find information about each task:

- **Configure real storage.** The INITIAL and RESERVED real storage for the logical partition in which z/VM is installed are set on the IBM Hardware Management Console (HMC). However, there are also actions you can take on z/VM to limit or increase the amount of real storage available to z/VM. For more information, see Chapter 18, “Host Storage Planning and Administration,” on page 629.
- **Provide virtual storage to virtual machines.** The amount of virtual storage CP assigns to a virtual machine when the virtual machine logs on is determined by an operand on the USER or IDENTITY statement in the virtual machine's definition, or through the STORAGE or MAXSTORAGE statements in the user, identity, or subconfiguration entries. The USER or IDENTITY statement can also set the maximum storage amount that each particular virtual machine user can define with the DEFINE STORAGE command. For more information, see “USER Directory Statement” on page 609, “IDENTITY Directory Statement” on page 502, “MAXSTORAGE Directory Statement” on page 537, and “STORAGE Directory Statement” on page 601.
- **Plan for using saved segments.** A saved segment is an area of virtual storage that holds data or reentrant code. Defining frequently used data as saved segments provides several advantages. For detailed information, refer to the *z/VM: Saved Segments Planning and Administration*.

Auxiliary Storage (Expanded Storage and DASD) Planning and Administration

The following sections describe planning and administration tasks for CP-owned direct access storage devices (DASDs), dedicated DASDs, DASDs for minidisks, DASDs for shared file pools, expanded storage, and virtual disks in storage.

CP-Owned DASDs

CP-owned DASDs are used for the CP system residence volume, real system paging, spooling, directory and dump space, and temporary disk space for virtual machines. Do the following for CP-owned DASDs:

- **Use HCM and HCD to define the DASD or, if needed, code an RDEVICE statement in the system configuration file for the DASD.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. For more information on coding the RDEVICE statement, see “RDEVICE Statement (DASD)” on page 226.
- **Format CP-owned DASDs.** Before CP can use a DASD as a CP-owned DASD, you must use the CPFMTXA utility, or the Device Support Facilities (ICKDSF) program to format the DASD. However, using ICKDSF is the recommended method to format DASD volumes for CP use. For more information on CPFMTXA, refer to *z/VM: CP Commands and Utilities Reference*. For more information on ICKDSF, refer to *Device Support Facilities User's Guide and Reference*.
- **Define a list of CP-owned volumes on the CP_OWNED system configuration file statement.** For more information, see “CP_OWNED Statement” on page 74.
- **Define the layout of the CP system residence volume on the FEATURES and SYSTEM_RESIDENCE statements in the system configuration file.** For more information, see “FEATURES Statement” on page 150 and “SYSTEM_RESIDENCE Statement” on page 273.

- **Create a parm disk** You must store system configuration files on a parm disk, which is a CMS-formatted minidisk on the IPL volume. For more information, see “Using Configuration Files” on page 17.
- **Allocate temporary disk space to virtual machines.** Use the MDISK directory statement to define temporary disk space for virtual machines. Virtual machine users can enter the DEFINE command to define temporary disk space when they need it. For more information, see “MDISK Directory Statement” on page 539.

Dedicated DASDs

A dedicated DASD is a DASD that CP allocates exclusively to a virtual machine. Do the following for a dedicated DASD:

- **Use HCM and HCD to define the DASD or, if needed, code an RDEVICE statement in the system configuration file for the DASD.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. For more information on coding the RDEVICE statement, see “RDEVICE Statement (DASD)” on page 226.
- **Code a DEDICATE statement in the virtual machine definition of the virtual machine to which you dedicate the DASD.** To dedicate the DASD after the user logs on, use the ATTACH command.
- **Set up a dedicated DASD so it can be shared with an operating system running on another processor (using reserve/release).** For more information, see “Sharing DASD between One Virtual Machine and Other Systems Using Real Reserve/Release” on page 669.

Note: If the DASD has not been used previously by the virtual machine's operating system, it must be initialized by the user after it is attached.

DASDs Used for Minidisks

To use a DASD to provide minidisks for virtual machines, do the following:

- **Use HCM and HCD to define the DASD or, if needed, code an RDEVICE statement in the system configuration file for the DASD.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. For more information on coding the RDEVICE statement, see “RDEVICE Statement (DASD)” on page 226.
- **Define on the USER_VOLUME_LIST statement in the system configuration file a list of volumes you use to contain minidisks.** For more information, see “USER_VOLUME_LIST Statement” on page 299.

Note that you can also define minidisks on CP-owned volumes if the CP-owned volume is formatted appropriately. Although you may use the CPFMTXA utility, it is recommended that you use the Device Support Facilities (ICKDSF) program to format DASD volumes for CP use. For more information on the CPFMTXA utility, see *z/VM: CP Commands and Utilities Reference*. For more information on ICKDSF, see *Device Support Facilities User's Guide and Reference*.

- **Define minidisks for users.** Use the MDISK directory statement to define a minidisk for a virtual machine. Use the LINK directory statement to define a link to another user's minidisk. The virtual machine for which the minidisk is defined is responsible for formatting it. For more information, see “MDISK Directory Statement” on page 539 and “LINK Directory Statement” on page 524.

In an SSI-enabled directory, MDISK definitions can be global or local. A global MDISK definition is included in a user or identity entry and the minidisk being defined can be linked by virtual machines on any member of the SSI cluster. A local MDISK definition is included in a subconfiguration entry and the minidisk

being defined can be linked only by virtual machines on the SSI member to which the subconfiguration entry applies.

Note: CP and the directory program do *not* prevent you from defining minidisks that overlap. If you define such overlap, you assume responsibility for data integrity. You can use the Directory Maintenance Facility (DirMaint) optional feature of z/VM to assist in managing the user directory.

- **Set up a minidisk so it can be shared with an operating system running on another processor and with other virtual machines (using reserve/release).** For more information, see “Sharing DASD among Multiple Virtual Machines by Using Virtual Reserve/Release” on page 665.

DASD Space Used for Shared File Pools

To define file pools, you need to estimate how large each file pool will become. Also define one or more virtual machines to be used for file pool service machines. In so doing, you must decide what the initial DASD storage for the file pool will be.

For information on generating a file pool, refer to *z/VM: CMS File Pool Planning, Administration, and Operation*.

Expanded Storage

Expanded storage is hardware available only on certain processors. It provides another level of general-purpose storage. Expanded storage may be dedicated to one or more virtual machines and shared with CP. It can also be used for paging and minidisk caching. Do the following for Expanded Storage:

- **Plan a map of expanded storage** and determine which virtual machines should have access to this resource (see “Mapping Expanded Storage” on page 635).
- **Use the XSTORE directory statement to attach expanded storage to a virtual machine.** (You can also do this by using the ATTACH XSTORE command.) For information on the XSTORE directory statement, see “XSTORE Directory Statement” on page 624. For information on the ATTACH XSTORE command, refer to *z/VM: CP Commands and Utilities Reference*.
- **Use the RETAIN XSTORE command** to set aside expanded storage for exclusive use by CP (see *z/VM: CP Commands and Utilities Reference*). Note that CP determines which portion of expanded storage it will use for paging and minidisk caching. Use the RETAIN XSTORE command to override this.
- **Code the NOMDC operand of the MINIOPT directory statement** if you do *not* want to use a portion of expanded storage as a minidisk cache (see “MINIOPT Directory Statement” on page 550 and Chapter 19, “Expanded Storage Planning and Administration,” on page 633). Otherwise, you do not need to code the MINIOPT directory statement.

Virtual Disks in Storage

A virtual disk in storage is the temporary simulation of an FBA minidisk in an address space in host storage. Because a virtual disk in storage is not mapped to a real DASD, having a real FBA DASD in the system configuration is not required. By avoiding the I/O overhead, virtual disks in storage may be faster to use than other minidisks.

There are two ways to define a virtual disk in storage:

- Using the DEFINE command. This creates a private (nonshareable) virtual disk in storage that is destroyed when the user detaches it or logs off.

There is a limit on the amount of storage that can be allocated for virtual disks in storage created by a single user using the DEFINE command. This is called the user limit. The built-in default for the user limit is 0. You can override the built-in default by defining the user limit on the FEATURES statement in the system configuration file or by using the SET VDISK command. For more information, see “FEATURES Statement” on page 150.

- Using the MDISK directory statement. This creates a shareable virtual disk in storage. Use the LINK directory statement to define a link to another user's virtual disk in storage. A shareable virtual disk in storage is created when the first user links to it (the owner links to it by logging on) and destroyed when the last user detaches it or logs off. The first user must initialize or format the virtual disk in storage. For more information, see “MDISK Directory Statement” on page 539 and “LINK Directory Statement” on page 524.

Note: An MDISK statement for a virtual disk in storage can be included only in a user entry or subconfiguration entry. The scope of the virtual disk in storage is local, which means it can be shared only with users on the system where it is created.

There is a limit on the total amount of storage that can be allocated for virtual disks in storage on the system. This is called the system limit. The built-in default for the system limit is the minimum of:

- The amount of virtual storage that can be represented by one-quarter of the usable dynamic paging area (DPA) below 2 GB (based on the fact that each gigabyte of virtual disk defined requires 2050 pages of real storage below 2 GB)
- The amount of storage represented by one-quarter of the paging space defined for CP use.

You can override the built-in default by defining the system limit on the FEATURES statement in the system configuration file or by using the SET VDISK command. For more information, see “FEATURES Statement” on page 150.

Guests, servers, and other applications that use FBA minidisks can use virtual disks in storage without recoding. Because of their volatility, virtual disks in storage should not be used for permanent data; work files and other files that hold temporary results may be appropriate for virtual disks in storage. For an example of coding VSE guests to use a virtual disk in storage for storing label information areas and the cross system communication file (lock file), see the *z/VM: Running Guest Operating Systems* book.

Terminals

The following list describes tasks for terminals and where to find information about each task:

- **For all real terminals use HCM and HCD to define them or code an RDEVICE statement in the system configuration file.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. Otherwise, see “RDEVICE Statement (Graphic Display Devices)” on page 229.
- **Define primary and alternate system consoles using HCM and HCD or define primary and alternate system consoles on either the OPERATOR_CONSOLES or EMERGENCY_MESSAGE_CONSOLES statement in the system configuration file.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*.

Otherwise, see either “EMERGENCY_MESSAGE_CONSOLES Statement” on page 138 or “OPERATOR_CONSOLES Statement” on page 208.

- **To define a virtual machine operator console for a virtual machine, code the CONSOLE directory statement in the virtual machine definition for a user.** For more information, see “CONSOLE Directory Statement” on page 478.
- **Define terminals for virtual machines.** To define a terminal for a virtual machine, code the DEDICATE or SPECIAL directory statements, or both, in the virtual machine definition for a user. For more information, see “DEDICATE Directory Statement” on page 491 and “SPECIAL Directory Statement” on page 589.

Unit Record Devices

The tasks for a unit record device depend on whether the unit record device is (a) dedicated to a virtual machine or (b) used for spooling.

Dedicated Unit Record Devices

To dedicate a unit record device to a virtual machine, perform the following:

- **Use HCM and HCD to define the device or code an RDEVICE statement in the system configuration file for the device.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. Otherwise, see:
 - “RDEVICE Statement (Card Punches)” on page 220
 - “RDEVICE Statement (Card Readers)” on page 222
 - “RDEVICE Statement (Impact Printers)” on page 233
 - “RDEVICE Statement (3800 Printers)” on page 246
- **Code a DEDICATE statement in the virtual machine's definition.** The virtual machine user is responsible for other device tasks (such as creating image libraries for dedicated 3800 printers, defining forms control buffers, and so on). For more information, see “DEDICATE Directory Statement” on page 491.

Spooled Unit Record Devices

To use a unit record device for spooling, perform the following:

- **Use HCM and HCD to define the device or code an RDEVICE statement in the system configuration file for each unit record device you use for spooling.** For more information on HCM and HCD, see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*. Otherwise, see “RDEVICE Statement” on page 216.
- **Create a list of user form names and their corresponding operator form numbers on either the FORM_DEFAULT or USERFORM statements.** For more information, see “FORM_DEFAULT Statement” on page 165 or “USERFORM Statement” on page 291.
- **Specify classification titles for specific classes of spooled output on the PRINTER_TITLE statement.** For more information, see “PRINTER_TITLE Statement” on page 210.
- **Define forms control buffers (FCBs) and universal character sets (UCSs) for 3203, 3211, 3262, 4245, and 4248 printers.** For more information, see Chapter 13, “Creating and Modifying Image Libraries for Printers,” on page 411.
- **Define image libraries for 3800 and impact printers.** For more information, see Chapter 13, “Creating and Modifying Image Libraries for Printers,” on page 411.

- **Define spooled unit record devices for virtual machines.** For more information, see “SPOOL Directory Statement” on page 594.

Performance Planning and Administration

The performance characteristics of an operating system are dependent on such factors as choice of hardware, the total number of users on the system during peak periods, functions being performed by the system, and the way system parameters are set up. You can improve performance to some degree by the choice of hardware and system options. The following general tasks pertain to improving your z/VM system efficiency:

- Plan how you will handle performance monitoring, measurements, improvements, and problems. Become familiar with the CP monitor facility and the facilities you can manipulate to change the performance characteristics of the system as a whole or of selected virtual machines.
- Before you decide which performance options to apply, monitor the system's current performance. This will help you determine which options would most likely give the system a performance gain and where performance bottlenecks are occurring. The CP monitor facility collects such data, which can then be processed to produce statistics to give you an understanding of system operation.
- Perform system tuning to do any of the following:
 - Process a larger or more demanding work load without increasing the system configuration
 - Obtain better system response or throughput
 - Reduce processing costs without affecting service to users.

Details on system tuning can be found in *z/VM: Performance*.

I/O Reconfiguration in z/VM

z/VM supports the hardware dynamic I/O configuration facility. This facility allows you to dynamically add, delete or modify the I/O configuration of the processor without requiring a power-on reset of the processor or IPL of z/VM.

z/VM's support allows the system administrator or system operator to use the HCM/HCD interface or CP's dynamic I/O configuration commands to change the I/O configuration of the processor without a re-IPL of z/VM or a power-on reset of the processor.

In addition to the HCM/HCD interface and the CP commands to dynamically alter the I/O configuration of the machine, other I/O commands allow you to:

- Query the logical partitions on a machine
- Query the channel paths
- Query the status of channel paths to devices

For more information on z/VM's support of dynamic I/O configuration, please see the *z/VM: I/O Configuration*.

OpenExtensions Planning

Planning for OpenExtensions involves setting up the OpenExtensions facilities in z/VM that allow users to run POSIX applications. These tasks involve assigning POSIX security values to users (by specifying certain system configuration file statements and CP directory statements) and setting up the OpenExtensions Byte File System. For an overview of how to set up OpenExtensions, see the z/VM: *OpenExtensions User's Guide*.

Planning for Multisystem Environments

Additional planning and configuration tasks are required to enable a z/VM system to participate in a multisystem environment:

- **Plan for a z/VM single system image (SSI) cluster.** A z/VM SSI cluster offers a comprehensive clustering solution that includes multisystem installation, single point of maintenance, autonomic minidisk cache management, and virtual server mobility. For additional information, see Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.
- **Plan for cross-system link (XLINK).** The XLINK function extends CP link protocols to control normal, stable, and exclusive read or read/write access across multiple z/VM systems for minidisks on shared DASD. For additional information, see Appendix D, “Using Cross-System Link (XLINK),” on page 859.

Part 2. System Planning and Administration

Chapter 2. Configuring Your System

This chapter provides an introduction to the files that define the configuration of your system.

Specifying System Configuration Information

Most of the information about the configuration of your system is defined in the system configuration file, which is a CMS data file. Additional configuration information is defined in the user directory files. You can also define the characteristics of screen logos in a logo configuration file. While the system is running, you can dynamically change many of these system characteristics by issuing various CP commands.

This chapter provides an overview of the configuration files and what they contain. The following chapters provide additional information about configuring your system:

- Chapter 5, “Defining I/O Devices,” on page 41 discusses considerations for defining I/O devices.
- Chapter 6, “The System Configuration File,” on page 47 describes the system configuration file in more detail.
- Chapter 7, “The Logo Configuration File,” on page 319 describes the logo configuration file in more detail.
- Chapter 16, “Redefining Command Privilege Classes,” on page 443 describes the user class structure.
- Chapter 17, “Creating and Updating a User Directory,” on page 453 describes how to define the user directory.

Using Configuration Files

The system configuration file and the logo configuration file, as well as any files that these configuration files imbed, are stored on the *parm disk*. The parm disk is a regular CMS-formatted minidisk that you identify to CP by writing an allocation map on the IPL volume marking the location of the minidisk. The parm disk is accessed at IPL time, and configuration information is read from the configuration files stored on the disk.

To place configuration information on the parm disk, you must do the following:

1. Choose a CMS-formatted minidisk on the IPL volume on which you plan to place configuration files. (If the minidisk is not CMS-formatted, the system will enter a wait state when you try to use it.)
2. Run the ICKDSF utility to rewrite the allocation map on the IPL volume to mark a parm disk extent that covers the location of the minidisk. See the *Device Support Facilities User's Guide and Reference* for details on formatting and allocating DASD volumes using ICKDSF.
3. Place a system configuration file (called SYSTEM CONFIG by default), a logo configuration file (called LOGO CONFIG by default), or both, on the parm disk. Other names can be used for these files. See “Passing IPL Parameters” on page 36 for specifying a name for the system configuration file. You can specify a name for the logo configuration file inside the system configuration file. Place any logo picture files on this disk also.

Configuring Your System

Note: Although the system control file (HCPSYS ASSEMBLE), system real I/O configuration file (HCPRIO ASSEMBLE), and system logo definition file (HCPBOX ASSEMBLE) are still supported, IBM strongly recommends that you use configuration files to define your system. Using the ASSEMBLE files is more difficult and error-prone, requires availability and knowledge of the necessary level of the IBM High Level Assembler licensed program (or an equivalent product), does not support recent CP enhancements, and requires rebuilding the CP module after making changes.

The HCPSYS ASSEMBLE file supplied with z/VM contains no system definitions. The supplied HCPRIO ASSEMBLE file contains only an RIOGEN CONS=DYNAMIC macro to indicate that console addresses are defined in the system configuration file. The supplied HCPBOX ASSEMBLE contains default system logos.

For information about the system definition macros, see the z/VM V6.2 (or previous) edition of this document.

A default SYSTEM CONFIG file is created at installation time. You can update this file or create your own system configuration file using the editor of your choice. Use the QUERY CPDISK command to find out what parm disks are accessed, the CPRELEASE command to release the parm disk, the LINK and ACCESS commands for write access, and the CPACCESS command to return the disk to CP. See Chapter 3, “Understanding the CP File System,” on page 25 for additional information on these commands.

During the IPL process, CP tries to access the first parm disk that is marked in the allocation map on the IPL volume. If there is a parm disk marked, and if the disk locations matching the extent represent a CMS-formatted minidisk, CP attempts to read the system configuration file from the disk.

The format of the system configuration file is described in “What You Can Specify in the System Configuration File.” If CP finds a file called SYSTEM CONFIG (or the name you specify on IPL), it examines the contents of the file and applies any changes requested in the file to the system configuration. Values defined in the system configuration file override any values defined in HCPSYS ASSEMBLE and HCPRIO ASSEMBLE. If CP finds a file called LOGO CONFIG (or the name defined in the system configuration file), it uses the contents of that file to override all the logo characteristics set in HCPBOX ASSEMBLE.

Before the first prompt, which asks you what method of system initialization you need, the system displays information about the parm disk. After the system is up and running, you can use the QUERY CPLOAD command to find out whether CP accessed a parm disk, and if so, what that disk was.

What You Can Specify in the System Configuration File

The system configuration file defines the basic characteristics of your system and allows you to define many system options, such as:

- The name of the single system image (SSI) cluster, the systems that are members of the SSI cluster, the location of the persistent data record (PDR), and the functional level of the SSI cluster.
- The devices CP should bring online at IPL time
- The time zone CP should select at IPL time from a list of time zones

- Whether CP should autolog special user IDs at IPL time, such as the accounting and symptom user IDs
- The contents of most translation tables defined in CP
- Whether CP should automatically attempt a warm start without changing the TOD clock at IPL time
- The number of buffers CP provides for the retrieving of command lines
- The characters used as default terminal characters, such as the line end character and the line delete character
- The defaults that will be used for querying other users' POSIX database information and having their POSIX security values changed
- The IODF that HCD will use to control CP's I/O configuration.

Note: You cannot define the size of real storage in the system configuration file. For information on defining the size of real storage to a value less than what is actually available, see the STORE parameter under “Passing IPL Parameters” on page 36.

Contents of the System Configuration File

The following sections contain a brief description of some of the statements that you can specify in the system configuration file. For complete descriptions of all the system configuration statements and general rules for coding a system configuration file, see Chapter 6, “The System Configuration File,” on page 47.

The Bare Minimum

You must include the following statements for the system to come up:

- CP_OWNED defines a volume in the CP-owned volume list. After the system is running, you can use the DEFINE CPOWNED command to change this list. (To make the change permanent, update the system configuration file.)
- SYSTEM_RESIDENCE specifies the location of the checkpoint and warm start areas.
- OPERATOR_CONSOLE defines a list of console addresses from which CP should choose the operator console.

These three statements are all that the system really needs to come up and start running.

Other Important Statements

You may also want to include the following statements:

- SYSTEM_IDENTIFIER and SYSTEM_IDENTIFIER_DEFAULT define system names for the processors on which you run z/VM.
- TIMEZONE_DEFINITION and TIMEZONE_BOUNDARY enable the system to choose the correct local time zone definition.
- IODF indicates that HCM and HCD will control the hardware and optionally the software I/O configuration.

Real Devices

The statements previously listed are the most basic ones that you need to get your system running and to give it an identifier and a local time. You can customize your system further with the other statements. For example, if you are not using HCM and HCD to control your software I/O configuration, you can define real devices to the system and establish characteristics for them using the following statements:

Configuring Your System

- RDEVICE defines real I/O devices that do not respond to a sense ID request and I/O devices that need more defining information than a sense ID request returns (for example, printers and communications controllers). After the system is running, you can use the SET RDEVICE command to define or redefine real devices.

See Chapter 5, “Defining I/O Devices,” on page 41 for information about which devices may need to be defined with RDEVICE statements.

- DEVICES tells CP whether to bring specified devices online, accept and build real device blocks for specified devices, and use the information returned from a sense ID request to help define a device. It is recommended that you let CP bring all devices online at IPL, and that you let CP use the sense information.
- HOT_IO_RATE specifies the maximum unsolicited interrupt rate for real devices.

You can control operations on real DASD using the following statements:

- DRAIN stops new allocations of certain types of space on the DASD.
- START restarts a DASD after it has been drained.

After the system is running, you can use the DRAIN (Disk) and START (Disk) commands to perform the same functions as the DRAIN and START statements.

User Volume List

You can generate and change the user volume list using the following statements:

- USER_VOLUME_LIST generates the user volume list.
- USER_VOLUME_EXCLUDE and USER_VOLUME_INCLUDE specify volumes to be excluded from or included in the user volume list. These statements can use wildcard characters (%) and *) in defining volume serial identifiers.

Cross-System Link Operations

You can control cross-system link (XLINK) operations using the following statements:

- XLINK_DEVICE_DEFAULTS changes the defaults for the location and format of the CSE area for specific DASD types.
- XLINK_SYSTEM_INCLUDE and XLINK_SYSTEM_EXCLUDE specify the systems to be included in or excluded from cross-system link protection.
- XLINK_VOLUME_INCLUDE and XLINK_VOLUME_EXCLUDE specify the DASD volumes to be included in or excluded from cross-system link protection.

Other System Attributes

You can set other attributes of your system using the following statements:

- EMERGENCY_MESSAGE_CONSOLES specifies a list of consoles that CP should notify if there is an impending abnormal end or other system emergency. If you do not include this statement, CP uses the list specified on the OPERATOR_CONSOLES statement for the list of emergency consoles as well.
- STORAGE allocates real storage and trace frames.
- JOURNALING specifies characteristics of the system's journaling facility. After the system is running, you can use the QUERY and SET JOURNAL commands to work with the journaling facility.
- PRIV_CLASSES changes the privilege classes authorizing certain CP functions.
- SYSTEM_USERIDS specifies user IDs that perform special functions during and after IPL. These user IDs identify the virtual machines that handle accounting records, system dump files, EREP records, and symptom records; the operator and startup user IDs are also specified.

- **FEATURES** sets several different attributes of the system. These attributes include:
 - Trying an automatic warm start without changing the TOD clock
 - Clearing TDISK DASD space automatically
 - Enabling the new LOGMSG support that causes CP to read log message information from disk files instead of the warm start area
 - Giving end users the authority to change their own privilege classes, and privileged users the authority to change the privilege classes of other users logged on to the system
 - Establishing the largest number of users who may be logged on to the system at one time
 - Enabling the facility that suppresses the password on the command line for AUTOLOG, LOGON, and LINK commands.
- **CHARACTER_DEFAULTS** specifies default characters, such as the line end character and the character delete character.
- **USER_DEFAULTS** determines what the defaults will be for:
 - the global lines per page value for all virtual printers and consoles that are defined on the system, and
 - querying other users' POSIX database information and having their POSIX security values changed.
 - **TRANSLATE_TABLE** specifies replacements for the standard translation tables that CP uses to accomplish certain tasks.
- **PRODUCT** defines a product or feature to the system.

Semantic and Syntactic Statements

The following statements affect the way that your system processes the system configuration file:

- **EQUATE** creates names for groups of systems that all have something in common and should, therefore, be treated similarly. You can use system names or nicknames created by **EQUATE** statements to preface statements that should only apply to certain systems.
- **IMBED** specifies the name and type of a file to be imbedded into the system configuration file.
- **TOLERATE_CONFIG_ERRORS** controls whether a section of the system configuration file must be without errors when CP processes it.

Spool File Processing

The following statements affect the way that your system processes spool files:

- **FORM_DEFAULT** defines default user form names for CP to use when it creates files on virtual printers, punches, consoles, or real card readers.
- **PRINTER_TITLE** specifies the printed output classes that are to contain classification titles.
- **USERFORM** creates a list of user form names and their corresponding operator form numbers, and can specify the forms as **NARROW** so that a narrow separator page is printed.

CP File System

CP_ACCESS statements direct CP to access CMS-formatted minidisks that contain information that CP can use at run time. Each **CP_ACCESS** statement specifies a CMS-formatted minidisk that CP should access after it brings the user directory online. After the system is up and running, you can use the **CPACCESS** command to perform the same function as the **CP_ACCESS** statement.

Logo Processing

LOGO_CONFIG specifies the name of a logo configuration file for CP to use.

What You Can Specify in the Logo Configuration File

You can use the logo configuration file to override all of the default logo information specified in the HCPBOX ASSEMBLE file included in the CP nucleus. You can change four logo pictures:

- Normal logo
- Minimum screen logo
- Basic logo
- Spooling logo

You can use statements in the logo configuration file to choose logo pictures for logical devices, SNA terminals, and locally attached terminals. CP can choose pictures for logical devices based on the user ID of the virtual machine that created the device, for SNA terminals based on the user ID of the VSM that is managing the terminal, and for locally attached terminals based on their device addresses. It can also choose pictures for locally attached terminals or logical devices based on the size of their screens.

You can also use the logo configuration file to define the contents of the following fields:

- The command area
- The input area at the bottom of the logo screen, and the layout of this area
- The online message found at the top of each logo screen
- The status areas (such as VM READ and CP READ)

Unless you specify a different file name and file type in the system configuration file, CP looks for a file called LOGO CONFIG after it has processed the system configuration file. If CP has accessed a parm disk successfully, it attempts to process a logo configuration file even if it does not find a system configuration file on the parm disk. After the system is up and running, you can use the REFRESH LOGOINFO command to change this information.

Contents of the Logo Configuration File

The logo configuration file contains the following four statements:

- CHOOSE_LOGO
- INPUT_AREA
- ONLINE_MESSAGE
- STATUS

For complete descriptions of these statements and information about creating a logo configuration file, see Chapter 7, “The Logo Configuration File,” on page 319.

Choosing Logo Picture Files

The CHOOSE_LOGO statement is the most complex of these statements. The CHOOSE_LOGO statement defines the logo picture files that CP uses for the following:

- Locally attached terminals. You can select certain pictures for certain terminal addresses.
- Terminals logging on through logical devices

- Terminals managed by certain VTAM service machines (VSMs)
- Separator pages of printed output.

You can also select a different logo picture file for each locally attached terminal and different picture files for terminals logging on through different user IDs. You can specify a logo picture file to appear on screens that are too small to accommodate the picture that another statement has specified for them.

Input Area

The `INPUT_AREA` statement contains information defining the layout of the input area that contains the user ID, password, and command areas of the logo screen. You can specify the number of lines each field should have, where the fields should appear, and the text that surrounds each area. You can use the `CHOOSE_LOGO` statement to put specific text into the command area; this text appears by default on the logo screen. This option is helpful for systems on which users often dial through to PVM or VTAM. For example, you can include the text `DIAL VTAM` in the command area.

Online Messages

The `ONLINE_MESSAGE` statement specifies the file that contains the online message that you want to appear at the top of the logo screen. You can change this message to show the date that the system was brought online, the version of z/VM that you are running, or whatever other information you may want.

Status Area

The `STATUS` statement specifies the text that appears in the bottom right corner of the screen. You can use this statement to change the contents of the status area to mixed case (for example, `RUNNING` to `Running`) or to change the text entirely.

Chapter 3. Understanding the CP File System

This chapter describes:

- Initial state of the CP file system
- Changing the list of disks accessed by CP
- Performance considerations
- Displaying the contents of CP-accessed minidisks
- Changing information on CP-accessed minidisks.

Initial State of the CP File System

After CP has read and processed the system and logo configuration files, it releases the temporary link and access that it established to the parm disk. The IPL process continues as it would if there had been no parm disk present. CP then prompts the operator with the options for the type of start:

```
17:10:58 Start ((Warm|Force|COLD|CLEAN) (DRain) (DIsable) (NODIRect))
17:10:58      (NOAUTOlog)) or (SHUTDOWN)
```

If you choose to start with no options or with any option other than NODIRECT, CP tries to bring the user directory online after it has performed the requested spool file initialization. After the user directory is brought online, CP tries to access any minidisks specified on the CP_ACCESS statements in the system configuration file. If no such statements exist, CP will not have any minidisks accessed. For example, to determine what minidisks (if any) CP has accessed, issue the following command:

```
query cpdisks
```

If no disks are accessed, you receive the following response:

```
No disks accessed.
Ready;
```

If a FEATURES statement in your system configuration file instructed CP to use log messages from files on CP-accessed minidisks, there would be no log message data because CP does not have any minidisks accessed. For example, to determine if any log message data exists, issue the following command:

```
query logmsg
```

And receive the response:

```
There is no logmsg data
Ready;
```

If CP had processed a logo configuration file at IPL time and the logo configuration file statements referred to logo picture files, an input area file, or an online message file, CP displays the standard system logo defined in HCPBOX ASSEMBLE on all terminals (because CP does not have any minidisks accessed).

Therefore, depending on information in your system and logo configuration files, CP may look for files on CP-accessed minidisks when it needs to find log message files or logos. If you had placed one or more CP_ACCESS statements in your system configuration file, the response to the QUERY CPDISKS command after an IPL might be similar to the following:

Understanding the CP File System

Label	Userid	Vdev	Mode	Stat	Vol-ID	Rdev	Type	StartLoc	EndLoc
PROD1	MAINT	0300	A	R/O	ESARES	0A0F	ECKD	2400	2449
BACKUP	MAINT	0301	B	R/O	ESARES	0A0F	ECKD	2450	2499

Ready;

This response indicates that MAINT's 300 and 301 disks are accessed by CP. Unless you specify otherwise, CP accesses these disks in stable-read (SR) mode so that while CP only has read-only access to the minidisks, no other user can obtain a write link to the minidisk. In this case, if a user requests a copy of the log messages, CP reads files on the CP-accessed minidisks (MAINT's 300 and 301) and displays the contents of one or more files at the user's terminal. If a user switches on a terminal, CP can construct a logo from information contained in logo picture files, an input area file, and an online message file on the CP-accessed minidisks.

Changing the List of Disks Accessed by CP

As previously discussed, the CP_ACCESS statements in the system configuration file define the initial list of disks accessed by CP. After the system is up and running, you can change the list of disks that CP searches for log message and logo information without having to shut down and restart the system. The CPACCESS and CPRELEASE commands are similar to the CMS ACCESS and RELEASE commands in that they enable privileged users to modify the list of CP accessed disks. However, unlike the CMS ACCESS and RELEASE commands, the CPACCESS and CPRELEASE do not affect any operations in the virtual machine where the command was issued. Instead, they instruct CP to modify its list of accessed minidisks. For example, to release a disk accessed by CP, issue the following command:

```
cprelease a
```

You receive these responses:

```
CPRELEASE request for disk A scheduled.  
Ready;  
CPRELEASE request for disk A completed.
```

If you issue QUERY CPDISKS, you see that in this case, CP has only a single disk accessed, and all the logo and log message information have to be on this disk.

Label	Userid	Vdev	Mode	Stat	Vol-ID	Rdev	Type	StartLoc	EndLoc
BACKUP	MAINT	0301	B	R/O	ESARES	0A0F	ECKD	2450	2499

Ready;

You can also add to the list of minidisks accessed by CP. For example, to add MAINT's 400 disk to the list of disks accessed by CP, issue the following command:

```
cpaccess maint 400 a
```

You receive these responses:

```
CPACCESS request for mode A scheduled.  
Ready;
```

```
CPACCESS request for MAINT's 0400 in mode A completed.
```

To determine which disks are now accessed, issue QUERY CPDISKS. You receive this response:

Label	Userid	Vdev	Mode	Stat	Vol-ID	Rdev	Type	StartLoc	EndLoc
PROD2	MAINT	0400	A	R/O	XAUSR8	0B12	CKD	2300	2349
BACKUP	MAINT	0301	B	R/O	ESARES	0A0F	ECKD	2450	2499

Ready;

You are only authorized to request that CP should access a minidisk if you have the authority to link to the minidisk yourself. To have CP access the minidisk in SR mode (the default), you must be authorized to link to the disk in SR mode yourself.

Whenever CP needs to display the log message or create a logo, it tries to read files from the minidisks that it currently has accessed.

Performance Considerations

Because CP tries to read files from CP-accessed minidisks whenever it displays log messages or logos, it may read certain files on the minidisks many times. Rather than reading these files from the minidisks each time, CP can cache the files in storage. Then, every time the files have to be read, CP does not have to wait for a copy of the files to be read from DASD because their contents are already in storage.

For example, to cache certain files that reside on CP-accessed minidisk, issue the following CPCACHE command:

```
cpcache sna% logms* a
2 file(s) cached.
Ready;
```

The response to the command indicates that 2 files were placed in storage as a result of the CPCACHE command. CPCACHE accepts the use of wildcard characters (%) and (*) to specify files that it should cache.

You can also give CP a list of files to read into storage whenever it accesses the minidisk. You do this by creating a file called CPCACHE FILES, which contains the list of files, and placing the file on the minidisk that CP accesses. This is an example of a CPCACHE FILES file:

```
*      logms*      /* Cache all log message related files */

sna%   logo        /* Cache all SNA logo picture files      */

online message    /* Cache the file that contains the
                  "VM/ESA Online" message                  */
```

CP attempts to read CPCACHE FILES on any minidisk it accesses, whether the access attempt is the result of a CPACCESS command or CP_ACCESS statements found in the system configuration file.

CP removes the appropriate cached files from storage when a CPRELEASE or CPACCESS command is issued for the minidisk from which the files were loaded. If the files were loaded into storage as a result of the CPCACHE command (rather than a CPCACHE FILES file), you have to issue the CPCACHE command again when CP reaccesses the disk.

Displaying the Contents of CP-Accessed Minidisks

Just as you can use the CMS LISTFILE command to display what files are on accessed minidisks, privileged users can use the CP CPLISTFILE command to display what files are on CP-accessed minidisks. For example, to display the LOGO files found on a CP-accessed minidisk, issue the following CPLISTFILE command:

```
cplistfile * logo a
```

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The response displays the file name and file type of the file, its format and size, the date it was last modified, and whether the file is currently cached:

Filename	Filetype	FM	Fmt	LRecL	Records	Date	Time	Cache
DEFAULT	LOGO	A	F	80	15	10/30/91	21:15:15	No
08E6	LOGO	A	F	80	23	02/20/92	08:12:56	No
LDEV	LOGO	A	F	80	15	11/30/91	21:14:50	No
LOCAL	LOGO	A	F	80	15	09/16/91	23:17:42	No
MOD5	LOGO	A	F	132	15	10/30/91	21:13:53	No
PVM	LOGO	A	F	78	15	10/30/91	21:15:02	No
SNA1	LOGO	A	F	78	15	11/29/91	12:32:35	Yes
SNA2	LOGO	A	F	78	15	10/30/91	21:14:35	Yes
SYSTEM	LOGO	A	F	80	15	10/30/91	21:14:29	No
TCP/IP	LOGO	A	F	78	15	01/27/92	20:22:09	No

Ready;

To display certain statistics about files on CP-accessed minidisks, issue:

```
cplistfile sna* logo a statistics
```

The response looks similar to this:

Filename	Filetype	FM	Opens	Closes
SNA1	LOGO	A	27	26
SNA2	LOGO	A	57	56

Ready;

Finally, to display the contents of a file that resides on a CP-accessed minidisk, issue:

```
cptype cpcache files a
```

And, receive this response:

```
*      logms*      /* Cache all log message related files */  
  
sna%   logo        /* Cache all SNA logo picture files    */  
  
online message    /* Cache the file that contains the  
                  "VM/ESA Online" message                */  
  
Ready;
```

You are authorized to display the contents of files using the CPTYPE command only if you have the authority to link to the minidisk on which the files reside.

Changing Information on CP-Accessed Minidisks

If your system configuration file contains a FEATURES statement that instructs CP to construct log messages from information in files on CP-accessed minidisks, you can no longer use the SET LOGMSG command to alter the contents of the log message. Instead, you must do the following:

1. Issue a CPRELEASE command to have CP remove the minidisk from its list of accessed disks.
2. Issue the CP LINK command and CMS ACCESS command to link and access the target minidisk in write mode.
3. Edit the files that contain the log messages for your system.
4. Issue the CMS RELEASE command and the CP DETACH command to release the minidisk and detach it from your virtual machine.
5. Issue a CPACCESS command to have CP add the minidisk to its list of accessed disks.

Even though you could have CP maintain read-only access to the disk while you are editing the files, it is recommended that you remove the disk from CP's list of accessed disks first. When CP accesses a minidisk, it reads the minidisk's file directory into storage. Any subsequent changes to the minidisk are not reflected into the file directory CP keeps in storage until you issue a CPACCESS command to have CP reaccess the minidisk. If you change files on the minidisk while CP has access to it, users may receive incorrect output in response to commands such as QUERY LOGMSG.

On the other hand, you may encounter another problem if you tell CP to remove the minidisk from its list of accessed minidisks before you make your change. If the minidisk you are changing is the only one that contained log message information, and a user issued a QUERY LOGMSG command while you were in the process of changing the log message, CP would find no log message files and would respond that no log message data existed.

For example,

```
query cpdisks
```

Label	Userid	Vdev	Mode	Stat	Vol-ID	Rdev	Type	StartLoc	EndLoc
PROD1	MAINT	0300	A	R/O	ESARES	0A0F	ECKD	2400	2449

Ready;

```
cprelease a
```

CPRELEASE request for disk A scheduled.

Ready;

CPRELEASE request for disk A completed.

```
query logmsg
```

There is no logmsg data

Ready;

It is recommended that to change the contents of minidisks that are accessed by CP, you should work with at least two disks. When you instruct CP to release one minidisk in order to change files on the minidisk, CP can still read information from the second minidisk.

For example:

```
query cpdisks
```

Label	Userid	Vdev	Mode	Stat	Vol-ID	Rdev	Type	StartLoc	EndLoc
PROD1	MAINT	0300	A	R/O	ESARES	0A0F	ECKD	2400	2449
BACKUP	MAINT	0301	B	R/O	ESARES	0A0F	ECKD	2450	2499

Ready;

```
cprelease a
```

CPRELEASE request for disk A scheduled.

Ready;

CPRELEASE request for disk A completed.

```
link maint 300 300 wr
```

Ready;

```
access 300 a
```

Ready;

```
xedit system logmsg a
```

Ready;

```
release a (detach
```

Ready;

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```
cpaccess maint 300 a
CPACCESS request for mode A scheduled.
Ready;
CPACCESS request for MAINT's 0300 in mode A completed.
```

You can now tell CP to release the B disk (MAINT's 301) and update it to contain the new SYSTEM LOGMSG file that you placed on MAINT's 300 disk.

You can update logo picture files, input area files, and online message files in a similar manner. CP uses the changed files as soon as the CPACCESS request for the minidisk completes.

Chapter 4. Using the Stand-Alone Program Loader

The Stand-Alone Program Loader (SAPL) is a generic loader that loads stand-alone programs stored in CMS module form on a CMS minidisk. Using SAPL, you can use any stand-alone program that can be generated in the form of a CMS module.

Examples of such programs are:

- The CP nucleus module (CPLOAD)
- Stand-Alone Program Loader Creation Utility (SALIPL)
- DASD Dump Restore Utility (DDR)
- Device Support Facilities Program (ICKDSF)

This chapter tells you how to use SAPL to load a stand-alone program that is generated in the form of a module.

This chapter also describes the IPL parameters supported by CP.

During the IPL process, various information is read from DASD devices. Here are some terms that will be used to refer to these devices:

- The **IPL device** is the device which is specified on the load screen and from which SAPL is loaded.
- The **SYSRES device** is the device from which SAPL loads the CP module.
- The **parm disk device** is the device on which the CP module finds the system configuration file.
- Other DASD devices are used but are not of interest for this discussion. They include the DASD devices used for the CP directory, warmstart, checkpoint, paging, spooling and user minidisks.

Creating the Stand-Alone Program Loader

Before a DASD device can be IPLed, SAPL must be written to the device using the Stand-Alone Loader Creation Utility (SALIPL). See the *z/VM: CP Commands and Utilities Reference* for information on how you can write SAPL to the IPL device by using SALIPL from the CMS command line. See the *Running Utility Programs in z/VM: System Operation* for information on how to write SAPL to the IPL device by using SALIPL on the real processor.

Important Note!

As of z/VM V5.1, the number of blocks on FBA DASD (SCSI or not) that SALIPL uses for SAPL has increased. SALIPL writes to blocks 5-207 on CP-formatted DASD. In previous releases, SALIPL wrote to blocks 5-31. You must ensure that no other functions, such as CP directory, warmstart, checkpoint, paging, spooling, or minidisks, are using the area to which SALIPL writes.

On a CMS minidisk with a RECOMP area, SALIPL writes SAPL to blocks 5-207 of the RECOMP area. In previous releases, blocks 5-31 of the RECOMP area were used. In order to accommodate the larger size of SAPL, you may need to increase the size of the RECOMP area on the CMS minidisk.

The following data is in the blocks that SALIPL writes out:

Blocks 5-196	SAPL program
Blocks 197-199	Reserved for IBM Use
Blocks 200-207	SCSI boot records

When SALIPL writes SAPL to the IPL device, defaults for the following attributes that SAPL uses are established:

- The location of the CMS minidisk where modules can be found
- The name of the module that is to be loaded by SAPL
- The location in storage at which the module will be loaded, if it is relocatable
- The IPL parameters that are passed to the program being loaded
- Operator instructions that are displayed on the SAPL screen.

These defaults can be overridden as described below.

The default module is CP (default name CPLOAD), but it may be a stand-alone program in CMS module form. You can have many CP modules in your installation, allowing for different conditions or providing backup. You select the CP module to be used:

- When you run Stand-Alone Program Loader Creation Utility (SALIPL)
- During IPL by overriding the SAPL defaults on the SAPL screen
- During SHUTDOWN REIPL by using the MODULE operand.

Although the file name of a CP module is variable, the file type must be MODULE. CP modules typically reside on a minidisk that is identified as a parm disk in the volume allocation table, but you can select the DASD volume and offset/extent from which SAPL will read. Therefore, you can have CP modules on multiple minidisks on multiple DASDs.

Note: Although SAPL will accept a load origin when loading a CP module, it has no effect. CP will always relocate itself to location X'2000'.

Overriding the Console that CP Will Use

If you only need to override the console that CP will use as the system operator console during CP initialization, specify a load parameter of CONSxxxx. For example:

- Specify CONSSYSG to use the integrated 3270 console on the IBM Hardware Management Console (HMC)

- Specify CONSSYSC to use the operating system messages panel on the HMC
- Specify CON\$xxxx to cause CP to use the 3270 at address xxxx.

If you only need to override the system configuration file that CP will use during system initialization, specify a load parameter of FNxxxxxx. For example, specifying FNSYS001 on the HMC will cause CP to search for a system configuration file to use at initialization with a file name of SYS001. The "xxxxxx" specifies a file name and must be between 1 and 6 characters in length. The file type will be CONFIG unless the FT= IPL parameter that was specified when SAPL was written to the configuration is more than 6 characters. In that case, you will need to access the SAPL screen using the method described in "Overriding Stand-Alone Program Loader Defaults."

Overriding the Nucleus Device and PARM Disk

If you want to override the CP nucleus and PARM disk, specify the *Idevno* or *Idevno.p* load parameter. The first letter of this parameter is "I" (short for "IPL").

- *devno* specifies the 5-digit device number where the parm disk holding the CP nucleus resides. The first digit of that device number identifies the subchannel set containing the device.
- *.p* specifies the 1-digit extent number of that parm disk.

Overriding Stand-Alone Program Loader Defaults

If the defaults that were established by the SALIPL utility when it wrote SAPL to the IPL device are acceptable, all you need to do is to IPL from the IPL device. If you need to change any of the defaults, however, then you must supply a load parameter with the address of a console for SAPL to use. The console specified must accept 3270 CCWs and data streams and have at least 20 lines and 80 columns.

If you are running SAPL on a real processor, you specify the console address by entering the device number of the console into the load parameter field of the load window on your processor console. The SAPL screen will be displayed on the specified console.

If you are running SAPL in a virtual machine, you specify the console address using the LOADPARM option of the CP IPL command. For example:

```
IPL 18B LOADPARM EA0
```

In this example, 18B is the DASD volume to load from and EA0 is the device number of the console to be used.

To cause the SAPL screen to appear on the integrated 3270 console on the HMC, specify SYSG as a load parameter. The operating system messages panel on the HMC (SYSC) cannot be used by SAPL because it does not accept 3270 CCWs and data streams.

To IPL from a SCSI Disk

If you are IPLing CP in a virtual machine from a minidisk on an emulated FBA device (SCSI), just specify the minidisk device address as the IPL device on the IPL command as shown in the previous example.

To IPL from a SCSI disk on the real processor, access the load window on the processor console in order to specify additional information. To IPL from a SCSI

disk in a virtual machine by using an FCP device, use the CP SET LOADDEV command to specify additional information that will be used by the CP IPL command:

- Specify the load address of the FCP device you wish to use.
- Specify the world wide port name (PORT on the SET LOADDEV command)
- Specify the logical unit number (LUN)
- Specify 0 for the boot program selector (BOOTPROG)
- Specify C8 for the boot record logical block address (BR_LBA) if the IPL device has been CP-formatted by ICKDSF or CPFMTXA. The SALIPL utility writes the SCSI boot record to block 200 (X'C8') of a CP-formatted device. For a CMS-formatted device, SALIPL writes the SCSI boot record at block 200 (X'C8') into the RECOMP area of the minidisk.
- For the load parameter operand, optionally specify a console address on which you wish the SAPL screen to appear.
- For the OS specific load parameters (SCPDATA) operand, optionally specify a console address on which you wish the SAPL screen to appear.

Note: As described earlier, the console specified must accept 3270 data streams. Specify SYSG for the integrated 3270 console on the HMC. The console may also be specified in the load parameter field of the load panel on the system console. Note that if both the OS specific load parameter SCPDATA and the load parameter fields are specified, SAPL will use the load parameter value.

If your configuration uses normal DASD devices (such as 3390), then the IPL device, SYSRES device, and parm disk device can all be the same device or different devices. **If the IPL device is an FCP device, then the IPL device, SYSRES device, and parm disk device must be the same SCSI disk.** This is because the FCP device, WWPN, and LUN combination specified on the load screen is the only DASD device path known during the IPL process.

The Stand-Alone Program Loader Screen

When the IPL completes and a valid console has been specified for the load parameter, you will see a menu screen similar to Figure 1. The defaults will be filled in for some of the fields — all fields except the comments section can be altered.

```
STAND ALONE PROGRAM LOADER: z/VM VERSION n RELEASE n.n
DEVICE NUMBER:  018B      MINIDISK OFFSET:  35      EXTENT:  -
MODULE NAME:    CPLOAD    LOAD ORIGIN:      2000
-----IPL PARAMETERS-----
cons=0ea0 fn=maine
-----COMMENTS-----
Secondary parm disks can be found on 18B at offset 185 and on 18A at offsets
35 and 185.
-----
9= FILELIST 10= LOAD 11= TOGGLE EXTENT/OFFSET
```

Figure 1. Stand-Alone Program Loader

The Stand-Alone Program Loader screen contains the following fields:

DEVICE NUMBER

Identifies the DASD volume from which SAPL will read.

If the multiple subchannel set facility is installed, this field is five digits. The first digit specifies the subchannel set in which the device resides, while the remaining four digits specify the device number. If the DEVICE option was specified on the SALIPL command that created SAPL, the value of that option is displayed.

If the multiple subchannel set facility is not installed, this field is four digits and specifies the device number in subchannel set zero. If the DEVICE option was specified on the SALIPL command, the low-order four digits of the option value are displayed.

If the designated device does not exist, an error message is produced (if the SAPL panel is being displayed) or a disabled wait PSW is loaded.

If you IPLed from an FCP device (SCSI disk), the DEVICE NUMBER field will contain the FCP device address. The WWPN and LUN are not displayed on the SAPL screen and cannot be changed. If you IPLed from an FCP device, you can change the DEVICE NUMBER value to a DASD volume (3390). If you IPLed from a DASD volume, however, you cannot change to an FCP device.

MINIDISK OFFSET

Specifies the offset from the beginning of the DASD volume to the start of the CMS minidisk from which SAPL is to read. This number is cylinders for count key data devices and blocks for fixed block architecture devices.

EXTENT

Specifies the extent number from 1 to 9 (first to ninth). This field may be used only with DASD volumes that have been formatted using the Device Support Facilities Program (ICKDSF) and have an allocation map containing PARM extents written on them. When a valid extent is entered, the offset corresponding to the extent will be displayed in the MINIDISK OFFSET field.

Note: Only one of the fields, EXTENT or MINIDISK OFFSET, can be altered at a time. Use PF11 to toggle which field can be altered.

MODULE NAME

Specifies the name of a module on the minidisk that will be loaded by SAPL.

LOAD ORIGIN

Specifies the storage location (HEX address) into which SAPL will load a relocatable module. Specify a LOAD ORIGIN value of X'2000' if IPLing a CP module. As of z/VM V5.1, CP will always run with an origin of X'2000'. If a value other than X'2000' is specified, CP will initially load at the specified address and then relocate itself to location X'2000'.

IPL PARAMETERS

Specifies the data that will be passed to the loaded program by SAPL. The contents of this field depends entirely on the program loaded by SAPL. For parameters valid for CP, see "Passing IPL Parameters" on page 36. **If you are IPLing CP from an FCP device (SCSI disk), PDVOL=addr must be specified as an IPL parameter.** See the PDVOL= description below for more information.

COMMENTS

Contains comments such as operator instructions. This field may only be altered by running the SALIPL utility.

There is also a message line after the comments area. Any informational messages or error messages will appear on the message line.

There is a list of program function (PF) key numbers and their functions at the bottom of the screen. PF11 toggles which of the two fields, MINIDISK OFFSET or EXTENT, is active. PF10 causes SAPL to try to load a module using the current contents of the fields. PF9 displays a list (FILELIST) of files that are on the minidisk. The module you wish to use can be selected on that screen. Figure 2 is an example of a Stand-Alone Program Loader file list screen.

STAND ALONE PROGRAM LOADER: z/VM VERSION <i>n</i> RELEASE <i>n.n</i>							
FILENAME	FILETYPE	FORMAT	LRECL	RECORDS	BLOCKS	DATE	TIME
DYN	MODULE	V	65535	59	925	2003/07/07	12:15:28
SALIPL	MODULE	V	24400	4	7	2003/06/22	15:30:10
SYSTEM	CONFIG	F	80	190	4	2003/06/17	14:47:19
HCPSAL	MODULE	V	24400	4	7	2003/06/15	14:32:29
END	MODULE	F	1024	1896	474	2003/06/01	13:40:19
DYNF	MODULE	V	65535	56	869	2003/05/22	12:36:18
DDR	MODULE	V	65535	5	30	2003/05/21	16:21:44
SALTEST	MODULE	F	7656	1	2	2003/05/21	11:11:22
LOGO	CONFIG	F	80	48	1	2003/05/18	16:31:48
LOGO	CONFOLD	F	80	48	1	2003/11/22	14:43:28
SYSTEM	CONFN	F	80	277	6	2003/08/08	15:40:51
GOTHIC	LOGO	F	79	16	1	2003/06/18	17:11:12
UMS	LOGO	V	75	16	1	2003/06/18	17:04:53
SPOOL	LOGO	F	46	16	1	2003/06/17	18:13:58
SYSTEM	NETID	F	80	8	1	2003/04/29	11:40:35
ONLINE	MESSFILE	F	80	1	1	2003/04/29	11:26:11
SYSTEM	LOGMSG	F	80	1	1	2003/10/03	9:04:22
3=QUIT 4=SORT(TYPE) 5=SORT(DATE) 6=SORT(NAME) 7=BACK 8=FORWARD 11=SELECT							

Figure 2. Stand-Alone Program Loader File List

The files displayed will initially be sorted in descending order by date and time. You can sort by file name/file type, file type/file name, and date/time by using the PF keys identified at the bottom of the screen. If you press PF11 (SELECT) when the cursor is on a line that lists a file, you will be returned to the main menu and the file name of the selected file will be placed in the MODULE NAME file.

Passing IPL Parameters

Using SAPL, you can pass up to 240 characters of parameters into CP at IPL time. The default contents of the 240-character parameter field can be selected when SALIPL is used to write SAPL to the IPL device. You can choose to override the defaults by using the full screen option of SAPL.

During CP initialization, CP scans the IPL parameter list from left to right. If a parameter is specified more than once, CP uses the last valid occurrence of the parameter.

The following list describes the parameters that CP supports:

BETA=string

specifies a variable length string representing a left-to-right hexadecimal bit mask, in integral 1-byte entities. This string is an enablement mask for

allowing otherwise disabled function for beta test. IBM customer support provides the proper enablement mask for customers that have engaged in a beta test agreement with IBM.

CONS=addr

CON=addr

specifies the location of the operator console that CP is to use. Specify a 1-digit to 4-digit device address for a 3270 console. Specify SYSC for the operating system messages panel on the Hardware Management Console (HMC). Specify SYSG for the integrated 3270 console on the HMC.

All OPERATOR_CONSOLES statements in the system configuration file are ignored. The console address specified will be added to the list of consoles defined on the EMERGENCY_MESSAGE_CONSOLES statement found in the system configuration file if it has not already been included in that list. For more information, see the description of the EMERGENCY_MESSAGE_CONSOLES statement.

FN=filename

specifies the file name of the system configuration file. If you do not specify this option, CP uses SYSTEM as the file name. If FN=filename is the only IPL parameter that you need to override, you could specify FNxxxxxx in the load parameter field of the load window of your processor console. By using the FNxxxxxx load parameter, the file name of your system configuration file is limited to 6 characters.

FT=filetype

specifies the file type of the system configuration file. If you do not specify this option, CP uses CONFIG as the file type.

NOEXITS

is intended to assist you in a situation where your dynamic additions to CP are somehow wrong and are preventing CP from completing system initialization. Use the NOEXITS parameter to tell CP not to process any of these requests from your system configuration file:

- CPXLOAD statement
- ENABLE EXIT statement
- EXTERNAL_SYNTAX statement
- ASSOCIATE MESSAGES statement
- The ENABLE operand of the ASSOCIATE EXIT statement

Except for examining the statement for syntactic correctness, CP will ignore the statement or the operand. If it was one of your dynamic additions to CP (for example, a CP exit) that was causing CP to not initialize, using NOEXITS may help you to IPL CP so that you can correct the problem.

NOHCD

specifies that CP should ignore any IODF statement in the system configuration file. The system initializes as if no IODF statement were present and HCD is not used for I/O configuration.

An example of when the NOHCD IPL parameter would be useful is if you encounter a disabled wait state because of problems with the IODF statement or problems with the file specified on the IODF statement. Use the NOHCD parameter to IPL the system without HCD and then change the IODF statement, replacing the IODF or otherwise investigate the wait state condition.

PROMPT

specifies that you wish to have CP prompt you about start-up options at IPL

time. If you specify this option, CP ignores the AUTO_WARM_IPL and AUTO_IPL operands on the FEATURES statement in the system configuration file.

The PROMPT parameter is only valid for the SAPL screen. This parameter is not acknowledged during CP bounce processing (SHUTDOWN REIPL or restarting after an abend).

PDNUM=*n*

specifies the number of the parm disk that you wish CP to use. CP will read the allocation map on the IPL device or the DASD volume indicated on the PDVOL option and will skip to the *n* parm disk. If the allocation map does not contain at least *n* parm disks, CP loads a disabled wait.

PDOFF=*offset*

specifies the offset at which the parm disk resides in the IPL device or the DASD volume indicated on the PDVOL option. If the DASD volume does not have at least *offset* cylinders or blocks, or if there is no CMS-formatted minidisk at the specified offset, CP loads a disabled wait.

PDVOL=*addr*

specifies the real address of the volume on which a parm disk resides that you wish CP to access. If there is no device at address *addr* or if the device is not a DASD volume, CP loads a disabled wait.

If you are IPLing CP from an FCP device (SCSI disk), PDVOL=*addr* must be specified as an IPL parameter. Any device address that is not in the I/O configuration of the system to be IPLed can be specified for *addr*. CP requires this parameter in order build the EDEVICE control block for the SYSRES/parm disk device during CP initialization. See “EDEVICE Statement” on page 133 for more information.

REPAIR

specifies that SSI cluster initialization and management functions be bypassed. This parameter is intended to be used only when a running system is required to correct a problem and there are no other active members in the SSI cluster. If any other member of the SSI cluster is active, system integrity will be compromised and data corruption can occur. An operator prompt is issued at IPL time to give the operator the option of continuing or stopping the IPL in case any other member in the SSI cluster is active. Spool file initialization occurs based on the contents of the FEATURES statement in the system configuration file, unless the PROMPT parameter is used, in which case CP prompts you about startup options at IPL time. When the REPAIR parameter is specified, the NOAUTOLOG and DISABLE IPL options are automatically invoked, whether or not they are entered.

If the system is not a member of an SSI cluster, the REPAIR parameter causes CP to bypass automatic logon of virtual machines as if NOAUTOLOG was specified and to disable terminal devices as if the DISABLE IPL option was specified.

selector:value(IPL parameter substring)

provides conditional IPL parameters to address system configuration requirements that differ based on environmental conditions. The *selector* designates a parameter that if equal to *value* causes the IPL parameter substring to be used to configure the control program. If the *selector* does not equal *value*, the IPL parameter substring is ignored. The *selector* must be followed immediately by a colon and the *value* with no intervening blanks. The following *selectors* are supported:

FN designates the configuration file name specified by either the last FN= parameter in the IPL parameter string, excluding conditional parameters, or the default value of SYSTEM.

The IPL parameter string is evaluated from left to right. Parameters that are not conditional can appear anywhere in the string, before or after conditional ones, and the order of parameters is preserved.

For example, if the IPL parameters are:

```
CONS=020 FN:SITE1(PDVOL=1111) NOEXITS FN:SITE2 (PDVOL=2222)
```

and z/VM is IPLed with a load parameter of:

```
FNSITE2
```

then the parameter:

```
FN=SITE2
```

will be appended to the IPL parameters by the Stand-Alone program Loader to produce:

```
CONS=020 FN:SITE1(PDVOL=1111) NOEXITS FN:SITE2 (PDVOL=2222)
FN=SITE2
```

which will in turn result in the IPL parameters:

```
CONS=020 NOEXITS PDVOL=2222 FN=SITE2
```

being used to configure the z/VM control program.

An FN= parameter within a conditional IPL parameters substring will be ignored, except that syntax errors in such parameters will be reported. In addition, only the last FN= parameter encountered is honored, so that for example:

```
FN=SITE1 FN:SITE1(PDVOL=1111) FN:SITE2(PDVOL=2222) FN=SITE2
CONS=020
```

would produce:

```
PDVOL=2222 FN=SITE2 CONS=020
```

not:

```
PDVOL=1111 FN=SITE2 CONS=020.
```

A new value for the parameter corresponding to the *selector* is ignored and only the last value of such a parameter in the unconditional portion of the IPL parameters is used. Conditional IPL parameters cannot be nested.

STORE=nnnnu

specifies the amount of storage you want CP to use. This amount can be less than the configured real storage. The size that you specify will be rounded up to a multiple of the storage increment size (which is calculated from the INITIAL and RESERVED storage allocations in the image profile for the logical partition). If you specify an amount that exceeds the configured real storage, CP uses the configured amount.

nnnn is a 1- to 4-digit decimal number and *u* is the storage unit suffix:

M	megabytes
G	gigabytes
T	terabytes
P	petabytes
E	exabytes

Using SAPL

Note: After IPL, if configured or standby real storage is available, you can dynamically increase the online real storage by issuing the SET STORAGE command. For more information, see *z/VM: CP Commands and Utilities Reference*.

Chapter 5. Defining I/O Devices

There are four methods that can be used to define I/O devices to CP during IPL:

- Allow CP to dynamically sense the devices
- Use RDEVICE statements or EDEVICE statements in the system configuration file
- Use RDEVICE macroinstructions in the HCPRIO ASSEMBLE file
- Use Hardware Configuration Manager (HCM) and Hardware Configuration Definition (HCD) to define the devices.

The first three methods can be used in combination with each other, but typically CP senses the devices and only those devices requiring additional definition will have an RDEVICE statement or an EDEVICE statement in the system configuration file. Generally, the HCPRIO ASSEMBLE file is used only in special circumstances, because updating the file requires rebuilding the CP module. It is recommended that the tables in this chapter be used to determine how, and if, a given device should be defined in the system configuration file. If a configuration file statement is listed as "not required", then no definition is required and VM will dynamically determine the device characteristics through device sensing. There may be cases where a configuration file statement, although "not required", should be used to specify additional options or features, or both. Devices not found in the tables are either unsupported or require an RDEVICE macroinstruction in HCPRIO.

To use HCM and HCD to define devices to CP, an IODF statement that specifies both an IODF and an *osconfig* name must be specified in the system configuration file. In this case, all devices are defined by HCD (except older and unsupported devices, which still can be defined in HCPRIO ASSEMBLE) and device sensing and RDEVICE statements or EDEVICE statements in the system configuration file cannot be used. For information about using HCM and HCD, see the *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*.

Device Support

A real device can be supported or unsupported. A supported device can be supported for CP and guest use or only for dedicated use by a single guest.

A supported device is one of those listed in the *z/VM: General Information* book along with the type of support it receives. If that book does not list a device, assume the device is not supported. The use of listed devices is fully supported by IBM through z/VM service support.

A device supported for CP and guest use is one that CP and virtual machines can use. CP provides system services for the device, including error recovery for guest DIAGNOSE I/O requests and a full command set (that is, you can use all device-oriented CP commands for the device). Such a device can also be shared among multiple guests if appropriate (for example, DASD) or can be dedicated to the exclusive use of a single guest.

A device supported for dedicated-only use by a single guest can only be logically attached to a single guest virtual machine at any one time. The guest must be fully capable of running with the device. CP cannot use the device itself, and DIAGNOSE I/O services are not supplied to the guest.

Unsupported Devices

An unsupported device is any device not listed in *z/VM: General Information*. An unsupported device must be dedicated to a single guest, but proper operation with z/VM and the guest is the customer's responsibility; IBM does not guarantee that unsupported devices will run properly with z/VM, and service support for such device attachments is not supplied.

An unsupported device must be defined to z/VM as some unrecognizable device type (that is, a device type different from any of the supported IBM devices) and must be defined with RDEVICE TYPE UNSUPPORTED statement in the system configuration file. By knowing the class of devices (DASD, tape, and so on) to which the unsupported device belongs, z/VM knows what kinds of unsupported devices are similar.

Note: DASD which is defined as being unsupported cannot be IPLed by CP. Unsupported DASD can only be used by a virtual machine which is IPLed either from a supported device or from a named saved system.

Device Sensing

Most IBM devices can be queried (sensed) to determine what type of device they are. This is done at IPL time and when a device is varied on. For example, assume you have an IBM DASD device at address 300. CP issues a sense ID command to device 300. The device returns information indicating what type of device it is.

CP may need more information than that returned by some devices when they are queried. An example of this type of device is the IBM 4248 printer. When queried, the printer returns only the information that it is a 4248. Necessary information such as the printer class and the forms control buffer to be used is not provided via sensing; if CP is not provided this information on an RDEVICE statement, CP uses default values for that type of printer.

If a device does not respond to the device sense ID command, then the device must be defined in the system configuration file using the RDEVICE statement.

For a complete description of the RDEVICE statement, see "RDEVICE Statement" on page 216.

DASD

Table 1 indicates for DASD devices whether or not a statement is required in the system configuration file. For some devices, a statement is needed only if the device is shared, in which case the following statement can be used:

```
RDEVICE rdev TYPE DASD SHARED YES
```

Table 1. Configuration Guide for DASD

Device	Statement Needed in Configuration File
3380 Models A04, AA4, B04, AD4, BD4, AE4, BE4, AJ4, BJ4, AK4, BK4	<ul style="list-style-type: none"> When not shared, not required When shared, TYPE DASD YES
3380 Model CJ2	<ul style="list-style-type: none"> When not shared, not required When shared, TYPE DASD YES
3390 Models A14, A18, B14, B18, B1C, A24, A28, B24, B28, B2C, A34, B34, A38, B38, B3C	<ul style="list-style-type: none"> When not shared, not required When shared, TYPE DASD YES

Table 1. Configuration Guide for DASD (continued)

Device	Statement Needed in Configuration File
3390 Models A98, B9C	<ul style="list-style-type: none"> • When not shared, not required • When shared, TYPE DASD YES
9336 Model 20	Not required

See “RDEVICE Statement (DASD)” on page 226 for a complete description of the RDEVICE statement.

Tapes

Table 2 indicates for tape devices whether or not a statement is required in the system configuration file. The TYPE operand of the RDEVICE statement is required for those devices whose characteristics cannot be dynamically determined.

Table 2. Configuration Guide for Tape Drives

Device	Statement Needed in Configuration File
3480 All Models	Not required*
3490 All Models	Not required*
3495 Tape Library Dataserver	**
3590 All Models	Not required*
Notes: *The 'TYPE TAPE' operand can be specified to provide query capability for tapes that are intentionally left offline at IPL. **See the <i>DFSMS/VM Installation and Customization Guide</i> for information on defining the 3495 Tape Library Dataserver for VM use.	

See “RDEVICE Statement (Tape Units)” on page 240 for a complete description of the RDEVICE statement.

Printers

Table 3 indicates for printer devices whether or not a statement is required in the system configuration file. The TYPE operand of the RDEVICE statement is required for those devices whose characteristics cannot be dynamically determined.

Table 3. Configuration Guide for Printers

Device	Statement Needed in Configuration File
3203 Model 5	TYPE 3203
3211 Models 1, 5	TYPE 3211 (For devices, such as a 4248, that emulate a 3211)
3262	TYPE IMPACT_PRINTER
3268 Models 2, 2C	Not required
3287 Models 1, 1C, 2, 2C, 4	Not required
3289 Models 1, 3, 4, 8	TYPE 3289
3800 Model 1	TYPE 3800

Defining I/O Devices

Table 3. Configuration Guide for Printers (continued)

Device	Statement Needed in Configuration File
3800 Models 3, 6, 8	TYPE Advance Function Printing (AFP) or TYPE 3800
3812	<ul style="list-style-type: none">• When coax attached, not required• When BSC attached, TYPE BSC_ADAPTER• When SDLC (VTAM attached), not required
3816	<ul style="list-style-type: none">• When coax attached, not required• When BSC attached, TYPE BSC_ADAPTER• When SDLC (VTAM attached), not required
3820	<ul style="list-style-type: none">• When channel attached for use as a PSF printer, TYPE AFP• When VTAM attached, TYPE 3705
3825	TYPE AFP
3827	TYPE AFP
3828	TYPE AFP
3835	TYPE AFP
3900	TYPE AFP
4245 Models 1, 12, 20	TYPE IMPACT_PRINTER
4248 Models 1, 2	TYPE IMPACT_PRINTER
6262 Models 14, 22	TYPE IMPACT_PRINTER

For BSC attached 3812 or 3816 printers, see “RDEVICE Statement (Communication Controllers)” on page 224 for a complete description of the appropriate RDEVICE statement. For the other printers, see “RDEVICE Statement (Advanced Function Printers)” on page 218 and “RDEVICE Statement (Impact Printers)” on page 233 for a complete description.

Unit Record Devices

Table 4 indicates for reader and punch devices whether or not a statement is required in the system configuration file. The TYPE operand of the RDEVICE statement is required for those devices whose characteristics cannot be dynamically determined.

Table 4. Configuration Guide for Reader and Punch Devices

Device	Statement Needed in Configuration File
3505 Models B1, B2	TYPE READER
3525 Models P1, P2, P3	TYPE PUNCH

See “RDEVICE Statement (Card Readers)” on page 222 and “RDEVICE Statement (Card Punches)” on page 220 for a complete description of the appropriate RDEVICE statement.

Displays

Display devices can be defined in the system configuration file. IBM 3277 displays have 3277 defined on the TYPE operand of the RDEVICE statement. All other non-3270 displays can be sensed and no configuration file statement is needed unless the device has special features, such as the Operator Identification Card. If a display has a special feature, an RDEVICE statement for the display is needed. For example, if a display has an Operator Identification Card, the following RDEVICE statement should be included in the system configuration file:

```
RDEVICE rdev TYPE 3270_DISPLAY OPER_IDENT_READER YES
```

The operand *rdev* is the real device number. For a complete description this statement, see “RDEVICE Statement (Graphic Display Devices)” on page 229.

Communication Controllers

Table 5 indicates for communication controller devices whether or not a statement is required in the system configuration file. The TYPE operand of the RDEVICE statement is required for those devices whose characteristics cannot be dynamically determined.

Table 5. Configuration Guide for Communication Controllers

Device	Statement Needed in Configuration File
3745	<ul style="list-style-type: none"> • When running NCP, not required • When running PEP for ASCII lines, TYPE TELE2_ADAPTER

See “RDEVICE Statement (Communication Controllers)” on page 224 for a complete description of the RDEVICE statement.

ESCON Devices

These ESCON® devices can be sensed by CP and do not require a system configuration file statement:

- 9032 ESCON Director Model 2
- 9033 ESCON Director Model 1
- 9034 ESCON Converter Model 1
- 9035 ESCON Converter Model 2
- ESCON CTCA

For information on defining ESCON devices that cannot be sensed by CP, see “RDEVICE Statement (Unsupported Devices)” on page 243 in the description of the RDEVICE statement in Chapter 6, “The System Configuration File,” on page 47. For information on defining ESCON-attached devices, see the appropriate device tables in this chapter.

Other Devices

Table 6 on page 46 indicates for various devices whether or not a statement is required in the system configuration file. The TYPE operand of the RDEVICE statement is required for those devices whose characteristics cannot be dynamically determined.

Defining I/O Devices

Table 6. Configuration Guide for Other Devices

Device	Statement Needed in Configuration File
3088	Not required
3423 Optical Media Attachment	TYPE UNSUPPORTED
3737 Remote CTCA	TYPE CTCA
3890 Document Processor	Not required
4753 Network Security Processor	Not required (looks like a 3088)
7171	TYPE 3270_DISPLAY
CTCA	TYPE CTCA
OSA	Not required

Chapter 6. The System Configuration File

This chapter:

- Discusses the parm disk
- Provides a summary of system configuration file statements
- Defines general rules for coding the system configuration file
- Describes each system configuration file statement in detail

The Parm Disk

The system definition information required at IPL resides in files on the *parm disk*, a CMS-formatted minidisk that CP can read. The parm disk must reside on the IPL volume. The system definition files on the parm disk include:

- The main system configuration file, usually called SYSTEM CONFIG, which contains operating characteristics such as the layout of the CP system residence disk, lists of DASD volumes that CP uses, your real storage configuration, and information CP requires to determine the correct offset from Coordinated Universal Time (UTC). It also contains real device definitions for I/O devices that do not respond to a sense ID request and for I/O devices that need more information defined than a sense ID request returns (for example, printers and communications controllers). This file is described in detail in this chapter.
- The logo configuration file, usually called LOGO CONFIG, which contains information about the creation and configuration of logos, including the file names and file types of the different logo files. For details, see Chapter 7, “The Logo Configuration File,” on page 319.

Note:

1. The parm disk must be CMS-formatted. If it is not CMS-formatted, the system enters a disabled wait state, code 6758. If you get this wait code, you can use the alternate parm disk at IPL time. To do this, use the Stand-alone Program Loader in console mode and change the parm disk extent on the Stand-alone Program Loader screen to the alternate parm disk extent.
2. During SHUTDOWN REIPL or system restart processing, CP uses the parm disk location from the previous IPL. If the parm disk was moved by use of CPFMTXA or ICKDSF, CP might fail to find the CPLOAD module and message HCP6739E is issued, or CP might find the old CPLOAD module on the previous parm disk. Use the EXTENT option of the SHUTDOWN command to force CP find the parm disk at its new location, or use the OFFSET option to specify the new location of the parm disk. It is recommended to only move the parm disk shortly before a planned REIPL.

Summary of System Configuration File Statements

Table 7 lists all the system configuration file statements, gives you a brief description of each statement, and points you to where you can get more information about each statement.

Table 7. System Configuration File Statements (SYSTEM CONFIG)

Statement	Description	Location
ACTIVATE ISLINK	Identifies a communication link to ISFC.	"ACTIVATE ISLINK Statement" on page 55
ALTERNATE_OPERators	Identifies up to eight user IDs that have the potential to become the system operator automatically when the primary system operator logs off.	"ALTERNATE_OPERATORS Statement" on page 57
ASSOCIate EXit	Assigns one or more entry points or external symbols to an exit point during initialization.	"ASSOCIATE EXIT Statement" on page 59
ASSOCIate MESSages/MSGs	Assigns an external symbol to a local message repository and gives CP information about how to select messages in that repository during initialization.	"ASSOCIATE MESSAGES / MSGS Statement" on page 63
BEGIN / END	Identifies blocks of system configuration file statements that apply to particular systems.	"BEGIN / END Statements" on page 66
CHARACTER_DEFaults	Establishes system-wide defaults for the logical character delete, escape, line delete, line end, and tab symbols.	"CHARACTER_DEFAULTS Statement" on page 68
CP_ACCESS	Defines the list of disks that CP accesses immediately when it brings the user directory on line.	"CP_ACCESS Statement" on page 71
CP_ADDON_INITIALIZE_ROUtines	Lists the installation-added entry points that will be called during system initialization.	"CP_ADDON_INITIALIZE_ROUTINES Statement" on page 73
CP_OWNeD	Defines and generates a list of up to 255 CP-owned volumes.	"CP_OWNED Statement" on page 74
CPXLoad	Loads a file containing customer-written CP routines from the parm disk or a CP-accessed disk into the system execution space during initialization.	"CPXLOAD Statement" on page 77
CU	Defines the way CP initializes specific control units.	"CU Statement" on page 82
DEFine ALIAS	Defines a new alias for an existing CP command on the system during initialization.	"DEFINE ALIAS Statement" on page 84
DEFine COMmand/CMD	Defines a new CP command or a new version of an existing CP command on the system during initialization.	"DEFINE COMMAND / CMD Statement" on page 87
DEFine DIAgnoSe	Defines a new DIAGNOSE code on the system during initialization.	"DEFINE DIAGNOSE Statement" on page 93
DEFine EXit	Defines a new exit point in CP during initialization.	"DEFINE EXIT Statement" on page 97
DEFINE LAN	Defines a guest LAN.	"DEFINE LAN Statement" on page 100
DEFINE VSWITCH	Creates a CP system-owned switch (a virtual switch) to which virtual machines can connect.	"DEFINE VSWITCH Statement" on page 104
DEVIces	Tells CP what to do with various devices at IPL.	"DEVICES Statement" on page 117
DISAbLe COMmand/CMD	Prevents CP from processing requests for the specified CP command during and after initialization.	"DISABLE COMMAND / CMD Statement" on page 122

Table 7. System Configuration File Statements (SYSTEM CONFIG) (continued)

Statement	Description	Location
DISable DIAGnose	Prevents CP from processing requests for the specified locally-developed DIAGNOSE codes during and after initialization.	"DISABLE DIAGNOSE Statement" on page 124
DISable EXits	Prevents CP from calling all entry points and external symbols associated with one or more exit points during and after initialization.	"DISABLE EXITS Statement" on page 126
DISTRIBUTE	Specifies the distribution features for the local system.	"DISTRIBUTE Statement" on page 128
DRAin	Stops new operations on specified real devices.	"DRAIN (Disk) Statement" on page 130
EDEvice	Defines an emulated device that represents a real device.	"EDEVICE Statement" on page 133
EMERGENCY_MESSAGE_CONSoles	Defines consoles for system emergency messages.	"EMERGENCY_MESSAGE_CONSOLES Statement" on page 138
ENable COMmand/CMD	Permits CP to process requests for the specified CP command during and after initialization.	"ENABLE COMMAND / CMD Statement" on page 140
ENable DIAGnose	Permits CP to process requests for the specified locally-developed DIAGNOSE codes during and after initialization.	"ENABLE DIAGNOSE Statement" on page 142
ENable EXits	Permits CP to call all entry points and external symbols associated with one or more exit points during and after initialization.	"ENABLE EXITS Statement" on page 144
ENFORCE_BY_VOLId	Enforces attachment of DASD devices by their VOLIDs on the ATTACH command.	"ENFORCE_BY_VOLID Statement" on page 146
EQUate	Groups names of systems that all have something in common and should thus be treated similarly.	"EQUATE Statement" on page 147
EXTERNAL_SYNTax	Adds locally-developed system configuration file statements to the system without modifying the system configuration file processor, HCPZSC ASSEMBLE.	"EXTERNAL_SYNTAX Statement" on page 149
FEATures	Establishes certain attributes of the system at system initialization.	"FEATURES Statement" on page 150
FORM_DEFault	Generates default user form names.	"FORM_DEFAULT Statement" on page 165
HOT_IO_Rate	Specifies the number of contiguous unsolicited interrupts that CP will accept from faulty I/O devices before it stops accepting input from those devices.	"HOT_IO_RATE Statement" on page 167
IMbed	Specifies files to imbed into the SYSTEM CONFIG file at IPL.	"IMBED Statement" on page 170
INIT_MITIME	Specifies the MITIME (the time interval at which a device is checked for missing interrupts) that is in effect during device initialization at system IPL time.	"INIT_MITIME Statement" on page 172
IODF	Specifies the IODF that HCD will use in its control of the I/O configuration.	"IODF Statement" on page 173
JOURNALing	Specifies whether CP should include the journaling facility in the system being generated; establishes attributes of the facility.	"JOURNALING Statement" on page 176
LOGO_Config	Specifies the name and type of a logo configuration file.	"LOGO_CONFIG Statement" on page 180
MODify COMmand/CMD	Redefines an existing CP command on the system during initialization.	"MODIFY COMMAND / CMD Statement" on page 181

System Configuration File

Table 7. System Configuration File Statements (SYSTEM CONFIG) (continued)

Statement	Description	Location
MODify DIAGnose	Redefines an existing DIAGNOSE code on the system during initialization.	"MODIFY DIAGNOSE Statement" on page 185
MODify EXit	Redefines or removes an existing dynamic CP exit point during initialization.	"MODIFY EXIT Statement" on page 188
MODify LAN	Modifies the properties of a guest LAN.	"MODIFY LAN Statement" on page 191
MODify PORT	Defines or changes the OSA-Express devices that make up a link aggregation group and to set the attributes of a link aggregation group.	"MODIFY PORT Statement" on page 193
MODify PRIV_CLASSES	Changes the privilege classes and establishes initial values.	"MODIFY PRIV_CLASSES Statement" on page 196
MODify VSWITCH	Modifies the properties of an existing virtual switch.	"MODIFY VSWITCH Statement" on page 198
OPERATOR_CONSoles	Defines a list of consoles from which CP can choose an operator console.	"OPERATOR_CONSOLES Statement" on page 208
PRINTER_Ttle	Specifies the printed output classes that are to contain classification titles.	"PRINTER_TITLE Statement" on page 210
PRIV_CLASSES	Changes the privilege class that authorizes certain internal CP functions.	"PRIV_CLASSES Statement" on page 212
PRODUCT	Defines a product or feature to the system.	"PRODUCT Statement" on page 214
RDEvice	Adds to the system's definition of a set of real devices.	"RDEVICE Statement" on page 216
RELOCATION_DOMAIN	Defines subsets of SSI membership as domains.	"RELOCATION_DOMAIN Statement" on page 251
SAY	Writes a line of text to the operator's console during initialization.	"SAY Statement" on page 252
SET	Defines default system configuration values.	"SET Statement" on page 254
SRM	Change system resource manager settings related to HiperDispatch.	"SRM Statement" on page 255
SSI	Define information about the name of the SSI cluster, location of the persistent data record (PDR), and systems that are members of the SSI cluster.	"SSI Statement" on page 258
STArt	Restarts devices after they have been drained; changes the processing options in effect for devices.	"START (Disk) Statement" on page 260
STORage	Configures the use of real storage.	"STORAGE Statement" on page 262
SYSTEM_ALias	Specifies HyperPAV alias devices to be automatically attached to the system during system initialization.	"SYSTEM_ALIAS Statement" on page 266
SYSTEM_DATEFormat	Sets the system-wide default date format for commands that provide multiple date formats.	"SYSTEM_DATEFORMAT Statement" on page 267
SYSTEM_IDentifier	Creates a system name for the processor on which you run z/VM.	"SYSTEM_IDENTIFIER Statement" on page 268
SYSTEM_IDENTIFIER_DEFault	Provides CP with a default system name.	"SYSTEM_IDENTIFIER_DEFAULT Statement" on page 271
SYSTEM_RESidence	Describes the layout of the system residence disk.	"SYSTEM_RESIDENCE Statement" on page 273
SYSTEM_USERids	Specifies user IDs that will perform special functions during and after IPL.	"SYSTEM_USERIDS Statement" on page 275
THROTtle	Limits the number of I/O operations that guest operating systems can initiate to a specific real device.	"THROTTLE Statement" on page 279

Table 7. System Configuration File Statements (SYSTEM CONFIG) (continued)

Statement	Description	Location
TIMEZONE_Boundary	Tells CP which time zone to choose at IPL.	"TIMEZONE_BOUNDARY Statement" on page 281
TIMEZONE_DEFINITION	Defines system time zones according to their distance from UTC.	"TIMEZONE_DEFINITION Statement" on page 283
TOLERATE_CONFIG_ERRORS	Marks sections of the system configuration file in which CP is not to tolerate errors.	"TOLERATE_CONFIG_ERRORS Statement" on page 285
TRANSLATE_TABLE	Specifies replacements for standard translation tables.	"TRANSLATE_TABLE Statement" on page 287
USERForm	Creates a list of user form names and their corresponding operator form numbers; specifies forms as NARROW so that a narrow separator form is printed.	"USERFORM Statement" on page 291
USER_DEFAULTS	Defines defaults to be used for <ul style="list-style-type: none"> global lines per page values for virtual printers and consoles defined on the system, and querying other users' POSIX database information and having their POSIX security values changed. 	"USER_DEFAULTS Statement" on page 292
USER_VOLUME_EXclude	Defines volumes to be excluded from the user volume list.	"USER_VOLUME_EXCLUDE Statement" on page 295
USER_VOLUME_INclude	Defines user volumes by a generic volume identifier.	"USER_VOLUME_INCLUDE Statement" on page 297
USER_VOLUME_List	Generates a list of user DASD volumes not to be used for paging, spooling, directory, or temporary disk space.	"USER_VOLUME_LIST Statement" on page 299
VMLAN	Controls global attributes for guest LAN and virtual switch support.	"VMLAN Statement" on page 303
XLINK_DEVICE_DEFAULTS	Changes the defaults for the CSE area location and format for particular DASD types.	"XLINK_DEVICE_DEFAULTS Statement" on page 307
XLINK_SYSTEM_EXclude	Specifies the systems that CP is to exclude from cross-system link.	"XLINK_SYSTEM_EXCLUDE Statement" on page 311
XLINK_SYSTEM_INclude	Specifies the systems that CP is to include in cross-system link.	"XLINK_SYSTEM_INCLUDE Statement" on page 312
XLINK_VOLUME_EXclude	Specifies the DASD volumes that CP is to exclude from cross-system link.	"XLINK_VOLUME_EXCLUDE Statement" on page 314
XLINK_VOLUME_INclude	Specifies the DASD volumes that CP is to include in cross-system link.	"XLINK_VOLUME_INCLUDE Statement" on page 316

General Rules for Coding a System Configuration File

When creating or updating a system configuration file, you must follow some general syntax rules.

Format

The system configuration file can be a fixed-length or variable-length record file. After all continuations of a statement have been resolved, no individual statement in the file should be longer than 4000 characters, and no individual record in the file should be longer than 4000 characters.

Comments

You can add comments to the file by delimiting them with a beginning character sequence of /* and an ending sequence of */. A single comment may span multiple records in the file. Thus,

```
/*-----*
 * The following section defines the CP owned volume list *
 *-----*/
```

is a valid comment. As many comments as necessary may be entered on a single record in the file. For example,

```
Features Retrieve Max 100 /* Max for all */ Default 7 /* 7 to start */
```

is allowed.

Continuations

To put a statement in more than one record of the configuration file, place a comma at the ends of all but the last line of the statement. For example, you can code the FEATURES statement as follows:

```
Features
  Retrieve Max 100 , /* Max for all */
  Default 7 /* 7 to start */
```

A comma at the end of a line indicates that the statement is not yet complete. You should not code a comma if the statement information is complete but a comment continues to the next record.

```
Features
  Retrieve Max 100 , /* Maximum number of buffers a non
                    ... privileged user may ask for */
  Default 7 /* Seven to start. This matches the
            ... previous release's default */
```

is valid, but a comma after DEFAULT 7 would make the statement invalid, as you have specified no subsequent options. The comma can be placed directly after the last entry on the line. Thus, the example above would also be valid if specified as

```
Features,
  Retrieve Max 100, /* Maximum number of buffers a non
                   ... privileged user may ask for */
  Default 7 /* Seven to start. This matches the
            ... previous release's default */
```

Finally, a blank line does not cause a continuation to be terminated. You could specify

```
Features,

  Retrieve Max 100
```

because CP ignores any blank lines in the configuration file.

Case

In general, it does not matter whether information in the system configuration file is entered in upper case or mixed case. Most entries in the configuration file are converted to upper case before they are processed. Thus,

```
System_Identifier_Default THATVM
```

and


```
System_Identifier_Default thatvm
```

would have the same results. An exception to this rule occurs when CP encounters a quoted string in the file. A quoted string is any string enclosed within single quotation marks; the string may contain blanks and special character sequences such as `/*` and `*/` that are not usually permitted in a single token. Where quoted strings are allowed and a quoted string is specified in the configuration file, the text inside the quotation marks is not converted to upper case. In the following example, the specified printer title would remain in mixed case:

```
Printer_title I 'Internal Use Only'
```

while

```
Printer_title J Confidential
```

would create a print classification of CONFIDENTIAL.

Record Qualifiers

You can instruct CP to process certain statements in the system configuration file only if the file is being used on certain systems. To do this, add one or more record qualifiers onto the front of a statement. A record qualifier consists of a parameter followed by a colon. The parameter can be the system name to which you wish the statement to apply, or it can be one of the following:

- a pattern that contains the special characters `*` (used in place of one or more arbitrary characters) and `%` (used in place of exactly one arbitrary character) and that matches one or more systems to which you wish the statement to apply
- a symbol defined with an EQUATE statement that lists the system or systems to which you wish the statement to apply. An EQUATE statement can list such systems either explicitly or describe them using the pattern matching discussed above.

For example, specifying

```
BOBVM1: BOBVM2: Operator_Consoles 00F2
```

will cause the above OPERATOR_CONSOLES statement to be processed only if the system being IPLed is called BOBVM1 or BOBVM2. CP finds out the name of the system from SYSTEM_IDENTIFIER or SYSTEM_IDENTIFIER_DEFAULT statements.

The Order of Statements in the File

In general, statements may be specified in the system configuration file in any order. There are, however, a few exceptions to this rule:

- TIMEZONE_BOUNDARY statements can refer only to time zones that have been previously defined by TIMEZONE_DEFINITION statements.
- IMBED statements and LOGO_CONFIG statements can only use the special filename or filetype of `-SYSTEM-` if the system name has been previously resolved by a SYSTEM_IDENTIFIER or SYSTEM_IDENTIFIER_DEFAULT statement.
- Record qualifiers can only be used if the system name has been previously resolved by a SYSTEM_IDENTIFIER or SYSTEM_IDENTIFIER_DEFAULT statement.

Therefore, we recommend that you code SYSTEM_IDENTIFIER, SYSTEM_IDENTIFIER_DEFAULT, and EQUATE statements at the top of the configuration file.

System Configuration File

For statements that do not specify lists of items, statements that occur later in the configuration file override equivalent statements specified earlier. For example,

```
Features  Disable Clear-TDisk
.
.
.
Features  Enable  Clear_TDisk
```

would cause TDISK clearing to be enabled. Exceptions to this rule are the CP_OWNED statement and the IODF statement. If you specify more than one CP_OWNED statement with the same slot number, CP uses only the first occurrence of these statements and ignores the subsequent statements. Likewise, if you specify more than one IODF statement, CP uses only the first occurrence of the IODF statement and ignores the subsequent statements.

Statements that specify lists of items are usually processed cumulatively.

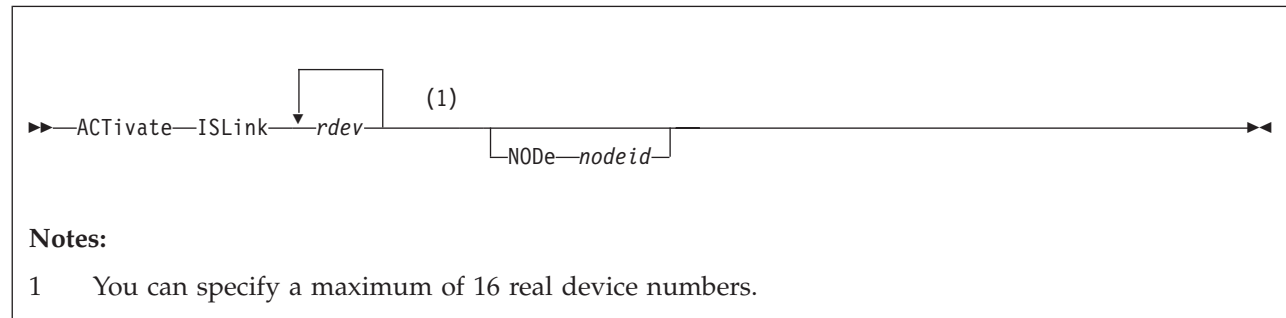
```
User_Volume_List ESAUS1 ESAUS2 ESAUS3
.
.
.
User_Volume_List ESAUS4 ESAUS5 ESAUS6
```

would cause the user volume list to consist of all six specified volumes. Two exceptions to this rule are the OPERATOR_CONSOLES statement and the EMERGENCY_MESSAGE_CONSOLES statement. Each invocation of one of these statements defines an entire list of consoles to be used for a specific purpose; any subsequent invocation causes the entire list for that purpose to be replaced.

Checking the Syntax of Statements in the File

You can check the syntax of the statements in a system configuration file by using the CPSYNTAX command. This command checks the specified system configuration file and any files imbedded in that file. For details, refer to the *z/VM: CP Commands and Utilities Reference* book.

ACTIVATE ISLINK Statement



Purpose

Use the ACTIVATE ISLINK statement to identify a communication link to ISFC.

How to Specify

Include as many statements as needed; they are optional.

Note that when an SSI statement is included in the configuration file, ACTIVATE ISLINK statements must also be specified to define direct ISFC connections from every member to each of the other members of the SSI cluster.

Operands

rdev

identifies one to sixteen real device numbers you want to use as a link.

When the first device is initialized for a new link, the ISLINK for that node is created automatically.

NODE *nodeid*

is the optional node (gateway) identifier for the ISFC link expected for each *rdev*. If not specified, it is determined by device initialization.

If a conflicting *nodeid* is specified for an already active device, an error message is issued.

Usage Notes

1. The system operator receives all informational and error messages.
2. You can improve throughput across your ISFC link by activating more than one device on the same link. Note, however, that FICON subchannels on the same channel path share some hardware resources. In general you will observe better data transfer rates if subchannels on a given link are configured to use different channel paths.
3. When an SSI statement is specified, ACTIVATE ISLINK statements must also be specified to define direct ISFC connections to each of the other members of the SSI cluster. If other member(s) are joined to the cluster during IPL of an SSI member, ISFC connections to the joined members must be established before the system operator is logged on and IPL completes.
 - If there is not an ISFC connection to every joined member, message HCP1669I is displayed and the system waits until there are connections to all joined members.

ACTIVATE ISLINK

- If there are not enough ACTIVATE ISLINK statements to define direct connections to every joined member, message HCP1670E is displayed, followed by disabled wait state 1670.
4. Avoid using different CHPID speeds in any one logical link, as that will cause the ISFC logical link to operate less efficiently.

ALTERNATE_OPERATORS Statement



Purpose

Use the ALTERNATE_OPERATORS statement to specify a maximum of eight user IDs that have the potential to become the system operator automatically when the primary system operator logs off.

How to Specify

The ALTERNATE_OPERATORS statement is optional. You can place the ALTERNATE_OPERATORS statement anywhere in the system configuration file. If you specify more than one ALTERNATE_OPERATORS statement, the last statement overrides any previous specifications.

Operands

userid

specifies up to eight alternate operator user IDs. If the current primary system operator logs off and the default primary system operator is not available, one of these user IDs automatically becomes the primary system operator if the following conditions are met:

- the user ID is logged on or disconnected
- the user ID has at least one of the privilege classes required for the system operator at the time the operator logs off.

The variable *userid* is an alphanumeric character string of as many as eight characters. There is no default alternate operator user ID.

Usage Notes

1. If alternate operator user IDs are specified and the primary system operator logs off, CP will select the default operator ID before the alternates if the default operator is logged on or disconnected.
2. If no alternate operator user IDs are specified or no alternate can be selected when the primary system operator logs off, there will be no operator until one the following events occurs:
 - The default operator ID logs on
 - Any user ID logs on with at least one of the privilege classes required for the system operator
 - The SET SYSOPER command successfully selects a new operator
 - The system is IPLed.
3. For more information on the default primary system operator ID, see “SYSTEM_USERIDS Statement” on page 275.
4. For more information on defining operator privilege class, see “PRIV_CLASSES Statement” on page 212.

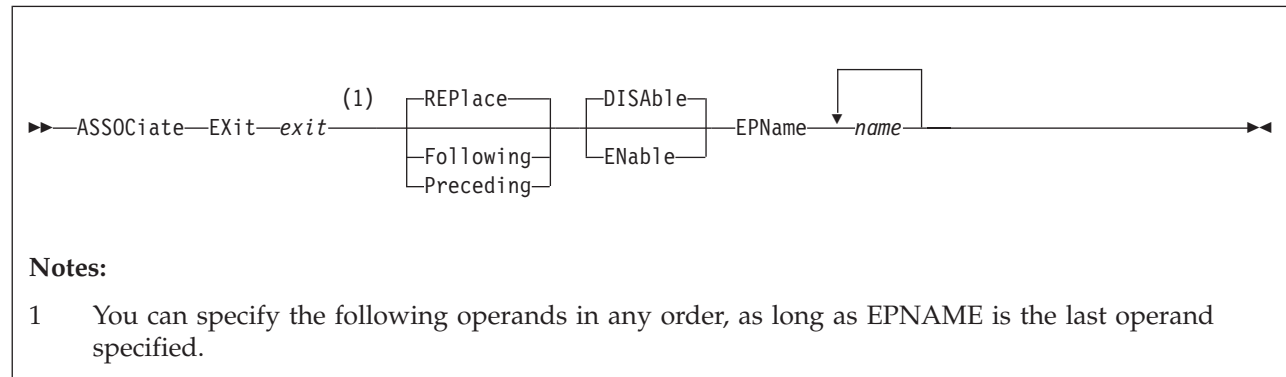
ALTERNATE_OPERATORS

Examples

To specify user IDs ALTOP, OTHEROP and OPBACKUP as alternate operators, use the following ALTERNATE_OPERATORS statement:

```
Alternate_Operators,  
    ALTOP, /* This ID is tried after the default operator */  
    OTHEROP, /* This ID will be tried next */  
    OPBACKUP /* This ID is tried last */
```

ASSOCIATE EXIT Statement



Purpose

Use the ASSOCIATE EXIT statement to assign one or more entry points or external symbols to an exit point during initialization.

You can also assign entry points and external symbols to an exit point after initialization using the ASSOCIATE EXIT command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place ASSOCIATE EXIT statements anywhere in the system configuration file.

If you specify more than one statement with the same exit point number, CP keeps a cumulative list of operations. For example, if you have one statement indicating that you want to replace the list of entry point names and a later statement indicating that you want to add an entry point to the end of the list, CP replaces the list **and** adds to the end. The second statement does not overrule the first statement.

Operands

exit

is the number of the exit point to which you want to assign an entry point or external symbol. The variable *exit* must be a hexadecimal number between X'0000' and X'FFFF'.

REPlace

tells CP to replace the current list of entry point names and external symbols that are already associated with this exit point with the list specified after the EPNAME operand.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

Following

tells CP to add the specified entry point names or external symbols to the end of the list of existing entry point names and external symbols that are already associated with the specified exit point number.

ASSOCIATE EXIT

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

Preceding

tells CP to add the specified entry point names or external symbols to the beginning of the list of existing entry point names and external symbols that are already associated with the specified exit point number.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

DISAbLe

tells CP not to call the entry points and external symbols associated with this exit point until you enable it. (For more information about enabling exit points, see Usage Note 4.) If omitted, DISABLE is the default.

ENAbLe

tells CP to immediately start calling the entry points and external symbols associated with this exit point.

EPName *name*

is the name (or names) of the entry point or external symbol that CP calls when encountering this exit point number. Each *name* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the four special characters (\$, #, _, and @), or any combination thereof.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

Usage Notes

1. If you specify the ASSOCIATE EXIT statement in your system configuration file, you should also specify the CPXLOAD statement (see “CPXLOAD Statement” on page 77) to load the customer-written CP routines for the exit point into the system execution space. These customer-written CP routines should contain the entry point names and external symbols that you will specify on the ASSOCIATE EXIT statement.

If CP cannot locate one or more of the entry point names or external symbols on your ASSOCIATE EXIT statement after initialization, CP will ignore the unknown entry point name or external symbol that it does not recognize and continues normal processing. If the unknown entry point or external symbol is part of a list associated with an exit point, CP continues processing the other members of the list. CP does not ignore an exit point because it cannot find one entry point or external symbol in the list. CP only ignores an exit point if it cannot find all the entry points and external symbols in the list.

For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.

2. To display whether there are any unknown entry points or external symbols associated with an exit point, use the QUERY UNRESOLVED command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
3. If you specify the ASSOCIATE EXIT statement and do not specify the ENABLE operand, CP will redefine the exit point with the information from your ASSOCIATE EXIT statement, but will not call any of the entry points or external symbols associated with that exit point until you later enable it.
4. There are 4 ways to enable an exit point:

- Specify another ASSOCIATE EXIT statement further on in your system configuration file and specify the ENABLE operand,
- Specify an ENABLE EXITS statement (see “ENABLE EXITS Statement” on page 144) further on in your system configuration file,
- Enter an ASSOCIATE EXIT command after initialization and specify the ENABLE operand, or
- Enter an ENABLE EXITS command after initialization.

For more information about the ASSOCIATE EXIT or ENABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.

By default, exit points are disabled. Thus, in general, you should follow any ASSOCIATE EXIT commands or statements with ENABLE EXITS commands or statements.

5. CP calls the entry points and external symbols for an exit point in the order that you specify them on the ASSOCIATE EXIT statement or command, unless an entry point overrides this action. Any entry point can tell CP to change the normal processing flow by skipping one or all subsequent entry points or external symbols.
6. To display status and usage statistics information about a specific exit point after initialization, use the QUERY EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

Note: While processing the ASSOCIATE EXIT statement (or command), CP creates a CP exit block for the specified exit point. For a static exit point, CP does not create CP exit control blocks until you associate one or more entry points or external symbols with that exit point. If you try to issue a QUERY EXITS command against such an exit point, CP issues message HCP2752E as the response to your QUERY EXITS command. For a dynamic exit point, QUERY EXITS responds with the definition of the exit, even if there are no entry points associated with it.

7. To display the address of the CP exit block for a specific exit point after initialization, use the LOCATE XITBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*. Again, if you have not associated one or more entry points or external symbols with the specified exit point, there is no CP exit block for CP to locate and display. Instead, CP issues error message HCP2752E.
8. To display the address of the CP indirect call locator block for a specific exit point, use the LOCATE ICLBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
9. To change the definition of an existing dynamic exit point, or remove the exit point from the system, use the MODIFY EXIT statement (see “MODIFY EXIT Statement” on page 188) or command. For more information about the MODIFY EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
10. To stop CP from calling the entry points and external symbols associated with one or more exit points after defining those exit points, use the DISABLE EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
11. To remove the customer-written CP routines from the system execution space:
 - a. Use the DISASSOCIATE command to revoke all entry point and external symbol assignments made with the ASSOCIATE EXIT statement (or command)
 - b. Use the CPXUNLOAD command to unload the customer-written CP routines.

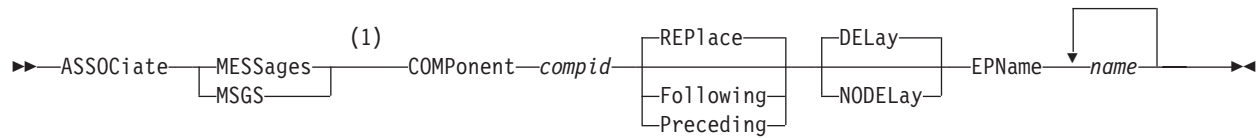
ASSOCIATE EXIT

12. After creating a CP exit block, CP will not erase that CP exit block until another IPL. Disabling the exit point affects certain fields in the CP exit block, but does not erase it. Disassociating the entry point names and external symbols erases those fields in the CP exit block, but does not erase the CP exit block itself.
13. For more information about user-defined exit points, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP associate entry point HCPSRC00 with exit number F and to replace any existing entry point associations, use the following:
`Associate Exit f EName hcpsrc00`
2. To have CP add entry point HCPSRC04 at the end of the current list for exit point 9C, use the following:
`Associate Exit 9c Following EName hcpsrc04`

ASSOCIATE MESSAGES / MSGS Statement



Notes:

- 1 You can specify the following operands in any order, as long as EPNAME is the last operand specified.

Purpose

Use the ASSOCIATE MESSAGES / MSGS statement to assign an external symbol to a local message repository and to give CP information about how to select the messages in that repository during initialization.

You can also assign external symbols to local message repositories after initialization using the ASSOCIATE MESSAGES or MSGS commands. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place ASSOCIATE MESSAGES or MSGS statements anywhere in the system configuration file.

If you specify more than one statement with the same component name, CP keeps a cumulative list of operations. For example, if you have one statement indicating that you want to replace the list of entry point names and a later statement indicating that you want to add an entry point to the end of the list, CP replaces the list **and** adds to the end. The second statement does not overrule the first statement.

Operands

COMPonent *compid*

tells CP the component identifier to use when issuing one of the messages in the local message repository. The variable *compid* is a 1-character to three-character alphanumeric string. For example, the component ID for the system message repository (z/VM) is HCP, which is, by default, the last message repository in the search list. For more information, see Usage Note 1 on page 64.

REPlace

tells CP to replace the current list of entry point names and external symbols that are already associated with this local message repository with the list specified after the EPNAME operand.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

ASSOCIATE MESSAGES / MSGS

Following

tells CP to add the specified entry point names or external symbols to the end of the list of existing entry point names and external symbols that are already associated with the specified local message repository.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

Preceding

tells CP to add the specified entry point names or external symbols to the beginning of the list of existing entry point names and external symbols that are already associated with the specified local message repository.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

DElay

tells CP to process this ASSOCIATE statement after all of the CP_ACCESS statements have been processed and after all of the delayed CPXLOAD statements have been processed. If omitted, DELAY is the default.

NODElay

tells CP to process this ASSOCIATE statement immediately.

EPName *name*

is the name (or names) of the entry point or external symbol that points to the data in the system execution space where the local message repository can be found. Each *name* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the four special characters (\$, #, _, and @), or any combination thereof.

Note: The order that you specify the entry points and external symbols is the order in which CP will call them.

Usage Notes

1. HCP is the standard component ID for z/VM messages. If you do not specify any ASSOCIATE MESSAGES or MSGS statements (or commands) for an entry point, HCPMES is, by default, the only message repository in the search list for that entry point.

If you do assign one or more local message repositories to an entry point, those repositories are added to the search list in the order that you specify (using the REPLACE, FOLLOWING, or PRECEDING operands) and, by default, HCPMES is the last message repository in the search list.

When the routines in that entry point issue a message, CP searches the first message repository in the search list. If CP finds the message in that repository, it issues the message and does not search any more repositories. If CP does not find the message, it continues searching through each repository until it finds the first occurrence of that message.

Using ASSOCIATE MESSAGES or MSGS statements (or commands), you can assign local message repositories which override existing z/VM messages in the HCPMES repository. Or, you can specify HCP as the component ID and move the z/VM message repository to a place in the search list other than last place.

2. Before CP can begin using your message repository, you must:

- a. Generate your messages using the CMS GENMSG command. For more information about the CMS GENMSG command, see the *z/VM: CMS Commands and Utilities Reference*.
- b. Load the message repository file using the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. If CP cannot find the entry point you specified for EPNAME when the message is being displayed, CP displays message substitution data, if any.
4. To display information about the local message repositories available on your system, use the QUERY CPLANGLIST command and specify the ASSOCIATED operand. For more information, see the *z/VM: CP Commands and Utilities Reference*.
5. To remove the message repository file from the system execution space:
 - a. Use the DISASSOCIATE command to revoke the external symbol assignment made with the ASSOCIATE MESSAGES or MSGS statement (or command.)
 - b. Use the CPXUNLOAD command to unload the repository.

For more information about the DISASSOCIATE or CPXUNLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
6. To have CP use the message repositories associated with a specific component, you must specify that component ID on the COMPID keyword of the HCPCONSL macroinstruction. For more information about the HCPCONSL macroinstruction and about using your own message repositories, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP assign an uppercase English message repository containing messages starting with OUR to entry point OURMESS1, use the following:

```
Associate Messages component our,          /* Set it up so we can use */
                        preceding,         /* messages we wrote.      */
                        epname    ourmess1
```

BEGIN / END Statements

►►—*qualifier(s)*—BEGIN—

►►—*qualifier(s)*—END—

Purpose

Use BEGIN and END statements to identify blocks of system configuration file statements that apply to particular systems. Blocks make it easy to define CP-owned lists and other statements that are unique to specific systems in a common configuration file.

How to Specify

BEGIN is an optional statement. If a BEGIN statement is specified, then a corresponding END statement must be specified in the same file. A BEGIN block cannot end in a different file.

Statement blocks bound by BEGIN and END cannot be nested in other BEGIN blocks.

Operands

qualifier(s)

are the record qualifiers used to identify the systems that are associated with a BEGIN block. For the definition of a record qualifier, see “Record Qualifiers” on page 53. Up to 64 qualifiers can be specified on a BEGIN or END statement.

The END statement applies to all qualifiers specified on the previous BEGIN statement. Therefore, qualifiers are optional on END, but if specified, must match those specified on the previous BEGIN.

Usage Notes

1. No record qualifiers are allowed on individual statements within a BEGIN block.
2. If an error related to a BEGIN or END statement is found, a wait state 1689 occurs. A BEGIN or END error could result in statements being included or excluded erroneously. Depending on which statements process incorrectly, the system might initialize in a manner that results in loss of data. The wait state enables you to fix the problem without risking the loss of data.

Examples

1. To have one set of CP-OWNED statements apply to one system and another set of CP-OWNED statements apply to another system, use the following statements:

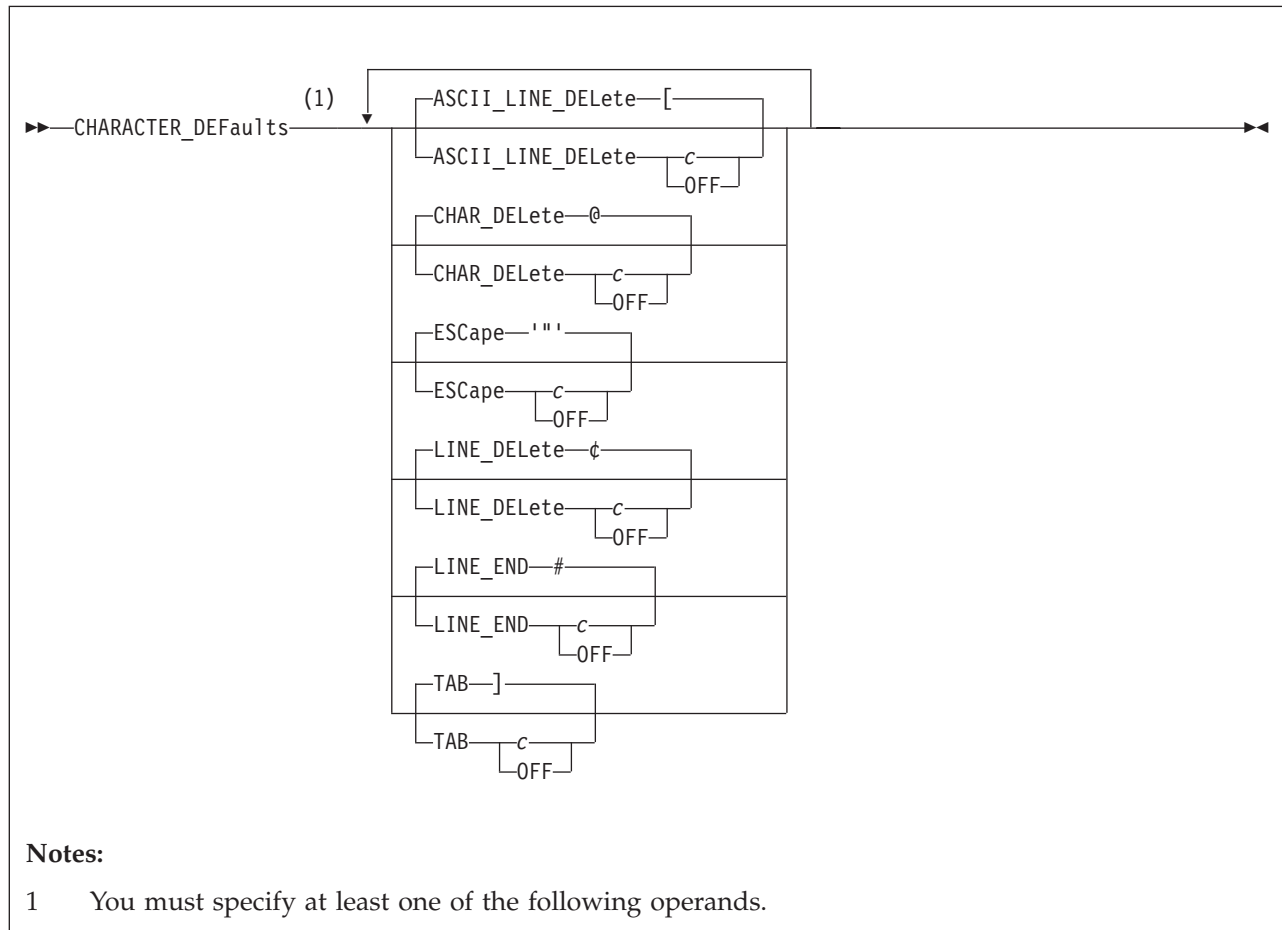
```
VM1: BEGIN
  CP_Owned Slot 1 VM1PG1
  CP_Owned Slot 2 SPVOL1 Owned
  CP_Owned Slot 3 SPVOL2 Shared
  CP_Owned Slot 4 VM1PG2
VM1: END
```

```
VM2: BEGIN
  CP_Owned Slot 1 VM2PG1
  CP_Owned Slot 2 SPVOL1 Shared
  CP_Owned Slot 3 SPVOL2 Owned
  CP_Owned Slot 4 VM2PG2
VM2: END
```

2. The following shows an OPERATOR_CONSOLES statement that applies to two systems:

```
VM1: VM2: BEGIN
  Operator_Consoles 0009 ,
                    001F 0500 0520 0530 0540 0550 0560 0570 0580 ,
                    001D 001E
END
```

CHARACTER_DEFAULTS Statement



Purpose

Use the CHARACTER_DEFAULTS statement to set the default characters that will represent the logical character delete, escape, line delete, line end, and tab symbols on your system.

Operands

ASCII_LINE_DELETE c

defines the logical line delete symbol for **ASCII** devices on your system. Choose a character that is not commonly specified by the users on your system. If you specify **OFF**, your system will not have a logical line delete function for ASCII devices. If omitted, the default is a left bracket ([).

CHAR_DELETE c

defines the default logical character delete symbol on your system. Choose a character that is not commonly specified by the users on your system. If you specify **OFF**, your system will not have a logical character delete symbol. If omitted, the default is an at sign (@).

ESCAPE c

defines the default logical escape symbol on your system. Choose a character

that is not commonly specified by the users on your system. If you specify **OFF**, your system will not have a logical escape character. If omitted, the default is a double quotation mark (").

LINE_DELETE *c*

defines the logical line delete symbol for all non-ASCII devices on your system. Choose a character that is not commonly specified by the users on your system. If you specify **OFF**, your system will not have a logical line delete function. If omitted, the default is a cent sign (¢).

LINE_END *c*

defines the logical line end symbol on your system. Choose a character that is not commonly specified by the users on your system. If you specify **OFF**, your system will not have a logical line end symbol. If omitted, the default is a pound sign (#).

TAB *c*

defines the logical tab symbol on your system. If you specify **OFF**, your system will not have a logical tab character. If omitted, the default is a right bracket (]).

For each of the Operands, you can specify *c* by typing the character (*c*), by typing the character enclosed in single or double quotation marks ('*c*') or ("*c*") or by typing the hexadecimal equivalent of the character (X'*hh*') or (X"*hh*"). If you need to specify a single quotation mark, enclose it within double quotation marks. If you need to specify a double quotation mark, enclose it within single quotation marks.

Usage Notes

1. The CHARACTER_DEFAULTS statement defines default symbols for your entire system. If you want to override the system defaults for a specific user, you can specify defaults for that user:
 - On the USER or IDENTITY directory statement in the user directory (see "USER Directory Statement" on page 609)
 - By having the user issue the CP TERMINAL command after logging on. For more information, see the *z/VM: CP Commands and Utilities Reference*.
2. You cannot use any of the letters A through Z, the numbers 0 through 9, or the bytes X'0E' (shift out) or X'0F' (shift in) for the line-end, line-delete, character-delete, escape, or tab characters.
3. With the widespread use of "@" in internet addresses, it is recommended that you specify OFF for the default character-delete symbol, or define a symbol other than @ as the character-delete symbol, to avoid problems in the data stream.
4. Specifying a blank character (X'40') for any of the default symbols is not recommended.
5. The character display depends on the code page used by the terminal emulator. These characters are from code page 037 United States:

```
# X'7B'
  SYSLEND LINEND

¢ X'4A'
  SYSLDEL LINDEL

@ X'7C'
  SYSLCEL CHARDEL
```

CHARACTER_DEFAULTS

```
" X'7F'  
    SYSLESCP ESCAPE  
  
b X'6A'  
    SYSTAB TABCHAR  
  
[ X'AD'  
    SYSALDEL LINDEL
```

Examples

1. To turn off the logical line delete symbol and define the logical tab symbol on your system as a backslash (\), use the following CHARACTER_DEFAULTS statement:

```
Character_Defaults Line_Delete off,      /* Turn off Line_Delete */  
                  Tab \                  /* Override Tab default */
```

CP_ACCESS Statement



Purpose

Use the CP_ACCESS statement to specify a CMS-formatted minidisk that CP should access when it brings the user directory online. This CP-accessed minidisk may contain system, logo, or device information to use at run-time. This information may include log messages and logos. CP searches for this information on any CP-accessed disks you specify in the order that you specify.

How to Specify

Include as many statements as needed; they are optional. You can place CP_ACCESS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

userid

specifies the user ID of the owner of the minidisk that you want to make available to CP.

vdev

is the virtual device number of the specified user's minidisk, as defined in the virtual machine definition in the user directory. The number can be any hexadecimal number between X'0000' and X'FFFF'.

fm is the file mode letter that you want assigned to all files on the specified minidisk. You can specify any letter from A to Z.

mode

is the access mode. The following is a list of valid modes listed in order of increasing control:

R Read-only access. CP establishes read access.

RR Read-only access. CP establishes read access.

W Write access. CP establishes write access.

WR Write access. CP establishes write access. If write access is denied, CP establishes read access.

M Multiple-write access. CP establishes write access. If a previous write, stable, or exclusive mode access exists, CP denies access.

MR Multiple-write access. CP establishes write access. If a previous write or stable access exists, CP establishes read-only access.

MW Multiple-write access. CP establishes write access in all cases.

SR (The default) Stable read-only access. CP establishes read access. CP denies all requests for write access to a disk with an existing SR mode access. A stable access means that the user holding the SR access can be assured that the disk remains stable, unchanged by others, until CP releases the access.

SW Stable write access. CP establishes write access. CP denies all requests for

write access to a disk with an existing SW mode access. A stable access means that the user holding the SW access can be assured that the disk remains stable, unchanged by others, until CP releases the access.

- SM** Stable multiple access. CP establishes write access. CP denies all requests for write access to a disk with an existing SM mode access. A stable access means that the user holding the SM access can be assured that the disk remains stable, unchanged by others, until CP releases the access.
- ER** Exclusive read-only access. CP establishes read access. CP denies all requests for access to a disk with an existing exclusive mode. An exclusive access means that the user holding the ER access has stable access with the added restriction that no one else has, or can get access to, the specified minidisk until CP releases the access.
- EW** Exclusive write access. CP establishes write access. CP denies all requests for access to a disk with an existing exclusive mode. An exclusive access means that the user holding the EW access has stable access with the added restriction that no one else has, or can get access to, the specified minidisk until CP releases the access.

Usage Notes

1. Because CP does not bring the user directory online until after all CP_ACCESS statements are parsed, CP cannot tell you whether you specified an invalid user ID and virtual device number combination. To find out which CP_ACCESS statements were valid, you must wait until initialization completes and check to see what minidisks CP accessed. To display all the CP-accessed minidisks, use the QUERY CPDISK command. For more information about the QUERY CPDISK command, see the *z/VM: CP Commands and Utilities Reference*.
2. If you specify the NODIRECT option during the IPL, CP ignores all CP_ACCESS statements in the system configuration file.
3. After initializing CP, use the CPACCESS command to access minidisks for CP and use the CPRELEASE command to release minidisks. For more information, see the *z/VM: CP Commands and Utilities Reference*.
4. The use of the stable and exclusive link modes (SR, SW, SM, ER, EW) is controlled by the LNKSTABL and LNKEXCLU options on the OPTION directory statement. For more information about the OPTION statement, see "OPTION Directory Statement" on page 561.

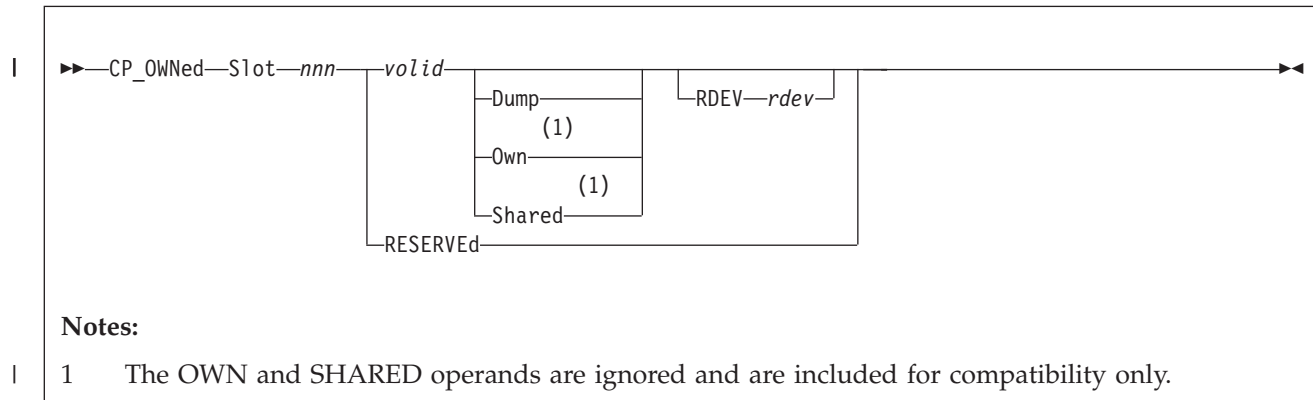
Examples

1. To access three minidisks owned by the MAINT and PICTURE user IDs, use the following CP_ACCESS statements:

```
CP_Access maint    0300  a  SR    /* Give CP access to LOGMSG files */
CP_Access maint    0301  b  SR    /* Give CP access to backup
                                LOGMSG files */
CP_Access picture  0193  c  SR    /* Give CP access to LOGO files */
```



CP_OWNED Statement



Purpose

Use the CP_OWNED statement to define a list of up to 255 CP-owned DASD volumes. CP-owned DASD volumes are the CP system residence volume and any volumes containing real system paging, spooling, dump, directory, and temporary disk space.

How to Specify

Include as many statements as needed; they are optional. You can place CP_OWNED statements anywhere in the system configuration file. If you specify more than one statement with the same slot number, CP uses only the first statement. Subsequent CP_OWNED statements do not redefine the slot.

Operands

Slot *nnn*

tells CP the number of the slot in the CP-owned volume list. *nnn* must be a decimal number from 1 to 255.

valid

is the 1- to 6-character volume serial number of the volume you want to include in the CP-owned volume list.

Dump

tells CP to reserve the spool space on the specified volume exclusively for dumps.

Own

is ignored and is included for compatibility only. In an SSI cluster, volume ownership is determined by the ownership information recorded on the volume.

Shared

is ignored and is included for compatibility only. In an SSI cluster, volume ownership is determined by the ownership information recorded on the volume.

RDEV *rdev*

specifies the real device address of the DASD volume you want to include in the CP-owned volume list. The variable *rdev* is a 1- to 4-character hexadecimal device address.

RESERVED

tells CP to reserve the slot for future use.

Usage Notes

1. Before CP can use a DASD, you must format, label, and allocate space on the DASD. You can do this using the Device Support Facilities program (ICKDSF) or the CPFMTXA utility. However, we recommend that you use the ICKDSF method of CP volume maintenance because it is required for certain DASD types. You should format ECKD[™] devices without filler records using ICKDSF. For more information about ICKDSF, see the *ICKDSF User's Guide and Reference*. For more information on the CPFMTXA utility, see the *z/VM: CP Commands and Utilities Reference*.
2. If you specify a volume that is not mounted on a CP_OWNED statement when CP is loaded, CP considers that volume unavailable. If possible, CP continues processing and creates an empty slot for the specified volume in the CP-owned volume list. By creating empty slots in the CP-owned volume list, you can provide space for future growth. When you need to attach a volume to the system, the system operator can mount and attach the volume (using the CP ATTACH command) without having to re-IPL the system. For more information about the CP ATTACH command, see the *z/VM: CP Commands and Utilities Reference*.
3. You can add new volumes to a system that has already been IPLed in RESERVED slots in the CP-owned volume list. For more information, see "Adding DASD Space to a Running System" on page 659.

To delete a CP_OWNED volume:

- Remove the CP_OWNED statement from the system configuration file. In this case, you must IPL with a cold start.
- Change the volid to RESERVED in the system configuration file. In this case, you must IPL, but a cold start may not be necessary.

Attention: If you delete any volume that contains spool space from the CP-owned volume list, or move any volume that contains spool space to a different slot in the CP-owned volume list, a clean start is required. A clean start causes the deletion of spool files and system data files, including named saved systems and saved segments. Files that need to be preserved over such a change should be dumped to tape using the SPXTAPE DUMP command.

After the clean start, SPXTAPE LOAD should be used to restore the spool files and system data files from tape. This ensures that spool files and system data files that existed on the system before deletion or movement of volumes in the CP-owned volume list are restored correctly.

4. If you specify the DUMP option for a volume with spool space that is already in use when you IPL the system, those spool files remain on that volume until you move them with a CP SPXTAPE DUMP command with the PURGE option. For more information about the CP SPXTAPE command, see the *z/VM: CP Commands and Utilities Reference*.
5. If the DASD volume at the specified RDEV address has a different volume ID than specified on the CP_OWNED statement, or if no DASD volume exists at the specified RDEV address, no volume with the specified volume ID is attached.

CP_OWNED

6. At system initialization (IPL), if more than one DASD volume has the same volume serial number (*valid*) and that *valid* is in the CP or user volume list, and no *rdev* has been specified for that *valid*, the volume with the lowest device number is attached to the system. This rule does not apply to duplicates of the system residence volume (the volume containing the minidisk from which the CP nucleus module was read).
7. Specifying an *rdev* on the CP_OWNED statement provides a convenient method for managing a case where there might be multiple DASD defined to the system that have the same volume ID, and the device with the higher device number is the one that should be attached. This eliminates the need to set the devices OFFLINE_AT_IPL and then attach the devices after the IPL process has completed.
8. See “Allocating Space for CP Hard Abend Dumps” on page 654 for IBM recommendations on dump space allocation.

Examples

1. To define a CP-owned volume list that contains:

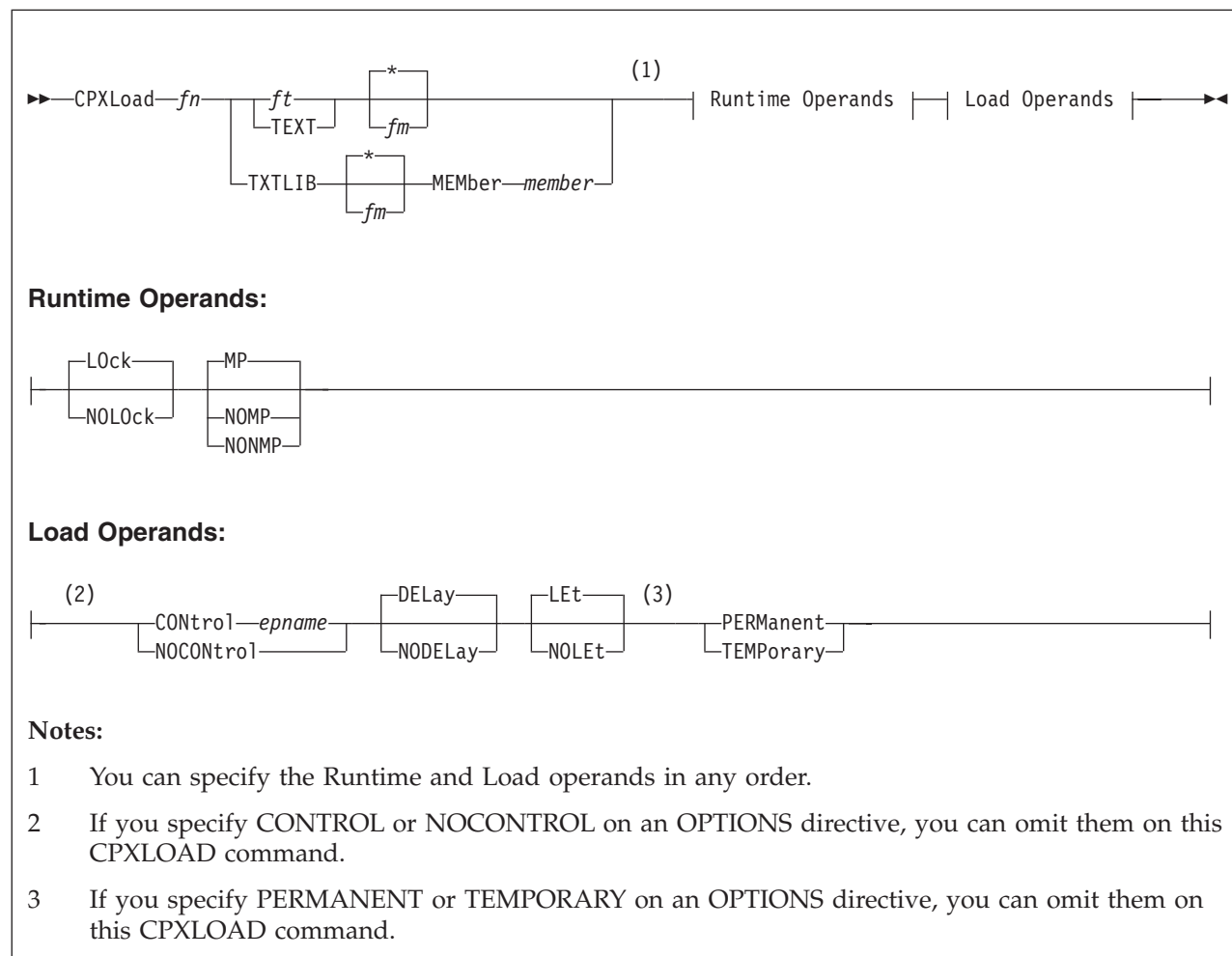
- A system residence volume
- A volume for spool and temporary disk space
- Two volumes for spool space, one residing at a particular RDEV number
- A volume for dump space
- Three empty slots for volumes you will be getting shortly

use the following CP_OWNED statements:

```
CP_Owned Slot 001 esares          /* System Residence volume */
CP_Owned Slot 002 essys1          /* Spool and T-disk space */
CP_Owned Slot 003 essys2          /* Spool space */
CP_Owned Slot 004 sysdmp Dump     /* Dump space */
CP_Owned Slot 005 spool1 RDEV 3BC0 /* More spool space */

CP_Owned Slot 006 Reserved        /* Leave some slots open in */
CP_Owned Slot 007 Reserved        /* case we need to add some */
CP_Owned Slot 008 Reserved        /* extra spool space later. */
```


CPXLOAD Statement



Purpose

Use the CPXLOAD statement to load a file containing customer-written CP routines from the parm disk or a CP-accessed disk into the system execution space during initialization.

You can also load customer-written CP routines into the system execution space after initialization using the CPXLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place CPXLOAD statements anywhere in the system configuration file. For more information about where you can place the customer-written CP routines, see Usage Note 3 on page 80.

Operands

fn is the name of the file that you want loaded. Because you are loading during

system initialization, you must make sure the CP routines are located in a place where CP can find them. See Usage Note 3 on page 80 for more information.

ft is the file type (other than TEXT or TXTLIB) of the file that you want loaded.

This file may contain CPXLOAD directives, text records, or a combination of both. If the file contains text records, it must have a fixed record format (RECFM F) and a logical record length of 80 (LRECL 80). If the file does not contain text records, it can be any record format and must have a logical record length less than 4,000 (LRECL < 4000).

TEXT

tells CP that this is a text file that contains 1 or more CSECTs and can contain 1 or more CPXLOAD directives. Text files must have a fixed record format (RECFM F) and a logical record length of 80 (LRECL 80).

TXTLIB

tells CP that the file is a text library that contains 1 or more members. A TXTLIB member can contain 1 or more control sections (CSECTs) and can contain CPXLOAD directives. TXTLIB files must have a fixed record format (RECFM F) and a logical record length of 80 (LRECL 80).

* tells CP to search the list of CP-accessed minidisks until it finds the first occurrence of the specified file that you want loaded. If you do not specify a file mode, * is the default.

fm is the file mode of the CP-accessed minidisk containing the file that you want loaded.

MEMber *member*

is the name of the member in the TXTLIB that you want loaded.

You can use generic member names to request a specific subset of files. A generic member name is a 1-character to 8-character string with asterisks (*) in place of 1 or more characters and percent signs (%) in place of exactly 1 character. For example:

hc%p* ...

lists all members that start with HC and have P as their fourth character.

LOck

NOLOck

has no effect and is retained only for compatibility. All symbols are considered resident, which means they cannot be locked or unlocked.

MP

tells CP that the entry point is multiprocessor (MP) capable. This means that the entry point can be dispatched on any of the machine's processors. If omitted, MP is the default.

NOMP

NONMP

tells CP that the entry point is dispatched only on the master processor, because (in general) the entry point assumes that competitive routines are also not multiprocessor (MP) capable. Use NOMP or NONMP to prevent entry points from overlaying each other's chains of control blocks when you do not take the precaution of getting a system lock. For example, SPOOL routines are NOMP.

CONtrol *epname*

tells CP to call the specified entry point after loading the customer-written CP

routines and before processing a CPXUNLOAD request. You can load the customer-written CP routines containing the specified entry point either before or within this CPXLOAD request. The variable *epname* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the 4 special characters (\$, #, _, and @), or any combination thereof.

Note: Normally, if CP cannot find an entry point when processing an exit point routine, it ignores the unknown entry point and continues normal processing. This is not true when you specify the CONTROL *epname* operand. If CP cannot find the entry point you specify on CONTROL, CP will terminate processing your CPXLOAD statement and will not load the customer-written CP routines into the system execution space.

NOCONtrol

tells CP not to call an entry point after loading the customer-written CP routines and before processing a CPXUNLOAD request.

DELaY

tells CP to process all CP_ACCESS statements before processing this CPXLOAD statement. The customer-written CP routines that you are loading must be located on one of the disks specified on one of the CP_ACCESS statements. If omitted, DELAY is the default.

NODELay

tells CP to process this CPXLOAD statement immediately and not to wait until after processing the CP_ACCESS statements. This means that the customer-written CP routines must be a file on the parm disk, which is the only disk that CP has access to at this stage of the initialization process. If you specify a file mode letter and NODELAY, CP ignores your file mode, issues message HCP2777I, and looks for your customer-written CP routines on the parm disk.

LEt

tells CP to load the specified file and to ignore any records that are completely blank or that contain an unexpected value in column 1. This is meant to accommodate the noncommented information that can be left in a TEXT file by an assembler utility such as VMHASM.

NOLEt

tells CP to stop loading the specified file when it encounters an unexpected value in column 1. Column 1 is expected to contain '*' (to denote a comment), X'02' (to denote a TEXT record), or blank (to denote a possible CPXLOAD directive).

PERManent

tells CP that the customer-written CP routines being loaded are to remain a part of CP until a CP SHUTDOWN command is issued or a software-initiated restart (bounce) occurs. This means you cannot use the CPXUNLOAD command to remove these CP routines.

TEMPorary

tells CP that the customer-written CP routines being loaded can be unloaded in the future with a CPXUNLOAD command.

Usage Notes

1. When loading your files into storage, CP treats each control section (CSECT) independently for storage allocation. Also during loading, CP allocates 1 page

of storage to each CSECT. There is 1 exception: if CP encounters a CSECT of zero length during CPXLOAD processing, that CSECT is deleted. If you need to load a zero-length CSECT, add an EXPAND directive to your input file. For example, if you had zero-length CSECT XXXDOG to load, you would add "EXPAND XXXDOG(8)" to your input file.

2. When invoking your files, CP treats each entry point in a CSECT independently for the MP attribute.
3. The customer-written CP routines that you are loading must be on a disk that CP has access to when the load operation is done. If you have a CPXLOAD statement in your system configuration file that specifies the NODELAY operand, the customer-written CP routines must be a file on the parm disk because the minidisks specified on CP_ACCESS statements are not available until the end of the initialization process. If your CPXLOAD statement specifies the DELAY operand, the customer-written CP routines can be on any disk, as long as you have specified a CP_ACCESS statement for that disk in your configuration file. For more information about the CP_ACCESS statement, see "CP_ACCESS Statement" on page 71.
4. You can specify runtime and load operands on either the CPXLOAD statement or the OPTIONS directive, or both. However, if you specify options on both and those options conflict, CP uses the options from the CPXLOAD statement. For example, suppose you specify PERMANENT on the OPTIONS directive and TEMPORARY on the CPXLOAD statement, CP will load the CP routines as temporary. For more information about the OPTIONS directive and several other directives, see the *z/VM: CP Exit Customization* book.
5. To assign entry points and external symbols to an exit point and to enable or disable that exit point, use the ASSOCIATE EXIT statement (see "ASSOCIATE EXIT Statement" on page 59) or command. For more information about the ASSOCIATE EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
6. To assign an external symbol to a local message repository, use the ASSOCIATE MESSAGES or MSGS statement (see "ASSOCIATE MESSAGES / MSGS Statement" on page 63) or command. For more information about the ASSOCIATE MESSAGES or MSGS command, see the *z/VM: CP Commands and Utilities Reference*.
7. To display information about customer-written CP routines loaded by the CPXLOAD statement, use the QUERY CPXLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
8. To display information about external symbols you may have loaded, use the LOCATE SYMBOL command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
9. To remove CPXLOADed files from the system execution space:
 - a. Use the DISASSOCIATE command to revoke all entry point and external symbol assignments made with the ASSOCIATE EXIT, MESSAGES, or MSGS statements or commands
 - b. Use the CPXUNLOAD command to unload the customer-written CP routines.For more information about the commands listed above, see the *z/VM: CP Commands and Utilities Reference*.
10. For more information about loading customer-written CP routines into the system execution space, about runtime and load operands, and about CPXLOAD directives, see *z/VM: CP Exit Customization*.

11. CPXLOAD provides the ability to load executable code, message repositories, and data modules dynamically. Only compiled files may be loaded. These compiled files would be the TEXT file output from the assembler or from the CMS GENMSG command.

Examples

1. To have CP load a multiprocessor capableabend text deck, use the following:

```
CPXload abend text * MP,          /* Load the abend text deck      */
                  Control kaos,
                  Permanent
```

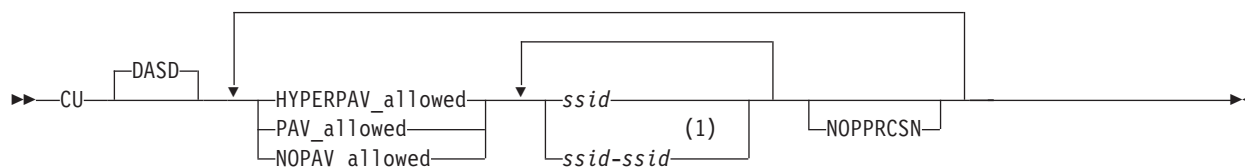
CP assigns a load identifier (load ID) to the loaded CP routines. If you ever want to unload these CP routines (using the CPXUNLOAD command), you will need to specify the load ID that CP assigned. If you do not know the load ID, use the ALL operand of the QUERY CPXLOAD command to display (among other things) the load IDs of all the CP routines loaded onto (and not yet unloaded from) the system.

The load ID that CP assigns is a 1-digit to 10-digit decimal number between 0 and 2,147,483,647. The first time you use the CPXLOAD statement (or command), CP assigns that set of customer-written CP routines a load ID of 0. CP increases the load ID by 1 for each subsequent CPXLOAD request. If all the CPXLOAD requests are successful, you will have a sequential list of loaded CP routines.

If one or more of the CPXLOAD requests are unsuccessful or you issue the CPXUNLOAD command to unload some customer-written CP routines, there will be one or more gaps in your sequential list of loaded CP routines. The next time you load some customer-written CP routines, CP ignores these gaps in the list and assigns the newly-loaded CP routines a load ID that is one more than the last assigned load ID.

For example, suppose you had customer-written CP routines loaded at IDs 0 through 7 and you unloaded the CP routines at IDs 2, 3, and 5. This means you still have CP routines loaded at IDs 0, 1, 4, 6, and 7. The next time you use the CPXLOAD command, CP will assign 8 as the load ID for those CP routines. CP will not try to fill in the gaps at 2, 3, or 5.

CU Statement



Notes:

- 1 If the same *ssid* is specified more than once, the last occurrence is used.

Purpose

Use the CU statement to define the way CP initializes specific control units.

Operands

DASD

tells CP that the specified control units are DASD control units.

HYPERPAV_allowed

tells CP to allow a specified control unit to operate with HyperParallel Access Volume (HyperPAV) devices in your z/VM system.

PAV_allowed

tells CP to allow a specified control unit to operate with Parallel Access Volume (PAV) devices in your z/VM system.

NOPAV_allowed

tells CP to not allow a specified control unit to operate with PAV or HyperPAV devices in your z/VM system.

ssid

ssid-ssid

is the subsystem identifier (as established in a control unit during its installation) of a control unit on which this statement is to operate. The variable *ssid* must be a hexadecimal number between X'0000' and X'FFFF'. You can specify a single subsystem identifier, a list, a range, or any combination thereof.

NOPPRCSN

tells CP to disable Peer-to-Peer Remote Copy (PPRC) suspend summary notifications for a specified control unit in your z/VM system.

Usage Notes

1. For any control units not specified in a CU statement, CP will attempt to establish the highest level of PAV mode that is supported by the functional capability of each control unit.
2. For each capability (HYPERPAV_allowed, PAV_allowed, NOPAV_allowed), the information on the CU statement is processed sequentially. If you specify more than one CU statement or you overlap ranges of subsystem identifiers, CP uses the last specification for each control unit. For example, if you specify:

CU	HYPERPAV	1000-1fff,
	PAV	1800-18ff,
	HYPERPAV	1820-182f

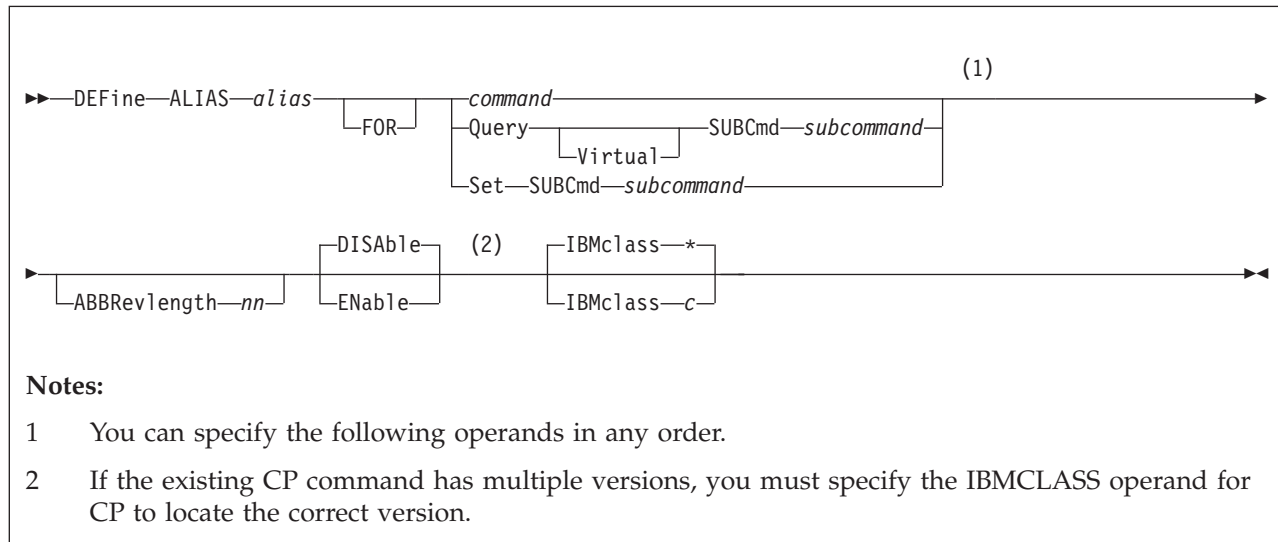
CP will allow PAV mode for control units 1800-181f and 1830-18ff, and will allow HyperPAV mode for control units 1000-17ff, 1820-182f, and 1900-1fff.

Examples

1. To have CP allow HyperPAV mode for control units 0000-0100, allow PAV mode for control units 2000-2100, and disallow aliases for control units 4100-4200, specify the following:

CU	HYPERPAV	0000-1000,
	PAV	2000-2100,
	NOPAV	4100-4200

DEFINE ALIAS Statement



Purpose

Use the DEFINE ALIAS statement to define a new alias for an existing CP command on the system during initialization.

You can also define a new alias after initialization using the DEFINE ALIAS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DEFINE ALIAS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

alias

is the name of the alias that you are defining. The variable *alias* must be a 1-character to 12-character string.

command

is the name of the existing CP command for which you are creating an alias. The variable *command* is a 1-character to 12-character string.

Query SUBCmd subcommand

tells CP the name of the existing CP QUERY subcommand for which you are creating an alias. The variable *subcommand* is a 1-character to 12-character string.

Query Virtual SUBCmd subcommand

tells CP the name of the existing CP QUERY VIRTUAL subcommand for which you are creating an alias. The variable *subcommand* is a 1-character to 12-character string.

Set SUBCmd *subcommand*

tells CP the name of the existing CP SET subcommand for which you are creating an alias. The variable *subcommand* is a 1-character to 12-character string.

ABBRevlength *nn*

is the length of the smallest acceptable abbreviation of the alias that you are defining. The variable *nn* is a decimal number between 1 and the length of the full alias name.

DISAbLe

tells CP not activate this alias until you enable it. (For more information about enabling aliases, see Usage Note 5 on page 86.) If omitted, DISABLE is the default.

ENAbLe

tells CP to immediately activate this alias.

IBMclass *

tells CP to define aliases for all versions of the specified command or subcommand. If omitted, IBMCLASS * is the default.

IBMclass *c*

tells CP to define an alias for a specific version of the specified command or subcommand. The variable *c* can be any 1 of the following:

- A** this is a system-control command to be used by the primary system operator.
- B** this is a command for operational control of real devices.
- C** this is a command to alter host storage.
- D** this is a command for system-wide control of spool files.
- E** this is a command to examine host storage.
- F** this is a command for service control of real devices.
- G** this is a general-use command used to control the functions of a virtual machine.
- 0** (zero) this command has no specific IBM class assigned.

Usage Notes

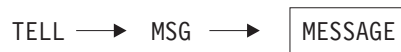
1. You can create many aliases for one command, but you cannot create an alias for an alias. For example, the CP MSG command is actually an alias for the CP MESSAGE command.



You can create another alias for the MESSAGE command.



But you cannot create an alias for MSG.



DEFINE ALIAS

2. If you specify the QUERY, QUERY VIRTUAL, or SET operands, you are creating an alias for a subcommand, not a command. For example, suppose you created alias TUBE for the CP QUERY VIRTUAL GRAF command. To invoke your new alias, you would enter QUERY VIRTUAL TUBE, not QUERY TUBE or just TUBE.
3. When specifying an alias name, you can use special characters in the name. However, we do not recommend that you use the pattern matching characters (* and %). You can use these characters to define aliases, but they may seem confusing when you issue other commands that allow you to use the pattern matching characters because CP will interpret the % or * in your alias name as a pattern matching character.
4. If you try to define a minimum abbreviation that matches the abbreviation for an existing command, subcommand, or alias CP rejects your DEFINE statement. For example, if you created a "QUEUE" alias with a minimum abbreviation of 2, CP would reject your QUEUE alias because "QU" is an abbreviation for the QUERY command. In this case, you would need to specify a minimum abbreviation greater than or equal to 4 because the first 3 characters of QUERY and QUEUE are identical.
5. If you do not specify the ENABLE operand, the new alias is initially in a disabled state. To activate an alias after defining it, use the ENABLE COMMAND or CMD statement (see "ENABLE COMMAND / CMD Statement" on page 140) or command. For more information about the ENABLE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference* book.
6. To deactivate an alias after defining it, use the DISABLE COMMAND or CMD statement (see "DISABLE COMMAND / CMD Statement" on page 122) or command. For more information about the DISABLE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference* book.
7. Once defined, an ALIAS NAME cannot be used again. An ALIAS cannot be modified or eliminated. It can only be disabled. Only a SHUTDOWN or RESTART IPL will eliminate an ALIAS.
8. For more information about creating an alias, see the *z/VM: CP Exit Customization* book.

Examples

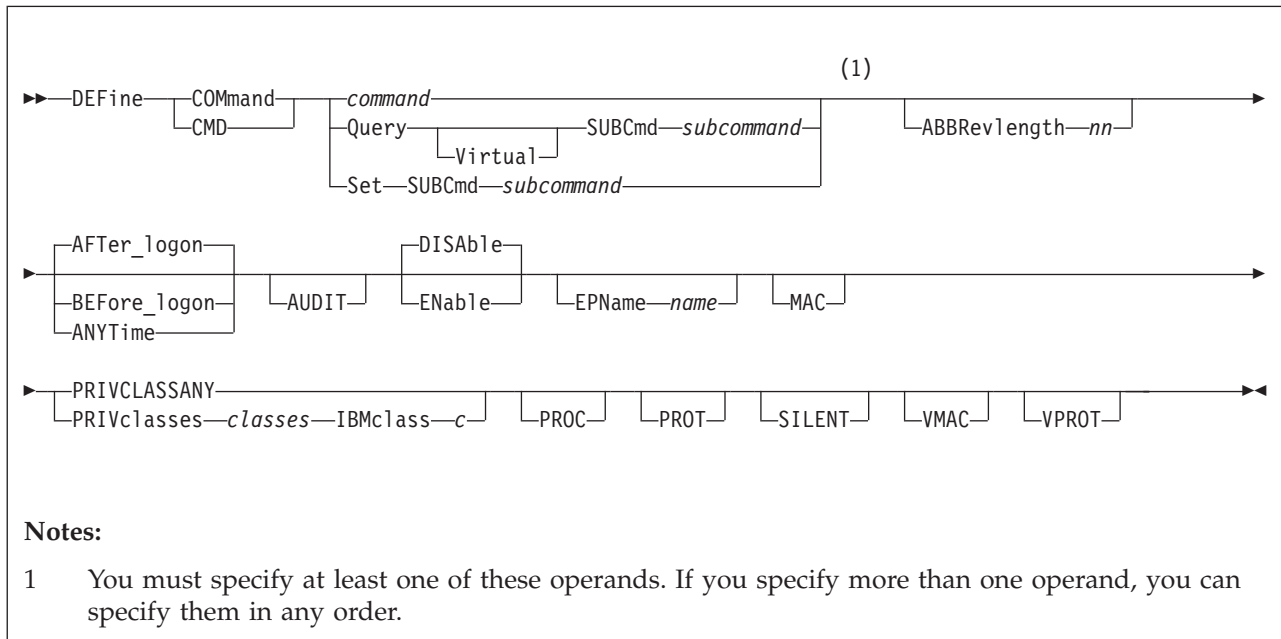
1. To have CP define GOODNIGHT as an alias for the CP SHUTDOWN command and make it available immediately after initialization, use the following:

```
Define Alias goodnight For shutdown,      /* Goodnight, Gracie! */
                          AbbrevLength 5,
                          Enable
```
2. To have CP define TELL as an alias for the IBM class <ANY> version of the CP MESSAGE command and make it available immediately after initialization, use the following:

```
Define Alias tell For message,    /* Create CP TELL command so users do not */
                                IBMclass 0, /* get confused when they drop out of CMS */
                                Enable
```
3. To have CP define NUKE as an alias for all of the IBM class versions of the CP PURGE command and make it available immediately after initialization, use the following:

```
Define Alias nuke For purge,      /* Set it up so that users can "nuke" */
                                IBMclass *, /* instead of "purge" */
                                Enable
```

DEFINE COMMAND / CMD Statement



Purpose

Use the DEFINE COMMAND or CMD statement to define a new CP command or a new version (by IBM class) of an existing CP command on the system during initialization.

You can also define a new CP command after initialization using the DEFINE COMMAND or CMD commands. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DEFINE COMMAND or CMD statements anywhere in the system configuration file. If you specify more than 1 statement with the same command or subcommand name, CP uses only the first statement. Subsequent DEFINE COMMAND or CMD statements do not redefine the command.

Operands

command

is the name of the command that you are defining. The variable *command* is a 1-character to 12-character string.

Query SUBCmd *subcommand*

tells CP the name of the CP QUERY subcommand that you are defining. The variable *subcommand* is a 1-character to 12-character string.

Query Virtual SUBCmd *subcommand*

tells CP the name of the CP QUERY VIRTUAL subcommand that you are defining. The variable *subcommand* is a 1-character to 12-character string.

DEFINE COMMAND / CMD

Set SUBCmd *subcommand*

tells CP the name of the CP SET subcommand that you are defining. The variable *subcommand* is a 1-character to 12-character string.

ABBRlength *nn*

is the length of the smallest acceptable abbreviation of the command or subcommand that you are defining. The variable *nn* is a decimal number between 1 and the length of the full command or subcommand name.

AFTER_logon

tells CP that the command version you are defining will only be issued by users after they log onto the system. Most CP commands fall into this category. The default is AFTER_LOGON.

BEFORE_logon

tells CP that the command you are defining will only be issued by users before they log onto the system. For example, the CP DIAL command can only be used before logon.

Note: If you specify BEFORE_LOGON, you must specify PRIVCLASSANY because CP cannot check privilege classes before a user logs on. Thus, you cannot specify BEFORE_LOGON with the PRIVCLASSES or IBMCLASS operands.

ANYTime

tells CP that the command version you are defining can be issued by users both before and after they log onto the system. For example, many systems let users issue the CP MESSAGE or MSG commands before and after logon.

Note: If you specify ANYTIME, you must specify PRIVCLASSANY because CP cannot check privilege classes before a user logs on. Thus, you cannot specify ANYTIME with the PRIVCLASSES or IBMCLASS operands.

AUDIT

tells the external security manager (ESM) to audit the command that you are defining. When you audit a command, the ESM logs each attempt by users to issue this command.

DISABLe

tells CP not to call the entry points and external symbols associated with this CP command until you enable it. (For more information about enabling CP commands, see Usage Note 4 on page 90.) If omitted, DISABLE is the default.

ENABLe

tells CP to immediately start calling the entry points and external symbols associated with this CP command.

EPName *name*

tells CP the name of the entry point that contains the code to process the command. The variable *name* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the four special characters (\$, #, _, and @), or any combination thereof.

Note: If you are defining a new command, you must specify EPNAME. If you are defining a new version of an existing command, specifying EPNAME is optional. This is because CP only allows one entry point per command, regardless of how many versions that command has. So, when you define a new version of an existing command, CP already knows the entry point name.

The QUERY and SET commands are the only exceptions, because they have subcommands. Note that CP only allows one entry point per subcommand, regardless of how many versions that subcommand has.

MAC

tells CP to enable mandatory access control (MAC) for the command that you are defining. When MAC is enabled for your command, the external security manager (ESM) compares the security label of the user who issued your command to the security label of the resource or user that your command will affect. If you want the ESM to dynamically turn MAC on or off for this command, specify the VMAC operand.

PRIVCLASSANY

tells CP that users with any privilege class can issue the command that you are defining.

PRIVclasses *classes*

tells CP that only users with 1 or more of the specified privilege classes can issue the command that you are defining. The variable *classes* is 1 or more privilege classes in the range A through Z, 1 through 6, or an asterisk (*). Privilege class * indicates all privilege classes (A-Z and 1-6).

Note:

1. If you want more than one privilege class, specify your classes in one string of characters. Do not separate the classes with blank spaces. For example, specify "privclasses abc123", not "privclasses a b c 1 2 3".
2. If you specify PRIVCLASSES, you must also specify IBMCLASS. You can specify these 2 operands in any order.

IBMclass *c*

tells CP what type of command you are defining. The variable *c* can be any 1 of the following:

- A** this is a system-control command to be used by the primary system operator.
- B** this is a command for operational control of real devices.
- C** this is a command to alter host storage.
- D** this is a command for system-wide control of spool files.
- E** this is a command to examine host storage.
- F** this is a command for service control of real devices.
- G** this is a general-use command used to control the functions of a virtual machine.

Note: If you specify IBMCLASS, you must also specify PRIVCLASSES. You can specify these 2 operands in any order.

PROC

tells CP that, after performing the initial privilege class checks, your command processor will be responsible for any further calls to the external security manager (ESM) for the command that you are defining.

PROT

tells the external security manager (ESM) to protect the command that you are defining. When protection is enabled for your command, the ESM checks an access list to ensure that the user who issued your command is authorized to do so. If you want the ESM to dynamically turn protection on or off for your command, specify the VPROT operand.

SILENT

tells CP that the responses from the command you are defining can be

DEFINE COMMAND / CMD

suppressed by invoking it using the SILENTLY command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

Note: Response suppression is supported only for the ATTACH, DETACH, and GIVE commands.

VMAC

gives the external security manager (ESM) the power to dynamically turn mandatory access control (MAC) on or off. If you specify MAC and VMAC for this command, you are enabling MAC and allowing the external security manager (ESM) to dynamically disable MAC. If you specify VMAC and you do not specify MAC for this command, you are disabling MAC and allowing the ESM to dynamically enable MAC.

VPROT

gives the external security manager (ESM) the power to dynamically turn command access protection on or off. If you specify PROT and VPROT for this command, you are enabling protection and allowing the external security manager (ESM) to dynamically disable that protection. If you specify VPROT and you do not specify PROT for this command, you are disabling protection and allowing the ESM to dynamically enable that protection.

Usage Notes

1. For each existing CP command, CP has at least one command table entry block. If the command has more than one privilege class, CP has one command table entry block for each version of the command. The only exceptions to this are the QUERY and SET commands. CP has at least one command table entry block for each QUERY and SET subcommand.
2. When you define a new CP command or a new version of an existing CP command, you must supply CP with certain information about that command. The amount of information you must supply varies depending on what you are defining. You must always supply the command (or subcommand) information and the following table lists any other operands you are required to supply when defining a new command or command version.

When Adding a New:	You Must Specify:		
Command	EPNAME PRIVCLASSANY	- or -	EPNAME PRIVCLASSES IBMCLASS
Command Version	PRIVCLASSANY	- or -	PRIVCLASSES IBMCLASS

3. To load the command processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
4. If you do not specify the ENABLE operand, the new CP command is initially in a disabled state. To activate a CP command after defining it, use the ENABLE COMMAND or CMD statement (see “ENABLE COMMAND / CMD Statement” on page 140) or command. For more information about the ENABLE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.

5. To display the address of the CP command table entry block, the current IBM class, and the current privilege class for a specified CP command, use the LOCATE CMDBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To change the definition of an existing CP command, use the MODIFY COMMAND or CMD statement (see “MODIFY COMMAND / CMD Statement” on page 181) or command. For more information about the MODIFY COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
7. Once defined, COMMANDS, SUBCOMMANDS, ALIASES, and DIAGNOSE codes cannot be DELETED. They can be altered in various appropriate ways but they remain in existence until a SHUTDOWN or RESTART IPL is done.
8. To deactivate a CP command after defining it, use the DISABLE COMMAND or CMD statement (see “DISABLE COMMAND / CMD Statement” on page 122) or command. For more information about the DISABLE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
9. To remove the command processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
10. When specifying a command or subcommand name, you can use special characters in the name. However, we do not recommend that you use the pattern matching characters (* and %). You can use these characters to define commands, but they may seem confusing when you issue the LOCATE CMDBK command. For example, suppose you define 2 new commands: CPU% — to calculate recent CPU busy as a percentage, and CPU1 — to cause some action on real processor number 1. If you issue LOCATE CMDBK CPU%, CP displays information on both CPU% and CPU1, because CP interprets the % in your LOCATE command to be a pattern matching character.
11. If you try to define a minimum abbreviation that matches the abbreviation for an existing command or subcommand, CP rejects your DEFINE statement. For example, if you created a “QUEUE” command with a minimum abbreviation of 2, CP would reject your QUEUE command because “QU” is an abbreviation for the CP QUERY command. In this case, you would need to specify a minimum abbreviation greater than or equal to 4 because the first 3 characters of QUERY and QUEUE are identical.
12. For more information about user-defined commands, see the *z/VM: CP Exit Customization* book.

Examples

1. To define a new command, TELL, with:
 - 3 versions:
 - Privilege class A, IBM class A, issued after logon
 - Privilege class B, IBM class B, issued after logon
 - Any privilege class, no IBM class, issued before and after logon,
 - No minimum abbreviation, and
 - The same entry point and syntax as the CP MESSAGE command,
 use the following statements:

```

Define Cmd tell EPName hcpxmgs,      /* Create class A "CP TELL"    */
                IBMClass a,          /*      command.              */
                PrivClasses a

Define Cmd tell IBMClass b,          /* Create class B "CP TELL"    */

```


DEFINE COMMAND / CMD

```
PrivClasses b      /*  command.          */

Define Cmd tell AnyTime, /* Create "CP TELL" command for */
PrivClassAny      /*  any class user, to use    */
                  /*  before or after logon.    */
```

Attention: Normally, it is not a good practice to define a CP command that has the same name as a command, exec, or function belonging to another z/VM subsystem. (This newly-defined command will interfere with the CMS TELL command.) However, in this case, we thought we would show you an example of how to create a “synonym” for a common CMS command that could be used by novice z/VM users when they accidentally drop out of their CMS session into CP.

2. To define 2 new commands, CONTINUE and RESUME, which behave like the CP BEGIN command, use the following statements:

```
Define Cmd continue AbbrevLength 4, /* Create "CP CONTINUE"      */
EPName hcpcmcbe, /*  command to use instead  */
IBMClass g,      /*  of CP BEGIN.            */
PrivClasses g

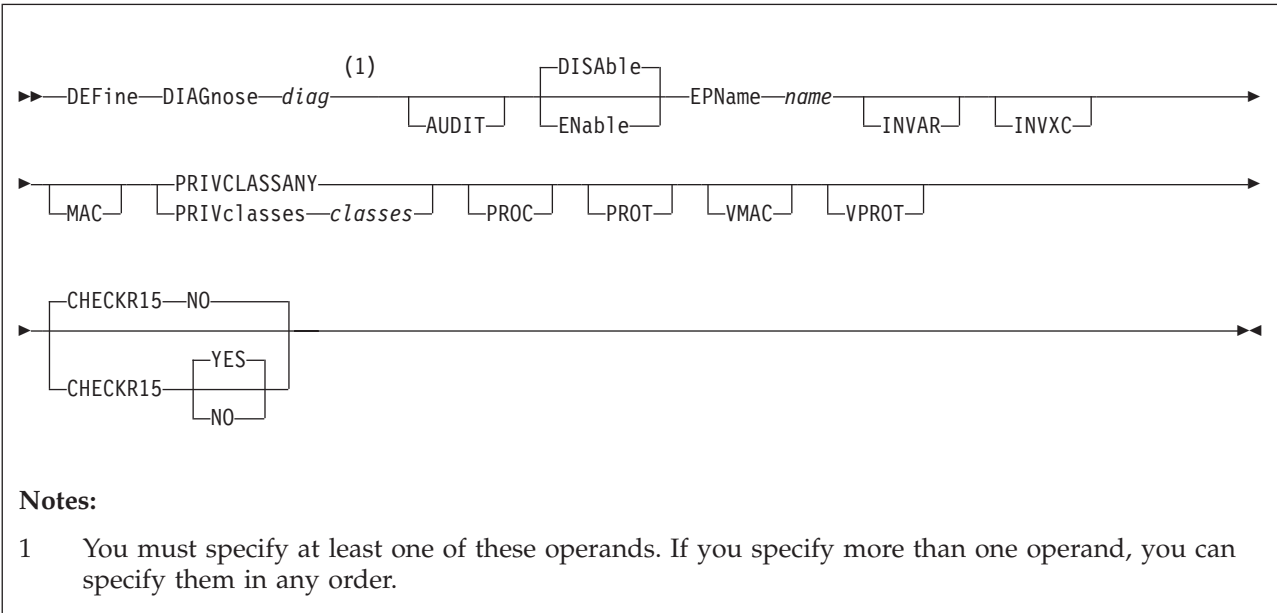
Define Cmd resume EPName hcpcmcbe, /* Create "CP RESUME" command */
IBMClass g, /*  to use instead of CP      */
PrivClasses g /*  BEGIN.                  */
```

In this example, the CONTINUE and RESUME commands:

- Have the same entry point and syntax as the CP BEGIN command,
- Are IBM class G,
- Are privilege class G, and
- Can only be issued after logon.

Additionally, the CONTINUE command has a minimum abbreviation of 4 (CONT) and the RESUME command has no minimum abbreviation.

DEFINE DIAGNOSE Statement



Purpose

Use the `DEFINE DIAGNOSE` statement to define a new `DIAGNOSE` code on the system during initialization.

You can also define a new `DIAGNOSE` code on the system after initialization using the `DEFINE DIAGNOSE` command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place `DEFINE DIAGNOSE` statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

diag
is the number of the `DIAGNOSE` code that you are defining. The variable `diag` is a hexadecimal number between `X'0'` and `X'03FC'` and must be a multiple of 4. The recommended variable range is a value between `X'100'` and `X'1FC'` because that is the range of `diagnose` codes reserved for customer use. All other `DIAGNOSE` code numbers are reserved for IBM use.

AUDIT
tells the external security manager (ESM) to audit the `DIAGNOSE` code that you are defining. When you audit a `DIAGNOSE` code, the ESM logs each attempt by users to issue this `DIAGNOSE` code.

DISAbLe
tells CP not to call the entry points and external symbols associated with this

DEFINE DIAGNOSE

DIAGNOSE code until you enable it. (For more information about enabling DIAGNOSE codes, see Usage Note 3 on page 95.) If omitted, DISABLE is the default.

ENable

tells CP to immediately start calling the entry points and external symbols associated with this DIAGNOSE code.

EPName *name*

tells CP the name of the entry point that contains the code to process the DIAGNOSE code that you are defining. The variable *name* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the four special characters (\$, #, _, and @), or any combination thereof.

INVAR

tells CP not to process this DIAGNOSE code if the virtual machine issuing the DIAGNOSE code is in host access register mode.

INVXC

tells CP not to process this DIAGNOSE code if the virtual machine issuing the DIAGNOSE code is in Enterprise System Architecture/Extended Configuration (ESA/XC) mode.

MAC

tells CP to enable mandatory access control (MAC) for the DIAGNOSE code that you are defining. When MAC is enabled for your DIAGNOSE code, the external security manager (ESM) compares the security label of the virtual machine that issued your DIAGNOSE code to the security label of the resource or user that your DIAGNOSE code will affect. If you want the ESM to dynamically turn MAC on or off for this DIAGNOSE code, specify the VMAC operand.

PRIVCLASSANY

tells CP that users with any privilege class can issue the DIAGNOSE code that you are defining.

PRIVclasses *classes*

tells CP that only users with 1 or more of the specified privilege classes can issue the DIAGNOSE code that you are defining. The variable *classes* is 1 or more privilege classes in the range A through Z, 1 through 6, or an asterisk (*). Privilege class * indicates all privilege classes (A-Z and 1-6).

Note: If you want more than one privilege class, specify your classes in one string of characters. Do not separate the classes with blank spaces. For example, specify "privclasses abc123", not "privclasses a b c 1 2 3".

PROC

tells CP that, after performing the initial privilege class checks, your DIAGNOSE code processor will be responsible for any further calls to the external security manager (ESM) for the DIAGNOSE code that you are defining.

PROT

tells the external security manager (ESM) to protect the DIAGNOSE code that you are defining. When protection is enabled for your DIAGNOSE code, the ESM checks an access list to ensure that the user who issued your DIAGNOSE code is authorized to do so. If you want the ESM to dynamically turn protection on or off for your DIAGNOSE code, specify the VPROT operand.

VMAC

gives the external security manager (ESM) the power to dynamically turn mandatory access control (MAC) on or off.

VPROT

gives the external security manager (ESM) the power to dynamically turn DIAGNOSE code access protection on or off. If you specify PROT and VPROT for this command, you are enabling protection and allowing the external security manager (ESM) to dynamically disable that protection. If you specify VPROT and you do not specify PROT for this command, you are disabling protection and allowing the ESM to dynamically enable that protection.

CHECKR15 YES

CHECKR15 NO

indicates whether the diagnose router should check register 15 upon return from the diagnose handler.

Usage Notes

1. If you do not specify the ENABLE operand, a new DIAGNOSE code is initially in a disabled state after being defined. CP treats disabled DIAGNOSE codes as if they were never defined. If you try to use a disabled DIAGNOSE code in a program, CP will give you a program check specification exception.
2. To load the DIAGNOSE processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. To activate a new DIAGNOSE code after defining it, use the ENABLE DIAGNOSE statement (see “ENABLE DIAGNOSE Statement” on page 142) or command. For more information about the ENABLE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
4. To change the definition of an existing DIAGNOSE code, use the MODIFY DIAGNOSE statement (see “MODIFY DIAGNOSE Statement” on page 185) or command. For more information about the MODIFY DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
5. To display information about a DIAGNOSE code (status, entry point name, and privilege class) after initialization, use the QUERY DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To display the address of the CP DIAGNOSE code table block for a DIAGNOSE code after initialization, use the LOCATE DGNBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To deactivate a DIAGNOSE code after defining it, use the DISABLE DIAGNOSE statement (see “DISABLE DIAGNOSE Statement” on page 124) or command. For more information about the DISABLE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
8. Once defined, DIAGNOSE codes cannot be deleted. They can be altered in various appropriate ways, but they remain in existence until a SHUTDOWN or RESTART IPL is done.
9. To remove the DIAGNOSE processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
10. Many external security managers (ESMs) do not support DIAGNOSE codes above X'03FC'. For this reason, CP does not support DIAGNOSE codes above X'03FC'. The DIAGNOSE codes between X'0000' and X'03FC' are divided as follows:

DEFINE DIAGNOSE

X'0000' to X'00FC'

Reserved for IBM use

X'0100' to X'01FC'

Reserved for customer use

X'0200' to X'03FC'

Reserved for IBM use.

11. When CHECKR15 YES is specified, the diagnose router will check register 15 on return from the diagnose handler. If register 15 contains:

RC = 0

Processing was successful. Complete the guest instruction.

RC = 4

Processing failed due to a condition which would cause a guest program check. Simulate guest program interruption passed in R0.

RC = 8

Nullify the instruction.

RC = 12

Present the machine check then nullify the instruction. R2 will contain the address of the MCRBK which will contain the machine check information.

RC = 16

Generate machine check for processing damage, then go to HCPENDOP to terminate the instruction.

RC = 20

Present the machine check, then go to HCPENDOP to terminate the instruction. R2 will contain the address of the MCRBK, which contains machine check information.

RC = 24

Issue error message or soft abend for paging I/O error, then nullify the instruction. R1 has the message or abend number.

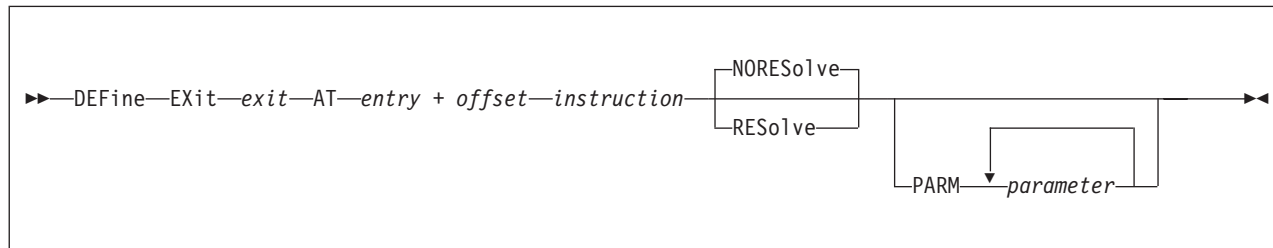
If a return code is invalid (negative, not a multiple of 4 or too big (RC > 24)), then a soft abend will occur.

12. For more information about user-defined DIAGNOSE codes, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP define a general purpose DIAGNOSE code (X'10C') that will be processed by entry point HCPSRC00, use the following:
Define Diagnose 10c EName hcpsrc00,
PrivClasses g
2. To have CP define DIAGNOSE code X'100' and make it available to users with privilege classes C or E, use the following:
Define Diagnose 100 EName qwerty,
PrivClasses ce
3. To have CP define DIAGNOSE code X'18C' and make it available to all users, use the following:
Define Diagnose 18c EName hcpsrc00,
PrivClassAny

DEFINE EXIT Statement



Purpose

Use DEFINE EXIT to define a new exit point in CP during initialization.

You can also define a new CP exit point after initialization using the DEFINE EXIT command. For more information, see the *z/VM: CP Commands and Utilities Reference* book.

How to Specify

Include as many statements as needed; they are optional. You can place DEFINE EXIT statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

exit

is the number of the exit point you are defining. This value must be a hexadecimal number between X'0' and X'FFFF'. The recommended value is between X'F000' and X'FFFF', because that range is reserved for customer use. All other exit numbers are reserved for IBM, vendor, or general use.

AT *entry + offset instruction*

identifies the location of the exit point you are defining and the instruction that is located at the exit point. The variable *entry* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: \$ (dollar sign), # (number sign), _ (underscore), or @ (at sign). The rest of the string can be alphabetic or numeric characters, the four special characters (\$, #, _, or @), or any combination. The variable *offset* must be a 1-character to 4-character even hexadecimal number between X'0' and X'FFFE'. The variable *instruction* must be a 2-, 4-, or 6-character hexadecimal number.

NOREsolve

tells CP to resolve the entry points associated with this exit number the first time they are called. This is the default.

RESolve

tells CP to resolve the entry points associated with this exit number when the association is first established. Any existing associated entry points are resolved immediately.

PARM *parameter*

is a list of one or more parameters to be supplied to the exit. Five kinds of tokens can be used to define a parameter:

DEFINE EXIT

1. Addresses: strings up to eight characters long, consisting of the hexadecimal digits 0 through 9 and A through F.
2. General Registers: strings beginning with G or R, followed by a decimal number between 0 and 15 or a hexadecimal digit, designating the contents of a general register.
3. Indirection: a percent sign (%), which causes the contents of an address or the contents of an address in a register to be used instead of the address or register contents itself.
4. Arithmetic: a plus sign (+) or minus sign (-).
5. Displacement: strings of up to four hexadecimal digits.

Each parameter string specifies how to combine these tokens to generate a parameter value to be passed to an exit routine. The following is a Backus-Naur definition of the syntax of a parameter:

```
<parameter> ::= <anchor> | <anchor><vector>
<anchor> ::= <reg> | 0...FFFFFFFF | <anchor>%
<vector> ::= <modifier> | <vector>% | <vector><modifier>
<modifier> ::= +<disp> | -<disp> | +<reg> < or. -<reg>
<reg> ::= G<digit> | R<digit>
<digit> ::= 0...15 | 0...9, A...F
<disp> ::= 0...7FFF
```

Usage Notes

1. To load the exit processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
2. To assign entry points or external symbols to an exit point, use the ASSOCIATE EXIT statement (see “ASSOCIATE EXIT Statement” on page 59) or command. For information about the ASSOCIATE EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
3. To activate a new exit after defining it, use the ENABLE EXITS statement (see “ENABLE EXITS Statement” on page 144) or command. For information about the ENABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.
4. To change the definition of an existing dynamic exit point, or remove the exit point from the system, use the MODIFY EXIT statement (see “MODIFY EXIT Statement” on page 188) or command. For information about the MODIFY EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
5. To display information about an exit (status, entry point name, and parameters), use the QUERY EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference* book.
6. Exit numbers are allocated as follows:
 - X'0000' to X'7FFF' are reserved for IBM use.
 - X'8000' to X'FFFF' are reserved for vendor and general use.
 - X'F000' to X'FFFF' are reserved for private customer use.
7. The RESOLVE option ensures that the entry names associated with an exit point are defined.
8. Each exit is passed a parameter list that begins with three standard parameters, as described in the *z/VM: CP Exit Customization* book. Additional parameters, specified by the PARM operand, are optional and follow the first three in the order in which they are specified.

9. Errors (for example, addressing exceptions) during evaluation of user-defined parameters when an exit is being invoked cause CP toabend.
10. For more information about user-defined exits, see the *z/VM: CP Exit Customization* book.

Examples

1. To define an exit that will be entered every time a MESSAGE command is issued, use the following:

```
Define Exit f422 At hcpxmngms + 4 41700000 /* Exit from MESSAGE cmd */

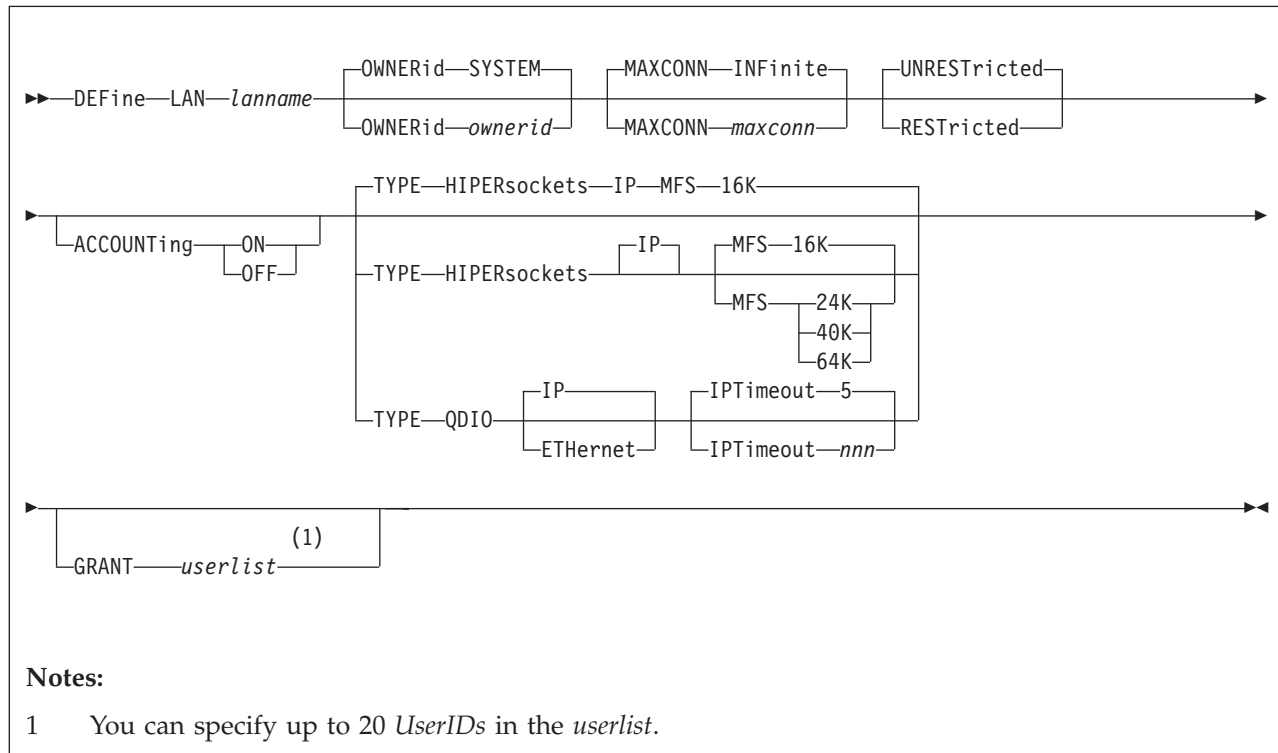
Enable Exits f422 /* */
```
2. To define exit X'F800', pass it two additional parameters, and associate it with entry point QWERTY, use the following:

```
Define Exit f800 At hcplog + 7ce 41204028, /* */
      Parm g1+8% g4 /* */

Associate Exit f800 EPname qwerty /* */

Enable Exits f800 /* */
```

DEFINE LAN Statement



Purpose

Use the `DEFINE LAN` statement to create a guest LAN which can be shared among virtual machines on the same VM system. Each guest LAN segment is identified by a unique combination of `ownerid` and `lanname`. A VM user can create a simulated network interface card (NIC) and connect it to this LAN segment. See “NICDEF Directory Statement” on page 556 for more information about the statement. Alternatively, a VM user can create a virtual network adapter (with the `CP DEFINE NIC` command) and connect it to this LAN (with the `COUPLE` command). See the *z/VM: CP Commands and Utilities Reference* for more information on these commands. For more information about virtual networking options in VM, see *z/VM: Connectivity*.

The `MODIFY LAN` statement can be used to add additional users to be included in the initial access list of a `RESTRICTED` LAN. For more information, see “`MODIFY LAN Statement`” on page 191.

You can also define a LAN after system initialization using the `DEFINE LAN` command. For more information about the command, see *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place `DEFINE LAN` statements anywhere in the system configuration file. If you specify more than one statement with the same `lanname` operand, the first definition will be accepted and subsequent statements will receive an error.

Operands

lanname

is the name of the new emulated LAN (Local Area Network). The *lanname* is a single token (1-8 alphanumeric characters). The combination of *ownerid* and *lanname* will identify this LAN for subsequent commands.

OWNERid *ownerid*

OWNERid **SYSTEM**

establishes the owner of the new LAN.

MAXCONN **INFinite**

MAXCONN *maxconn*

sets the maximum number of simultaneous adapter connections permitted at any given time. When MAXCONN is specified as INFinite, there is no limit on the number of connections. Any other value, *maxconn*, limits the number of simultaneous connections to a decimal number in the range of 1–1024 (inclusive).

If MAXCONN is omitted, the default is MAXCONN INFinite.

RESTRicted|**UNRESTRicted**

sets the type of authorization required to connect to this LAN. Options are:

RESTRicted

Defines a LAN with an access list to restrict connections. The LAN owner will use the **SET LAN** command to GRANT or REVOKE access to specific VM users (by userid). The **COUPLE** command will only allow authorized users (those on the access list) to connect a simulated adapter to a RESTRICTED network.

UNRESTRicted

Defines a LAN with no access list. When CP is in control of the LAN, connections to this LAN are not restricted by user ID. All users connected to this LAN will be able to use PROMISCUOUS Mode. If an External Security Manager (ESM) is in control of the LAN, the ESM may restrict access.

When neither option is specified, the default is to define an **UNRESTRicted** LAN.

ACCOUNTing **ON**

ACCOUNTing **OFF**

Allows a system administrator to control whether accounting records are created for the LAN being defined. The default setting may be changed by the VMLAN statement in the system configuration file, and queried by QUERY VMLAN.

TYPE **HIPERsockets**

defines a guest LAN for use by simulated HiperSockets adapters. A HiperSockets LAN can only accept connections from a simulated HiperSockets adapter.

If **TYPE** is omitted, the default is **TYPE HIPERsockets**.

MFS **16K**

MFS **24K**

MFS **40K**

MFS **64K**

sets the Maximum Frame Size (MFS) for adapters on this network. When an adapter is connected to this LAN, it will adopt the network MFS. The MFS

DEFINE LAN

value determines the amount of storage to be allocated for internal structures, and limits the effective MTU size (Maximum Transmission Unit) for the coupled adapters. For general internet communications, a lower MFS is probably better. However, a high MFS may provide higher data transfer rates for applications that are capable of using larger packet sizes.

If MFS is omitted, the default for HiperSockets is 16 KB. The MFS operand is not valid for QDIO but the effective MFS is 8992 for a QDIO adapter.

TYPE QDIO

defines a guest LAN for use by simulated QDIO adapters. A QDIO LAN can only accept connections from a simulated QDIO adapter.

IP | ETHernet

indicates whether the transport for the LAN is ETHERNET or IP. An ETHERNET LAN operates at the Layer 2 level of the OSI model.

IPTimeout *nnn*

indicates the length of time in minutes that a remote IP address table entry remains in the IP address table for the virtual network.

nnn is a number from 1 to 240. 5 minutes is the default value.

GRANT *userlist*

defines the initial list of users to be included in the Initial Access list of a RESTRICTED LAN. If the GRANT operand is omitted, the default is to GRANT the LAN owner. You can specify up to 20 users in this list. If selected, the GRANT operand must be the last operand on this statement.

Usage Notes

1. A Class B user can invoke the SET LAN and DETACH LAN commands to operate on a SYSTEM LAN (or any LAN regardless of ownership).
2. When a RESTRICTED LAN is defined, the owner is automatically added to the access list.
3. A LAN segment created by the DEFINE LAN statement will be "persistent" (that is, it will survive LOGOFF of the owner). It can only be removed by an explicit DETACH LAN command.
4. MODIFY LAN cannot be used to change the type of transport. The LAN will need to be redefined.
5. The TYPE QDIO guest LAN supports two modes of operation for data transport in support of both TCP/IP and non-IP based applications. In deciding which mode to deploy for your network, some things to consider about deploying an ETHERNET virtualized LAN segment are:
 - Do your servers or applications need to have their own unique MAC addresses (load balancers)?
 - Do you plan to deploy non-IP based applications on your network (SNA or NetBIOS, for example)?
 - Do you want to build a virtual LAN segment that operates closely to its physical counterpart?

The key attributes of each transport mode with their operational characteristics are as follows:

- ETHERNET (Layer 2)
 - Supports all applications that deploy ETHERNET (IEEE 802).
 - ETHERNET frames are transported on the LAN segment.
 - All destinations are identified by MAC address.

- MAC addresses are locally administered by the LAN administrator through z/VM CP commands or configuration statements.
- Each host connection is identified by a single MAC address.
- This is a Link Layer transport, in which all hosts maintain their respective ARP caches.
- VLAN tagging resides within the ETHERNET frames per IEEE 802.1Q specifications.
- IP (Layer 3)
 - Supports IP for TCP/IP applications only.
 - IP packets are transported on the LAN segment.
 - All destinations are identified by IP addresses.
 - IP address assignments are set by the host running in the guest virtual machine.
 - Each host may have more than one IP address (multi-homed).
 - This is Link Layer independent (that is, no MAC addresses).
 - VLAN tagging resides in internal QDIO headers.

A guest LAN operates in only one mode for a given instance. For example, if the LAN is configured as IP, then all communications on the LAN segment must be IP based. The same is also true when the LAN is configured in ETHERNET mode.

Examples

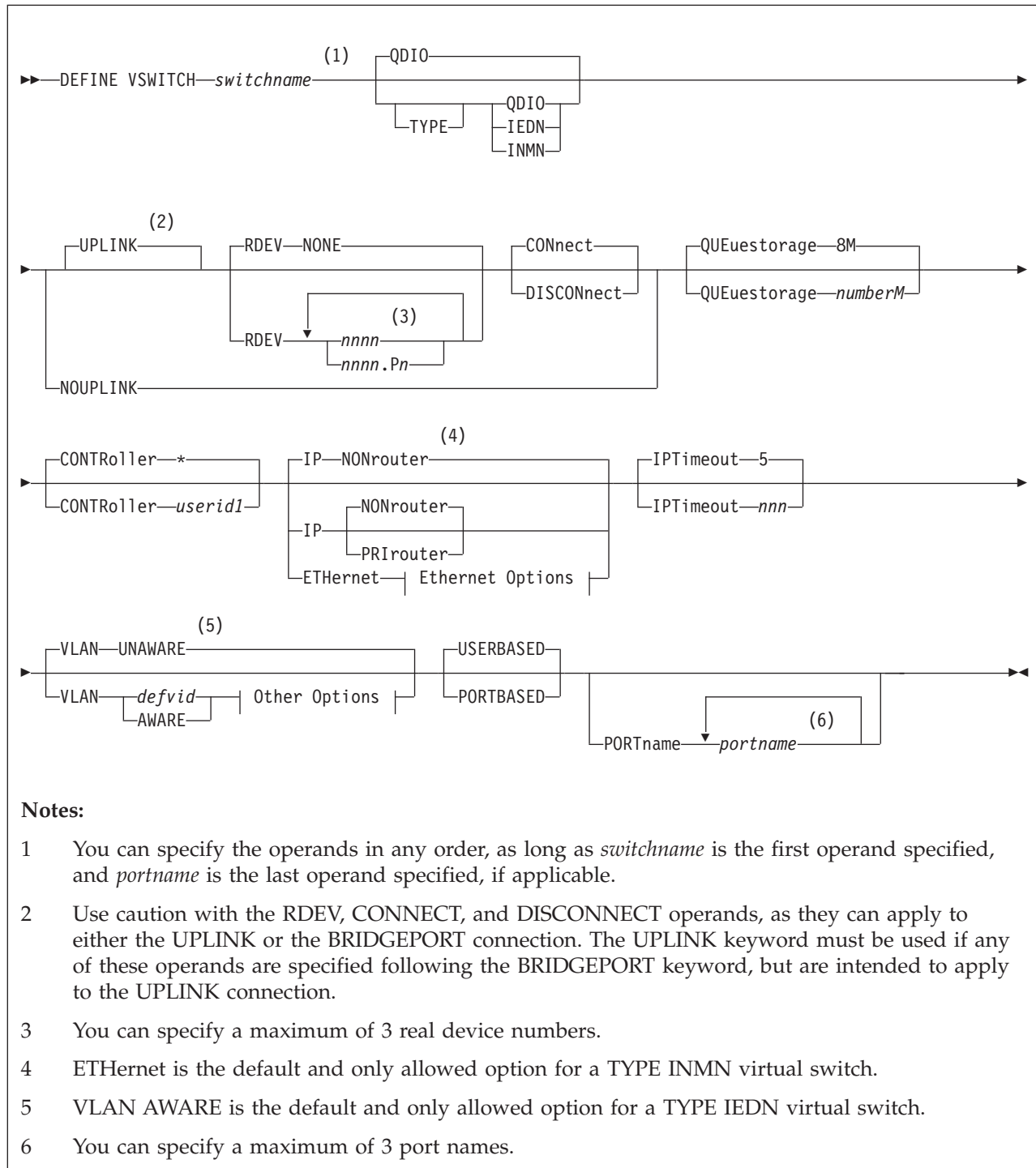
1. To create a user LAN named QDIO that will allow up to 16 connections, specify the following:

```
define lan type qdio maxconn 16
```
2. To create a system LAN named INEWS that allows up to 100 connections, specify the following:

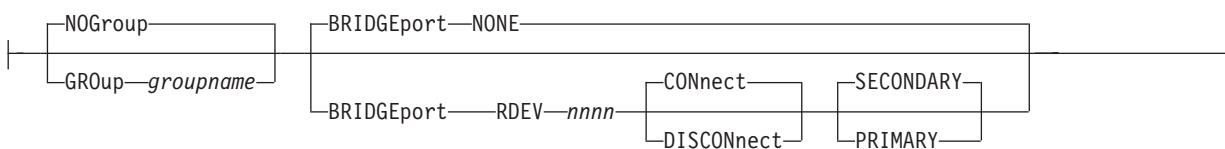
```
define lan inews ownerid system maxconn 100
```
3. To create a SYSTEM LAN named INEWS that will allow up to 100 connections and will not have accounting records created, specify the following:

```
cp define lan inews ownerid system maxconn 100 accounting off
```

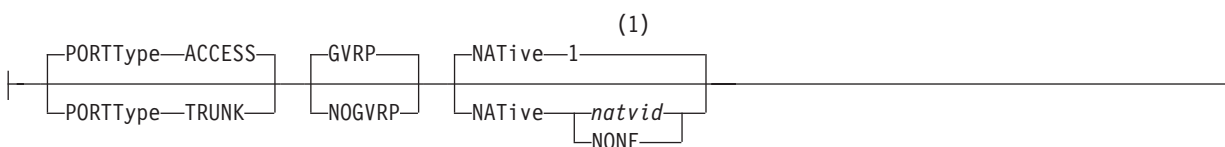
DEFINE VSWITCH Statement



Ethernet Options:



Other Options:



Notes:

- 1 NATIVE NONE is the default and only allowed option for a TYPE IEDN virtual switch.

Purpose

Use the DEFINE VSWITCH statement to create a CP system-owned switch (a virtual switch) to which virtual machines can connect. Each switch is identified by a *switchname*. A z/VM user can create the appropriate QDIO network interface card (NIC) and connect it to this switch with the NICDEF directory statement. See “NICDEF Directory Statement” on page 556 for more information about the statement. Alternatively, a z/VM user can create a virtual network adapter (with the CP DEFINE NIC command) and connect it to this LAN (with the COUPLE command). See *z/VM: CP Commands and Utilities Reference* for more information on these commands. For more information about virtual networking options in VM, see *z/VM: Connectivity*.

The MODIFY VSWITCH statement can be used to define the initial access list and other attributes of the virtual switch. See “MODIFY VSWITCH Statement” on page 198 for more information.

You can also define a virtual switch after system initialization using the DEFINE VSWITCH command. For more information about the command, see *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DEFINE VSWITCH statements anywhere in the system configuration file. If you specify more than one statement with the same *switchname* operand, the first definition will be accepted and subsequent statements will receive an error.

Operands

switchname

is the name of the new virtual switch. The *switchname* is a single token (1–8 alphanumeric characters) that identifies this virtual switch for subsequent commands.

DEFINE VSWITCH

TYPE

specifies the type of virtual switch to be created, specifically the hardware and protocol the virtual switch will emulate.

QDIO

defines a simulated Ethernet or IP virtual switch. A QDIO virtual switch creates a network comprised of both simulated QDIO devices residing on the same z/VM system, with real network devices located on an external or physical network. A QDIO type virtual switch can only accept connections from a simulated QDIO adapter. External connectivity to network devices on a physical network is achieved using the RDEV or GROUP keywords.

IEDN

defines a simulated virtual switch with hardware properties of an intraensemble data network managed by the Unified Resource Manager. An IEDN type virtual switch can only accept connections from a simulated IEDN or QDIO adapter (when OSDSIM authorization has been granted). If connectivity to the physical IEDN internal network is required, then only IEDN capable OSA-Express devices (CHPID type OSX) can be specified by the RDEV or the groupname on the GROUP keyword.

Note: This option is provided for use by the Unified Resource Manager when the z/VM image is a member of an ensemble.

ONLY a virtual switch defined through the Unified Resource Manager will have the necessary authorization to be allowed to connect to the physical IEDN network.

INMN

defines a simulated virtual switch with hardware properties of an intranode management network managed by the Unified Resource Manager. An INMN type virtual switch can only accept connections from a simulated INMN or QDIO adapter (when OSDSIM authorization has been granted). If connectivity to the physical INMN internal network is required, then only INMN capable OSA-Express devices (CHPID type OSM) can be specified by the RDEV or groupname on the GROUP keyword.

Note: This option is provided for internal use when the z/VM image is a member of an ensemble. The INMN is intended only for authorized applications such as those performing z/VM performance management functions.

UPLINK

enables and specifies connectivity for a virtual switch UPLINK port. The UPLINK port is a special port that typically is used to connect the virtual switch to a physical switch, essentially bridging the virtual switch's simulated network to a physical network.

RDEV *nnnn*

RDEV*nnnn*.*Pn*

is a real device number or a real device number and OSA-Express port number to be used as an UPLINK port to connect the virtual switch to the appropriate model OSA-Express device. The device selected must be compatible to the type of virtual switch created. Connectivity to the physical network will be prevented when the specified device doesn't match the virtual switch's type.

Specify each real device number as a hexadecimal number between X'0001' and X'FFFF'. If specifying a real device and an OSA-Express port number, specify the real device number as a hexadecimal number between X'0001' and X'FFFF' followed by a period (.), the letter 'P' (or 'p') followed by the port number as a hexadecimal number between X'0' and X'F'. For example, to specify port 1 for RDEV 300, specify "300.P1". The value of the port number depends on how many ports the OSA-Express hardware feature supports. If the port number is not specified, it will default to port 0.

You can specify a maximum of three real device numbers. If you specify more than one device number, each must be separated from the others by at least one blank. When the virtual switch has been defined with the GROUP attribute, any devices identified by the RDEV keyword are used for failover in the event of a real switch failure of the link aggregation group. Failover in this environment will be to a single OSA-Express device connected to a second real switch.

Each real device number represents a trio of devices. For example, specifying **RDEV 111 222 333** means that the first devices, 111-113, are used to provide the connection to the real hardware LAN segment. When issuing the VSWITCH command without the GROUP attribute, if there is a problem with the connection, devices 222-224 are used next to provide the connection, and if those devices fail to connect, devices 333-335 are used. This feature provides dynamic recovery for OSA-Express device failures when issuing the VSWITCH command without the GROUP attribute or for real switch failure when issuing the VSWITCH command with the GROUP attribute. (Failure of an OSA in an aggregated group is automatically handled by the virtual switch; that is, the virtual switch will transfer the data flow to the remaining OSAs in the group.)

RDEV NONE means that the virtual switch should not be connected to the real LAN segment when defined with NOGROUP. When the virtual switch has been defined with GROUP, RDEV NONE means that there is no link aggregation group failover in the event the real switch should fail.

CONnect

indicates that the currently configured virtual switch UPLINK port must be activated, and traffic may flow through the specified UPLINK ports device(s).

DISCONnect

indicates that the currently configured virtual switch UPLINK port must not be activated, and that no traffic is to flow through the specified UPLINK ports device(s).

A virtual switch can be functional without a connection to a real LAN segment, and traffic flows only between virtual machines coupled to the virtual switch.

NOUPLINK

indicates the virtual switch will never have connectivity to a physical network through the UPLINK port. This option removes the UPLINK port from the virtual switch. Once the UPLINK port is removed, it can never be added back to the virtual switch.

When the system is not managed by the Unified Resource Manager, the NOUPLINK option is used automatically when a type IEDN or INMN virtual switch is created. This is necessary to prevent a virtual switch defined outside the ensemble from ever connecting to the IEDN or INMN networks whenever this system joins an ensemble. Only a virtual switch defined through the Unified Resource Manager is allowed to connect to the physical IEDN or INMN networks.

DEFINE VSWITCH

Defining a virtual switch UPLINK port with either the RDEV or GROUP operands while also removing the UPLINK port with the NOUPLINK operand will cause the command to fail.

QUEuestorage *numberM*

indicates the upper limit of the amount of fixed storage CP and Queued Direct I/O Hardware Facility will use for buffers for each OSA-Express data device.

number defines the maximum number of megabytes of storage that can be consumed for QDIO queues on a single OSA port. When multiple OSA devices are defined in a link aggregation group, then each OSA port within the group will use the specified amount of storage. Fixed storage is allocated as needed based on network traffic, until the maximum of *numberM* are allocated.

number is a number from 1 to 8. 8M is the default value.

CONTRoller *

CONTRoller *userid1*

identifies the z/VM user ID that controls the OSA-Express device connected at the device number identified by *rdev*. CONTROLLER * means CP selects from any of the eligible TCP/IP stacks. See Usage Note 3 on page 112 for more information about the function of a controller.

If you specify multiple real devices on the RDEV keyword, or through the GROUP keyword, then specify CONTROLLER *, or allow it to default. The controller functions are then spread across multiple z/VM TCP/IP stacks, providing more flexibility in case of a failure. You can also specify a pool of specific controllers to be chosen from by specifying a list of user IDs after the CONTROLLER keyword with the SET VSWITCH command or the MODIFY VSWITCH statement.

IP

ETHernet

indicates whether the transport for the virtual switch is ETHERNET or IP. The ETHERNET transport type is Data Link (Layer 2) based, where the ETHERNET frame is used as a point of reference for source and destination Media Access Control (MAC) addresses in transporting ETHERNET frames on the LAN. The IP transport type is Network (Layer 3) based, where the IP packet is used as the point of reference for source and destination IP addresses in transporting IP packets on the LAN.

If this option is omitted for a type QDIO virtual switch, then the transport is set to IP NONROUTER. For an INMN virtual switch the setting is set to ETHERNET. An INMN virtual switch can function correctly only at the Data Link (layer 2) level. Specifying anything other than ETHERNET for an INMN virtual switch will cause the command to fail.

NONrouter

indicates that the OSA-Express device identified by the RDEV keyword will not act as a router to the Virtual Switch. If a datagram is received at this device for an unknown IP address, the datagram will be discarded. This is the default.

PRIrouter

indicates that the OSA-Express device identified by the RDEV keyword will act as a primary router to the virtual switch. If a datagram is received at this device for an unknown IP address, the datagram will be passed to the virtual switch.

GRoup *groupname*

indicates that the virtual switch UPLINK port is to be configured to use IEEE 802.3ad Link Aggregation. The *groupname* is a 1- to 8-character name that

identifies the group. Use the SET PORT GROUP command to specify the attributes of the group and the OSA-Express devices that will make up the group. This option can only be specified when the virtual switch has been defined with the ETHERNET transport attribute. **NOGROUP** means that the virtual switch will not use Link Aggregation.

BRIDGEport

configures and specifies connectivity for a virtual switch Bridge Port. The Bridge Port is a special port that is used to connect the virtual switch to a HiperSockets CHPID, essentially bringing the HiperSockets CHPID to the virtual switch's simulated and physical networks.

Configuring a virtual switch Bridge Port is only supported when the Bridge facility is supported by the processor, the virtual switch transport type is ETHERNET, and the virtual switch TYPE is QDIO or IEDN. Additionally, the ISOLATION feature cannot be used when the virtual switch has a Bridge Port.

Only guest operating systems running in a virtual machine under z/VM and exploiting QDIO Enhanced Buffer State Management (QEBSM) are eligible to be bridged from the HiperSockets CHPID to the virtual switch's simulated and physical networks.

NONE

specifies that the virtual switch does not have a Bridge Port.

RDEV *nnnn*

is a real device number to be used as a Bridge Port to connect the virtual switch to a HiperSockets CHPID. Only devices that have been configured with either of the two HiperSockets CHPID parameters IEDN_ACCESS or EXTERNAL_BRIDGED can be specified. Use these parameters on the DEFINE CHPID command or the appropriate CHPARM in the IOCP (2x for IEDN_ACCESS or x4 for EXTERNAL_BRIDGED).

The device selected must be compatible to the type of virtual switch created; for example EXTERNAL_BRIDGED for a QDIO type virtual switch and IEDN_ACCESS for an IEDN type virtual switch. Connectivity to the HiperSockets CHPID will be prevented when the specified device does not match the virtual switch's type.

You must specify a single real device number as a hexadecimal number between X'0001' and X'FFFD'. The real device number specified represents a trio of devices. For example, specifying BRIDGEPORT RDEV 508 means the devices, 508-50A, are used to provide the connection to the HiperSockets CHPID.

CONnect

indicates that the device identified by the RDEV keyword will be immediately activated, allowing the connection to be used as the active or standby Bridge Port.

DISCONnect

indicates that the device identified by the RDEV keyword will be placed in the inactive state. If this connection is the active Bridge Port connection, another virtual switch with a Bridge Port on the same CHPID in standby state will take over the active Bridge Port connection.

SECONDARY

indicates that this virtual switch should be assigned a role as a

DEFINE VSWITCH

SECONDARY Bridge Port for the HiperSockets CHPID. This is the default. See usage note 19 on page 115 for more information about the SECONDARY Bridge Port role.

PRIMARY

indicates that this virtual switch must be assigned the role as the PRIMARY Bridge Port for the HiperSockets CHPID. See usage note 19 on page 115 for more information about the PRIMARY Bridge Port role.

IPTimeout *nnn*

indicates the length of time in minutes that a remote IP address table entry remains in the IP address table for the virtual switch.

nnn is a number from 1 to 240. 5 minutes is the default value.

VLAN

used to enable and configure IEEE standard 802.1Q VLAN support for the virtual switch being defined. A VLAN-aware virtual switch provides VLAN controls at the user level (with SET VSWITCH GRANT VLAN and PORTTYPE commands) that can not be overridden by a guest host. If this option is omitted for a type QDIO or INMN virtual switch, then the virtual switch is set to VLAN UNAWARE. For an IEDN virtual switch the setting defaults to VLAN AWARE. An IEDN virtual network must always support and use IEEE standard 802.1Q. Attempting to specify VLAN UNAWARE or *defvid* for an IEDN virtual switch will cause the command to fail.

UNAWARE

indicates the virtual switch does not support IEEE standard 802.1Q. All frames flow within the virtual switch regardless of presence or absence of Virtual Local Area Network (VLAN) tags. Any VLAN tags present in the frames will be ignored within the switch (however the guest hosts may perform VLAN filtering at the virtual NIC level).

defvid

defines the virtual switch as a VLAN-aware switch supporting IEEE standard 802.1Q. The *defvid* defines the default VLAN ID to be assigned to guest ports when no VLAN ID is coded on the SET VSWITCH GRANT VLAN command, MODIFY VSWITCH GRANT VLAN statement, the SET VSWITCH PORTNUMBER command, the SET VSWITCH VLANID command, or through an ESM. It is a number from 1 to 4094. A VLAN-aware virtual switch provides VLAN controls at the user level (with SET VSWITCH GRANT, SET VSWITCH PORTNUMBER and SET VSWITCH VLANID commands) that may not be overridden by a guest host.

AWARE

defines the virtual switch as a VLAN-aware switch supporting IEEE standard 802.1Q without a default VLAN ID. When a virtual switch is specified as VLAN AWARE, one or more VLAN IDs must be assigned to each guest port by either a SET VSWITCH GRANT VLAN command, MODIFY VSWITCH GRANT VLAN statement, the SET VSWITCH PORTNUMBER command, the SET VSWITCH VLANID command, or through an ESM. Failure to assign an explicit VLAN ID causes all untagged frames transmitted from the port to be discarded. In the case of a VLAN-unaware guest using a PORTTYPE ACCESS all outbound frames will be discarded until a VLAN ID is set for the port.

PORTType ACCESS

defines the default porttype attribute for guests authorized for the virtual switch. For PORTTYPE ACCESS, the guest is unaware of VLAN IDs and sends and receives only untagged traffic.

PORTType TRUNK

defines the default porttype attribute for guests authorized for the virtual switch. For PORTTYPE TRUNK, the guest is VLAN aware and sends and receives tagged traffic for those VLANs to which the guest is authorized. If the guest is also authorized to the *natvid*, untagged traffic sent or received by the guest is associated with the native VLAN ID (*natvid*) of the virtual switch.

GVRP

indicates that the VLAN IDs in use on the virtual switch should be registered with GVRP-aware switches on the LAN. This provides dynamic VLAN registration and VLAN registration removal for networking switches. This eliminates the need to manually configure the individual port VLAN assignments.

NOGVRP

Do not register VLAN IDs with GVRP-aware switches on the LAN. When NOGVRP is specified VLAN port assignments must be configured manually.

NATive *natvid*

NATive NONE

the *natvid* option is available only on a VLAN-aware switch. When *natvid* is a number from 1 to 4094, this operand defines the native VLAN ID that is to be associated with untagged frames received and transmitted by the virtual switch. NATIVE NONE causes all untagged frames to be discarded, instead of being delivered with a native VLAN ID. If this option is omitted, 1 is used as the *natvid* for a type QDIO or INMN virtual switch and NONE will be used for an IEDN virtual switch. For a type QDIO or INMN virtual switch this is the default, but an IEDN virtual network must discard all frames without a VLAN ID. Specifying *natvid* for an IEDN virtual switch will result in command failure.

USERBASED

specifies that the virtual switch will be user based. Authorization and configuration will be for the user. Use the SET VSWITCH GRANT and REVOKE commands for authorization. Port numbers for guests will be assigned by CP.

PORTBASED

specifies that the virtual switch will be port based. All connections will be on a port basis. Each port must be configured with the SET VSWITCH PORTNUMBER command. This configuration will allow a guest to have multiple unique access ports connected to the same virtual switch instance.

PORTname *portname*

is a 1- to 8-character name that identifies the OSA-Express adapter. You can specify a maximum of three port names. Multiple port names are used when different port names are needed for the multiple *rdevs* specified on the RDEV operand. See Usage Note 10 on page 114 for more information.

Usage Notes

1. The DEFINE VSWITCH statement creates a virtual switch. The MODIFY VSWITCH statement can be used to modify a virtual switch by authorizing users to use the switch. Authorization to a virtual switch may also be provided by an External Security Manager.

DEFINE VSWITCH

2. Accounting is set for the switch based on the default accounting state as set by the SET VMLAN ACCOUNT SYSTEM command or configuration statement. If accounting is turned on after the virtual switch is defined, the virtual switch will need to be redefined for accounting to take effect.
3. A virtual switch's connection to a real hardware LAN segment is not operational until an eligible TCP/IP stack is selected to be the controller for the OSA-Express device. CP selects an eligible TCP/IP stack to be the controller by either:

- It is recommended that the VSWITCH controller be at the same release level as CP, although all supported releases are allowed.
- If CONTROLLER *userid1* is specified on the DEFINE or SET VSWITCH commands or the DEFINE or MODIFY VSWITCH system configuration statements, with either a single user ID or a list of user IDs, only those user IDs are selected.
- If CONTROLLER * is specified or allowed to default, CP selects from any eligible TCP/IP stack.

A TCP/IP stack becomes eligible when:

- The TCP/IP MODULE running in the controller is at a release level that supports the function required for the virtual switch.
- An IUCV *VSWITCH statement is included in its virtual machine definition.
- The TCP/IP VSWITCH CONTROLLER statement is coded, and has defaulted to be ON or is explicitly set to ON or ENSEMBLE in the TCP/IP configuration file or through an OBEYFILE command. When using an IEDN or INMN virtual switch, at least one or more controllers must specify the ENSEMBLE keyword on the VSWITCH CONTROLLER statement. Only controllers which specify ENSEMBLE will be selected to control an IEDN or INMN virtual switch.
- The stack has completed initialization.
- The stack has virtual device numbers available for CP to attach the control device.

The virtual device range used by CP is specified in the VSWITCH CONTROLLER TCP/IP configuration statement. If no VDEV range is specified, CP uses the virtual device number (*vdev*) that matches the *rdev* number specified on the DEFINE VSWITCH or SET VSWITCH command. See *z/VM: TCP/IP Planning and Customization* for more information about the VSWITCH CONTROLLER statement.

Note: Do not code DEVICE and LINK TCP/IP configuration statements for the device. Do not attach the device to a TCP/IP controller virtual machine. These steps are handled by DEFINE VSWITCH processing when a controller is selected.

If an eligible stack is not found, or none of the *rdevs* are operational, you receive a message, and the virtual switch operates in a local LAN environment.

4. The virtual switch supports two modes of operation for data transport in support of both TCP/IP and non-IP based applications. In deciding which mode to deploy for your network, some things to consider about deploying an ETHERNET virtualized LAN segment are:
 - Do your servers or applications need to have their own unique MAC addresses (load balancers)?
 - Do you plan to deploy non-IP based applications on your network (SNA or NetBIOS, for example)?

- Do you want to build a virtual LAN segment that operates closely to its physical counterpart?

The key attributes of each transport mode with their operational characteristics are as follows:

- ETHERNET (Layer 2)
 - Supports all applications that deploy ETHERNET (IEEE 802).
 - ETHERNET frames are transported on the LAN segment.
 - All destinations are identified by MAC address.
 - MAC addresses are locally administered by the LAN administrator through z/VM CP commands or configuration statements.
 - Each host connection is identified by a single MAC address.
 - This is a Link Layer transport, in which all hosts maintain their respective ARP caches.
 - VLAN tagging resides within the ETHERNET frames per IEEE 802.1Q specifications.
 - When GROUP attribute is specified, the frames can be transported as part of the IEEE 802.3ad standard.
- IP (Layer 3)
 - Supports IP for TCP/IP applications only.
 - IP packets are transported on the LAN segment.
 - All destinations are identified by IP addresses.
 - IP address assignments are set by the host running in the guest virtual machine.
 - Each host may have more than one IP address (multi-homed).
 - This is Link Layer independent (that is, no MAC addresses), and ARP processing is offloaded onto the OSE-Express adapter.
 - VLAN tagging resides in internal QDIO headers.
 - All hosts share the OSA-Express MAC address.

A virtual switch operates in only one mode for a given instance. For example, if the switch is configured as IP, then all communications on the LAN segment must be IP based. The same is also true when the switch is configured in ETHERNET mode. These transport modes affect the method of data transfer for the virtual switch. The other operations of the switch, such as guest authorization, failover, controller configuration, and so on, function the same for both modes.

5. The IP transport type is IPv4 only. In order to support IPv6 through the virtual switch RDEV, the ETHERNET transport is required.
6. MODIFY VSWITCH cannot be used to change the type of transport. The virtual switch will need to be redefined.
7. Use the QUERY CONTROLLER command output to find the TCP/IP stacks that are the virtual switch controllers. Use the QUERY VSWITCH command to display information about the virtual switch.
8. CP manages the devices used to control a virtual switch's connection to a real LAN segment through an OSA-Express device. CP attaches the devices to the z/VM TCP/IP virtual machine. CP also defines devices of type VSWITCH-OSD to the TCP/IP stack, concatenating *switchname* with *vdev* and "DEV" to form the device name and *switchname* with *vdev* and "LINK" to form the link names. These names appear in the TCP/IP query and trace information.

DEFINE VSWITCH

DEVICE and LINK statements must not be included in the TCP/IP configuration file for these devices.

The port number specified by *nnnn.Pnn* will be used by the TCP/IP (controller) when initializing the device. If the port number is not specified, it will default to port 0. If the port number is not supported on the device, initialization of the device will be terminated.

9. Multiple real devices and portnames can be specified on the RDEV and PORTNAME operands. This feature allows failover to an alternate real device in the event of a failure with the current OSA-Express or link aggregation group. All real devices specified must be active and connected to the same hardware LAN in order to effectively and dynamically failover to an alternate device. In addition, the alternate devices must be defined on separate CHPIDs. If your OSA-Express device requires a portname, specify one portname for each real device number.
10. When the real device identified by one of the *rdevs* is started, on a VSWITCH with the NOGROUP attribute, TCP/IP assigns the port name as the hardware adapter name. If an adapter name was already assigned by a previous connection, then the port name must be the same as assigned by any other connection in order to share the adapter. This includes sharing the OSA-Express adapter with this logical partition or all other partitions.

The PORTNAME operand is optional. However, some levels of the OSA-Express adapters require that the PORTNAME operand is specified. When such an adapter is in use and the PORTNAME operand is omitted, an error message is displayed during switch initialization.

If the device is already started, you must stop it by issuing the SET VSWITCH *switchname* DISCONNECT command before changing the port name.

11. PRIROUTER is required only when IP forwarding (routing) nodes will be coupled to the switch. Router nodes provide connectivity for their LAN segments (remote nodes) through their switch connection. When Router nodes are deployed, their switch connection must be configured as PRIROUTER. In addition to this, the switch itself must also be configured as PRIROUTER to the OSA-E adapter. This will insure delivery of datagrams destined for LAN segments that are connected through routers coupled to a switch. Only one connection on each OSA-Express card can be designated as PRIROUTER. If the switch is successful in establishing PRIROUTER on the OSA-Express card, no other node (or switch) sharing the same OSA-Express card will be able to act as PRIROUTER. If another connection has already been established as PRIROUTER, the switch will be left with NONROUTER status (which is reflected in the QUERY VSWITCH response).
12. NONROUTER is the default mode for the switch. Every node is directly coupled to the switch and the associated IP destinations are registered with the OSA-Express connection. This is the most efficient way to use the virtual switch. In this mode, packets with an unrecognized IP destination are automatically sent out through the switch connection.
13. For a VLAN aware virtual switch, you should specify the same native VLAN ID (*natvid*) as specified in your configuration of any physical switches in your network. Most hardware manufacturers use a default of 1. Specify NATIVE NONE or rely on the default when an IEDN virtual switch is defined. Untagged frames are not permitted on these networks. Specifying anything other than NATIVE NONE for an IEDN virtual switch will result in command failure.
14. SET VSWITCH cannot be used to change the VLAN awareness attribute. To change the attribute, detach the virtual switch and define it again with the correct attribute.

15. If the virtual switch is defined as VLAN UNAWARE, any attempts to define a VLAN membership will fail. When the CP access list is used, SET or MODIFY VSWITCH GRANT with VLAN membership list fails. In addition, SET or MODIFY VSWITCH VLANID fails and SET or MODIFY VSWITCH PORTNUMBER with VLAN members fails. When an ESM is used, the COUPLE command fails if a VLAN list is returned by the ESM.
16. IEDN virtual switch type requires at least one VLAN ID to be set before a NIC device can be connected to the virtual switch with the CP COUPLE command. For user based virtual switches, the VLAN IDs are set by the SET or MODIFY VSWITCH GRANT VLAN vidset. For port based virtual switches, the VLAN IDs are configured with the SET VSWITCH PORTNUMBER command or the SET or MODIFY VSWITCH VLANID commands.
17. An IEDN or INMN virtual switch with real network connectivity specified in the SYSTEM CONFIG file will only be created after the system is made an active member of an ensemble managed by the Unified Resource Manager. Only an IEDN or INMN virtual switch with the NOUPLINK option will be created during the IPL of z/VM.
Virtual switches which can connect to a real network managed by the Unified Resource Manager require resources that must be assigned by the Unified Resource Manager. The Unified Resource Manager cannot make these resources available until sometime after z/VM completes its IPL. When the system becomes an active member of the ensemble managed by the Unified Resource Manager, the virtual switch will be created. If the system is not going to be managed by the Unified Resource Manager, the virtual switch will be created immediately.
18. SET VSWITCH cannot be used to change the USERBASED/PORTBASED attribute. The virtual switch will need to be redefined.
19. A virtual switch's Bridge Port can be configured to take on the role as either the PRIMARY or as a SECONDARY Bridge Port for the HiperSockets CHPID. SECONDARY is the default role assigned when defining a virtual switch with a Bridge Port. A single PRIMARY Bridge Port and up to four SECONDARY Bridge Ports can be defined per HiperSockets CHPID.

A functional virtual switch configured for the PRIMARY role is always selected as the *active* Bridge Port connection. Functional virtual switches configured with the SECONDARY role provide backup (standby) capability in the event of failure on the part of the active Bridge Port connection.

The first virtual switch Bridge Port successfully connecting to the HiperSockets CHPID (whether PRIMARY or SECONDARY) will take on the responsibility as the active Bridge Port connection. When the active Bridge Port connection is a virtual switch with a SECONDARY role, then its responsibility as the active Bridge Port connection will be relinquished to a connection made by a virtual switch requesting the PRIMARY role.

Examples

1. To define a switch named BIGANG that connects to a real LAN through device fd00, specify the following:

```
define vswitch bigang rdev fd00
```
2. To define a switch named ETH1 that will use Link Aggregation, specify the following commands:

```
set port group eth1grp join b c d
define vswitch eth1 ethernet group eth1grp
```
3. To define a switch named LINPROD that uses OSA-Express hardware ports, specify the following:

DEFINE VSWITCH

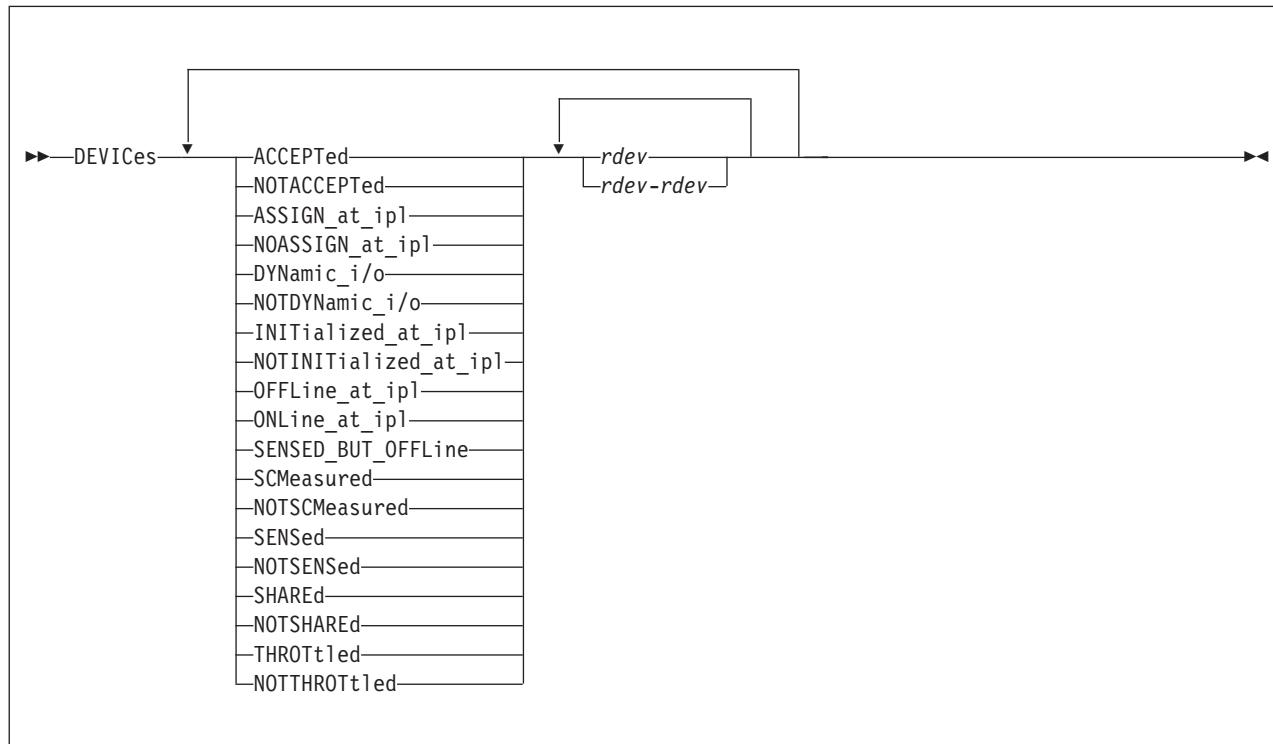
```
define vswitch linprod rdev 9c00.p0 9d00.p1 9e00
```

In the above example, device 9e00 will connect to port 0 on the OSA-Express.

4. To define a switch named ETH0 that connects to a real LAN through device 1e1b and to a HiperSockets CHPID through device 7000, specify the following:

```
define vswitch eth0 type qdio rdev 1e1b ethernet bridgeport rdev 7000
```


DEVICES Statement



Purpose

Use the DEVICES statement to tell CP how to handle specific devices during initialization. You can tell CP whether to:

- Accept (and build real device blocks for) specified devices
- Allow dynamic changes for specified devices
- Initialize the specified devices during IPL
- Measure the subchannels for specified devices
- Assign the tape drive to the system when the device is being brought online.
- Use the information returned from a sense ID request to help define the device
- Share DASD between independent operating systems
- Limit (throttle) the I/O rate for specified devices.

How to Specify

Include as many statements as needed; they are optional. You can place DEVICES statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Parameters

ACCEPTed

tells CP to accept the specified device or devices.

rdev

rdev-rdev

is the real device number of the device or devices that you are affecting. The variable *rdev* must be a hexadecimal number between X'0000' and X'FFFF'. You can specify a single device, a range of devices, or any combination thereof.

NOTACCEPTed

tells CP not to accept the specified device or devices.

Note: CP ignores any devices you specify on the NOTACCEPTED operand, even if you have explicitly defined those devices using RDEVICE statements in the system configuration file or using RDEVICE macroinstructions in the HCPRIO ASSEMBLE file.

ASSIGN_at_ip1

tells CP to assign the tape drive to the system when the device is being brought online.

NOASSIGN_at_ip1

tells CP not to assign the tape drive when the device is being brought online.

DYNamic_i/o

tells CP to allow dynamic I/O changes on the specified device or devices.

Note: If you want to allow dynamic I/O changes on *any* devices, do not forget to specify FEATURES ENABLE DYNAMIC_I/O in your system configuration file. This FEATURES operand enables or disables dynamic I/O changes for your system's processor. So, if you do not enable dynamic I/O changes on the processor, CP will not let you make dynamic I/O changes on any individual device or devices.

NOTDYNamic_i/o

tells CP not to allow dynamic I/O changes on the specified device or devices.

INITialized_at_ip1

tells CP to initialize the specified device or devices during IPL.

NOTINITialized_at_ip1

tells CP not to initialize the specified device or devices during IPL.

Note: The last two operands are functionally equivalent to the ONLINE_AT_IPL and OFFLINE_AT_IPL operands respectively.

OFFLine_at_ip1

tells CP not to initialize the specified device or devices at IPL.

Note: Due to the fact that Open Systems Adapter (OSA) devices may not be ready to come online until after system IPL has completed, this statement will not always work for OSA devices.

ONLine_at_ip1

tells CP to initialize the specified device or devices at IPL.

SENSED_BUT_OFFLine

tells CP not to initialize the specified device or devices at IPL, but to still issue a sense ID request to determine the device class or type.

SCMeasured

tells CP to collect subchannel measurement data for the subchannels of the specified device or devices.

NOTSCMeasured

tells CP not to collect subchannel measurement data for the subchannels of the specified device or devices.

SENSEd

tells CP to use the information returned from a sense ID request to determine the device class or type.

NOTSENSEd

tells CP not to use the information returned from a sense ID request to determine the device class or type.

SHARED

tells CP that the specified DASD device or devices will be shared between independent operating systems.

NOTSHARED

tells CP that the specified DASD device or devices will not be shared with any other independent operating system.

THROTTled

tells CP to limit (throttle) the rate of I/O coming from the specified device or devices.

NOTTHROTTled

tells CP not to limit (throttle) the I/O rate of the specified device or devices.

Usage Notes

1. If an IODF statement is defined in the system configuration file with the *osconfig* parameter specified, then the software I/O configuration will be controlled by HCD. In this case, the following DEVICES statements are ignored if they are specified:

- DEVICES ACCEPTED
- DEVICES NOTACCEPTED
- DEVICES DYNAMIN_I/O
- DEVICES NOTDYNAMIC_I/O
- DEVICES OFFLINE_AT_IPL
- DEVICES ONLINE_AT_IPL
- DEVICES SENSED_BUT_OFFLINE
- DEVICES SENSED
- DEVICES NOTSENSED
- DEVICES SHARED
- DEVICES NOTSHARED

Refer to “IODF Statement” on page 173 for more information.

2. If you do not specify the DEVICES statement in the system configuration file, the defaults that CP uses depend on what is specified on the SYSOPTS macroinstruction in the HCPSYS ASSEMBLE file.
 - If the SYSOPTS setting is SENSE=YES (the default), CP will:
 - Accept all devices,
 - Allow dynamic changes on all devices (if you specified FEATURES ENABLE DYNAMIC_I/O),
 - Initialize all devices,
 - Measure all devices,
 - Sense the characteristics of all devices,

DEVICES

- Not share any DASD devices,
- Not throttle any devices, and
- Not assign any tape drives to CP at IPL.

For any devices that you have not explicitly defined with the RDEVICE statement in the system configuration file or with the RDEVICE macroinstruction in the HCPRIO ASSEMBLE file, CP will sense the device, if possible, and dynamically build an RDEV for it.

- If the SYSOPTS setting is SENSE=NO, CP will accept, initialize, measure, and bring online only those devices that you explicitly define with RDEVICE statements. CP will not throttle or allow dynamic changes on any of these devices. CP will share DASD devices only if you specify the SHARED operand on the RDEVICE statement for that DASD. CP ignores all other devices.

Also, if you specify the wrong device type on the RDEVICE statement, CP will not bring the device online because of conflicting device information. That is, if you define a 3420 tape drive and the device is really a 3480 tape drive, CP will not bring the device online. If you specify the wrong device class, CP will not bring the device online. That is, if you define a tape drive and the device is really a DASD, CP will not bring the device online.

For more information about the RDEVICE statement, see “RDEVICE Statement” on page 216.

3. To allow or prevent dynamic changes after IPL, use the SET DYNAMIC_I/O command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
4. To start or stop subchannel measuring after IPL, use the SET SCMEASURE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
5. You can also share DASD devices between independent operating systems by specifying the SHARED operand on the SET RDEVICE command, by issuing the SET SHARED command, or by specifying the SHARED operand on the RDEVICE statement. For more information about the SET RDEVICE command, see the *z/VM: CP Commands and Utilities Reference*. For more information about the RDEVICE statement, see “RDEVICE Statement (DASD)” on page 226.
6. To define new devices after IPL, use the SET RDEVICE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. For each category (ACCEPTED, DYNAMIC_I/O, INITIALIZED_AT_IPL, MEASURED, ONLINE_AT_IPL, SENSED, SHARED, THROTTLED, and ASSIGN_AT_IPL), CP processes the information on the DEVICES statement sequentially. If you specify more than one DEVICES statement or you overlap ranges of real device numbers, CP uses the last specification. For example, if you specify:

```
DEVICES    NotAccepted  1000-1fff,  
           Accepted     1800-18ff,  
           NotAccepted  1820-182f
```

CP accepts devices at address 1800 through 181F and at address 1830 through 18FF. CP does not accept devices at address 1000 through 17FF, 1820 through 182F, and 1900 through 1FFF.

Note: The INITIALIZED_AT_IPL and ONLINE_AT_IPL operands perform exactly the same function. You can use these two operands (and their negative

counterparts, NOTINITIALIZED_AT_IPL and OFFLINE_AT_IPL) in any combination. If you overlap ranges of real device numbers, CP uses the last specification.

8. Similar to the OFFLINE_AT_IPL operand, the SENSED_BUT_OFFLINE operand applies only during system initialization. Devices brought online by dynamic I/O after system initialization are not affected by the SENSED_BUT_OFFLINE setting.

Examples

1. To have CP:

- Not accept a group of terminals, except for one,
- Allow dynamic I/O changes on all devices, except for 1905 through 1943.
- Initialize all devices, except 8E0 through 8EF,
- Measure all devices, except DASD 2F04,
- Leave a group of disks offline or not initialized,
- Not sense a group of tape devices,
- Share a string of DASDs at 1100 through 114F,
- Throttle the I/O rate to a shared database at 460 through 48F, and
- Assign tape drive 181 to CP,

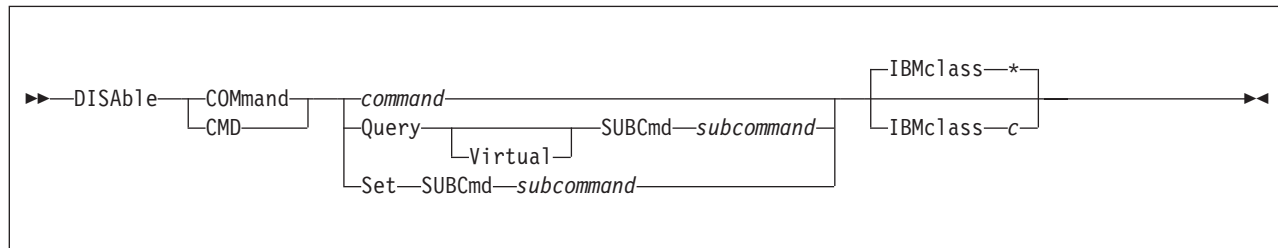
use the following DEVICES statement:

```

Devices NotAccepted 2f12-2f22,      /* Don't accept terminals */
        Accepted 2f1f,              /* ... except David's    */
        Dynamic_I/O 0000-ffff,      /* Dynamic changes are ok */
                                   /*   on these devices.    */
        NotDynamic_I/O 1905-1943,    /* No changes allowed on */
                                   /*   these ... ever!     */
        Initialized_at_IPL 0000-ffff, /* Initialize everything...*/
        NotInitialized_at_IPL 08e0-08ef, /* ... almost.          */
        SCMeasured 0000-ffff,        /* Measure everything ... */
        NotSCMeasured 2f04,          /* ... almost.          */
        Offline_at_IPL 0a00-0aff,     /* Backup DASD string    */
        NotSensed 0100-01ff,         /* Don't sense these tapes */
        NotShared 0000-ffff,         /* Don't share anything! */
        Shared 1100-114f,            /* ... except these.     */
        Throttled 0460-048f Rate 20  /* Limit the I/O on the  */
                                   /*   shared database DASD */
        Assign_at_ip1 181            /* Assign 181 to CP.     */

```

DISABLE COMMAND / CMD Statement



Purpose

Use the DISABLE COMMAND or CMD statement to prevent CP from processing requests for the specified CP command during and after initialization.

You can also prevent processing of CP commands after initialization using the DISABLE COMMAND or CMD commands. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DISABLE COMMAND or CMD statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

command

is the name of the command that you are disabling. The variable *command* is a 1-character to 12-character alphanumeric string.

Query SUBCmd *subcommand*

tells CP the name of the CP QUERY subcommand that you are disabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

Query Virtual SUBCmd *subcommand*

tells CP the name of the CP QUERY VIRTUAL subcommand that you are disabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

Set SUBCmd *subcommand*

tells CP the name of the CP SET subcommand that you are disabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

IBMclass *

tells CP to disable all versions of the specified command or subcommand. If omitted, IBMCLASS * is the default.

IBMclass *c*

tells CP to disable a specific version of the specified command or subcommand. The variable *c* can be any 1 of the following:

- A** this is a system-control command to be used by the primary system operator.
- B** this is a command for operational control of real devices.
- C** this is a command to alter host storage.

- D** this is a command for system-wide control of spool files.
- E** this is a command to examine host storage.
- F** this is a command for service control of real devices.
- G** this is a general-use command used to control the functions of a virtual machine.
- 0** (zero) this command has no specific IBM class assigned.

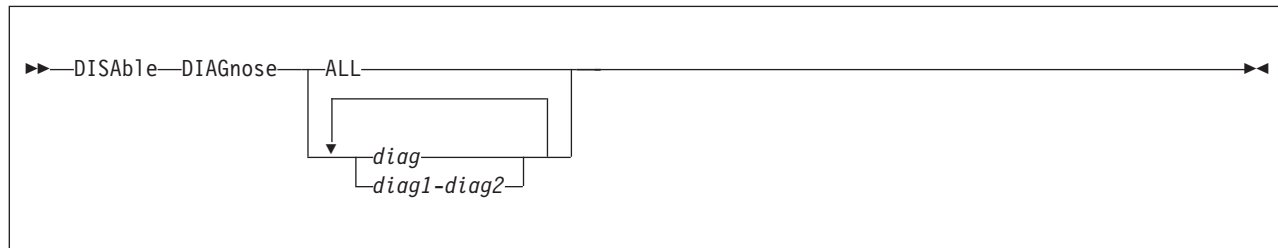
Usage Notes

1. To remove the command processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
2. To load the command processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. To deactivate a CP command while defining it, use the DISABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command. For more information about the DEFINE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
4. To activate a CP command:
 - While defining it, use the ENABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command.
 - After defining it, use the ENABLE COMMAND or CMD statement (see “ENABLE COMMAND / CMD Statement” on page 140) or command.
 For more information about the DEFINE or ENABLE COMMAND or CMD commands, see the *z/VM: CP Commands and Utilities Reference*.
5. To change the definition of an existing CP command, use the MODIFY COMMAND or CMD statement (see “MODIFY COMMAND / CMD Statement” on page 181) or command. For more information about the MODIFY COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
6. Once defined, COMMANDS, SUBCOMMANDS, and ALIASES cannot be deleted. They can be altered in various appropriate ways, but they remain in existence until a SHUTDOWN or RESTART IPL is done.
7. To display the address of the CP command table entry block, the current IBM class, and the current privilege class for a specified CP command, use the LOCATE CMDBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
8. For more information about enabling and disabling commands, see the *z/VM: CP Exit Customization* book.

Examples

1. To disable the class D version of the CP PURGE command, but not the class G version of the CP PURGE command, use the following:
 Disable Command purge IBMclass d
2. To disable the CP SHUTDOWN command, use the following:
 Disable Command shutdown

DISABLE DIAGNOSE Statement



Purpose

Use the DISABLE DIAGNOSE statement to prevent CP from processing requests for one or more locally-developed DIAGNOSE codes during and after initialization.

You can also prevent processing of locally-developed DIAGNOSE codes after initialization using the DISABLE DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DISABLE DIAGNOSE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ALL

tells CP to disable all existing DIAGNOSE codes.

Note: This operand disables all DIAGNOSE codes: the locally-defined ones, the IBM-supplied ones, and any supplied by third-party software vendors.

diag

diag1-diag2

is the number of the DIAGNOSE code that you are disabling. Each *diag* must be a hexadecimal number between X'0000' and X'03FC' and must be a multiple of 4. You can specify a single DIAGNOSE code, a range of DIAGNOSE codes, or any combination thereof.

Usage Notes

1. CP treats disabled DIAGNOSE codes as if they were never defined. If you try to use a disabled DIAGNOSE code in a program, CP will give you a program check specification exception.
2. To load the DIAGNOSE processing code into the system execution space, use the CPXLOAD statement (see "CPXLOAD Statement" on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. To define a new DIAGNOSE code, use the DEFINE DIAGNOSE statement (see "DEFINE DIAGNOSE Statement" on page 93) or command. For more information about the DEFINE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.

Note: Unless you specify the ENABLE operand of the DEFINE DIAGNOSE statement or command, the new DIAGNOSE code is initially in a disabled state after being defined.

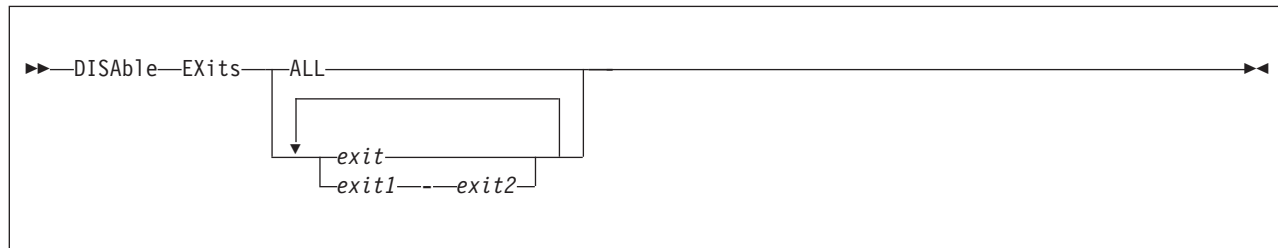
4. To activate a new DIAGNOSE code after defining it, use the ENABLE DIAGNOSE statement (see “ENABLE DIAGNOSE Statement” on page 142) or command. For more information about the ENABLE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
5. To change the definition of an existing DIAGNOSE code, use the MODIFY DIAGNOSE statement (see “MODIFY DIAGNOSE Statement” on page 185) or command. For more information about the MODIFY DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
6. To display information about a DIAGNOSE code (status, entry point name, and privilege class) after initialization, use the QUERY DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To display the address of the CP DIAGNOSE code table block for a DIAGNOSE code after initialization, use the LOCATE DGNBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
8. Once defined, DIAGNOSE codes cannot be deleted. They can be altered in various appropriate ways, but they remain in existence until a SHUTDOWN or RESTART IPL is done.
9. To remove the DIAGNOSE processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
10. Many external security managers (ESMs) do not support DIAGNOSE codes above X'03FC'. For this reason, CP does not support DIAGNOSE codes above X'03FC'. The DIAGNOSE codes between X'0000' and X'03FC' are divided as follows:
 - X'0000' to X'00FC'**
Reserved for IBM use
 - X'0100' to X'01FC'**
Reserved for customer use
 - X'0200' to X'03FC'**
Reserved for IBM use.
11. For more information about user-defined DIAGNOSE codes, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP disable DIAGNOSE code X'100', use the following:
 Disable Diagnose 100

 After initialization, any virtual machine that issues DIAGNOSE code X'100' receives a program specification exception in that virtual machine.
2. To have CP disable all DIAGNOSE codes on your system, use the following:
 Disable Diagnose All
3. To have CP disable all locally-defined DIAGNOSE codes, use the following:
 Disable Diagnose 100-1fc
4. To have CP disable all locally-defined DIAGNOSE codes except DIAGNOSE code X'01F0', use the following:
 Disable Diagnose 100-1ec 1f4-1fc

DISABLE EXITS Statement



Purpose

Use the DISABLE EXITS statement to prevent CP from calling all entry points and external symbols associated with one or more exit points during and after initialization.

You can also prevent CP from calling one or more exit points after initialization using the DISABLE EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place DISABLE EXITS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ALL

tells CP to disable all existing CP exit points.

exit

exit1-exit2

is the number of the exit point (or exit points) that you do not want CP to use. Each *exit* must be a hexadecimal number between X'0000' and X'FFFF'. You can specify a single exit point number, a range of exit point numbers, or any combination thereof.

Usage Notes

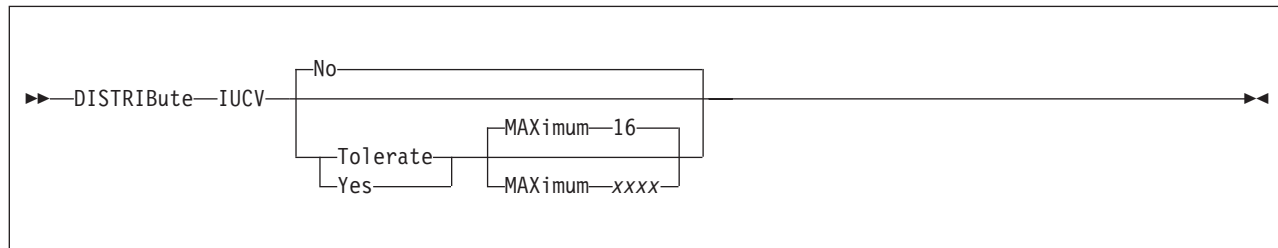
1. To load the exit point code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
2. To add to, change, or replace the list of entry points and external symbols associated with an exit point and to enable or disable that exit point, use the ASSOCIATE EXIT statement (see “ASSOCIATE EXIT Statement” on page 59) or command. For more information about the ASSOCIATE EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
3. To activate an exit point after defining it, use the ENABLE EXITS statement (see “ENABLE EXITS Statement” on page 144) or command. For more information about the ENABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.

4. To display status and usage statistics information about a specific exit point after initialization, use the QUERY EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
5. To display the address of the CP exit block for a specific exit point, use the LOCATE XITBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To display the address of the CP indirect call locator block for a specific exit point, use the LOCATE ICLBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To change the definition of an existing dynamic exit point, or remove the exit point from the system, use the MODIFY EXIT statement (see “MODIFY EXIT Statement” on page 188) or command. For more information about the MODIFY EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
8. To remove the exit point code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
9. After processing a DISABLE EXITS statement (or command), CP updates the status of the exit point in its CP exit block, but does not erase the CP exit block. CP will not erase any CP exit blocks until the next IPL.
10. For more information about user-defined exit points, see the *z/VM: CP Exit Customization* book.

Examples

1. To stop CP from calling the entry points and external symbols associated with CP Exits 1, 2, 3, 4, and 6, use the following:
Disable Exits 1-4 6
2. To stop CP from calling the entry points and external symbols associated with all CP exit points, use the following:
Disable Exits All

DISTRIBUTE Statement



Purpose

Use the DISTRIBUTE statement to specify distribution features for the local system.

How to Specify

Include as many statements as needed; they are optional. You can place DISTRIBUTE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

IUCV

indicates that IUCV distribution option is to be set.

No indicates that no Distributed IUCV traffic will be allowed to or from other nodes within the ISFC collection. This is the default.

Tolerate

indicates that Distributed IUCV is allowed to or from any other node in the ISFC collection. However, IUCV traffic will only leave the local node if the application specifies the target system name.

Yes

indicates that this node participates fully in Distributed IUCV across the entire ISFC collection. This means that target searches will be done to the ISFC collection instead of the default of just the local system.

MAXimum xxxx

indicates the number of megabytes of the largest distributed IUCV send allowed from the host. xxxx is a value between 1 and 1024. The default maximum is 16.

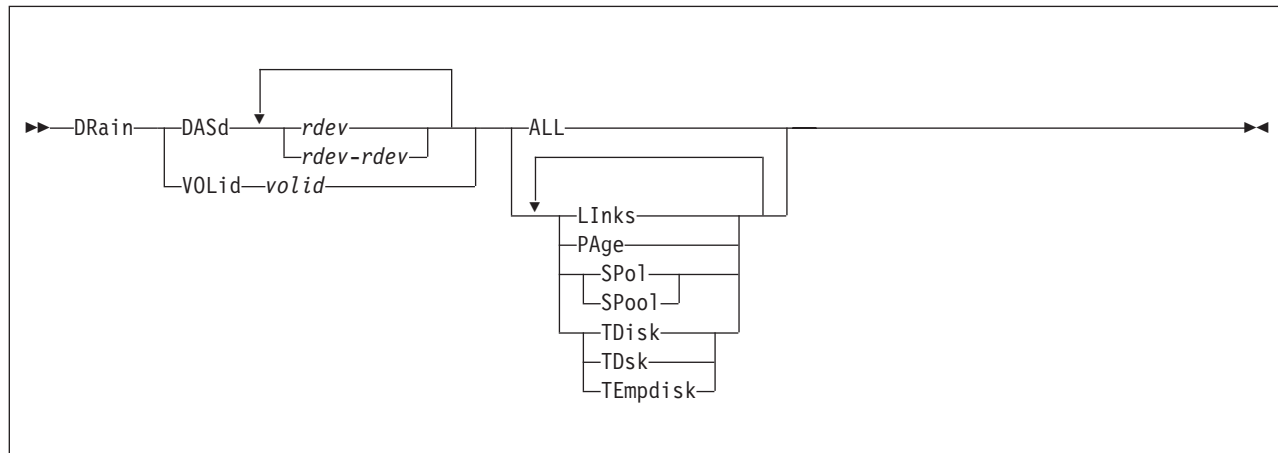
Note: It is recommended that all nodes in a CS collection have the same value specified for MAXIMUM because the maximum value is enforced only by the originating node.

Usage Notes

1. When TOLERATE is specified, IUCV will be distributed via the TARGET parameter of the IUCV macro. When YES is specified, IUCV will first attempt to satisfy a CONNECT on the local system and then will attempt to locate the target on a system within the CS collection. The only exception is if the application specifies that the CONNECT must be satisfied either locally or on a particular target system.

2. IUCV applications will behave the same in a distributed environment as they do on a local system with the following exceptions:
 - PURGE and REJECT will only be honored on the local system. Once a message is sent to the other system it is considered to be delivered.
 - The PRIORITY and MSGLIMIT directory specifications must be present on both systems if they are to be honored.
 - The default maximum data length is 16 MB per message. The maximum can be altered via the SYSTEM CONFIG file by using the DISTRIBUTE statement.

DRAIN (Disk) Statement



Purpose

Use the DRAIN statement to stop new operations on specified DASD. You can stop CP from:

- Writing pages to the specified device or devices
- Letting users link to minidisks on the specified device or devices
- Allocating spool space on the specified device or devices
- Allocating temporary minidisks on the specified device or devices.

How to Specify

Include as many statements as needed; they are optional. You can place DRAIN DASD statements anywhere in the system configuration file, but you must place DRAIN VOLID statements after the CP_OWNED statement (see “CP_OWNED Statement” on page 74) with the same volume serial number.

If you specify the same device on more than one statement, CP keeps a cumulative list of operations. For example, if you have one statement indicating that you do not want paging on a device and another statement indicating that you do not want temporary disks allocated on that same device, CP prevents paging **and** temporary disk allocation on that device. The second statement does not overrule the first statement.

Operands

DASd *rdev*

is the real device number of the DASD you want drained. The variable *rdev* is a hexadecimal number between X'0000' and X'FFFF'.

DASd *rdev-rdev*

is a range of real device numbers specifying the DASD you want drained. Each *rdev* is a hexadecimal number between X'0000' and X'FFFF'.

VOLid *valid*

is the volume serial number of the volume you want drained.

ALL

tells CP not to allow any new operations on this device, including:

- Writing pages during page-out
- Allowing minidisk linking
- Allocating space for new spool records.
- Allocating temporary disk space.

LInks

tells CP not to allow users to link to minidisks on this device.

PAge

tells CP not to write pages to this device during page-out operations.

SPo1**SPool**

tells CP not to allocate space on this device for new spool records.

TDisk**TDsk****TEmpdisk**

tells CP not to allocate temporary disk space on this device.

Usage Notes

1. When you drain a DASD (or one of its operations), CP makes the DASD appear to be full. Because the DASD appears to be full, CP tries to allocate from the next appropriate device, if possible. Issuing DRAIN (Disk) or START (Disk) commands does not cause CP to adjust the system counters. For example, if you are draining spool space on a DASD, CP does not adjust the amount of spool space that is unused and available to zero, even though, logically, there appears to be no available spool space on that DASD. Issuing a CP DETACH command adjusts the appropriate system counters to account for the space being removed from the system. For more information about the DRAIN (Disk), START (Disk), or DETACH commands, see the *z/VM: CP Commands and Utilities Reference*.
2. You can attach a draining DASD to a virtual machine.
3. Issuing CP ATTACH and DETACH commands does not affect the DRAINING status indicators, so you can drain a DASD before attaching it to the system. For more information about the CP ATTACH and DETACH commands, see the *z/VM: CP Commands and Utilities Reference*.
4. CP processes the system configuration file during an IPL, which means CP has not attached any volumes to the system when processing your DRAIN statements. Therefore, when you specify a DRAIN VOLID statement, you can only use volumes that were previously specified in the system configuration file on CP_OWNED statements.
5. Use the CP START (Disk) command or statement to tell CP to resume normal allocation on the device and use the QUERY DASD DRAINING command to get information about the draining status of your DASD. For more information about the START (Disk) or QUERY DASD DRAINING commands, see the *z/VM: CP Commands and Utilities Reference*. For more information about the START (Disk) statement, see “START (Disk) Statement” on page 260.

Examples

Use the DRAIN and START statements shown in Figure 3 on page 132 to have CP:

- Drain all operations on all DASD between X'0700' and X'07FF',
- Allow users to link to minidisks on DASD X'0700', and

DRAIN (Disk)

- Ensure that CP can write pages to the CP-owned paging pack (SYSPG1), if someone moves that DASD to one of the addresses that are draining (X'0700' through X'07FF')

```
Drain  DASD  0700-07ff  All      /* Do not allow any activity on
                                   these DASD ...          */

Start  DASD  0700      Links    /* ... except for 700, which has
                                   a minidisk I need to link to */

Start  Valid SYSPG1    Page     /* ... and, if Operations moves
                                   the CP-owned paging pack any-
                                   where in the 700-7FF range, it
                                   has to be useable for system
                                   paging!                  */
```

Figure 3. Example DRAIN and START Statements

After you IPL the system, you can use the CP QUERY DASD DRAINING command to see the results of your DRAIN (Disk) and START (Disk) statements. For example, if the CP-owned volume did not fall into the range of drained devices, you would see:

Vol-ID	Rdev	Draining:	PAGE	Links	SPool	TDisk
SYS700	0700		Yes	No	Yes	Yes
SYS701	0701		Yes	Yes	Yes	Yes
SYS702	0702		Yes	Yes	Yes	Yes
.						
.						
.						
SYS7FE	07FE		Yes	Yes	Yes	Yes
SYS7FF	07FF		Yes	Yes	Yes	Yes

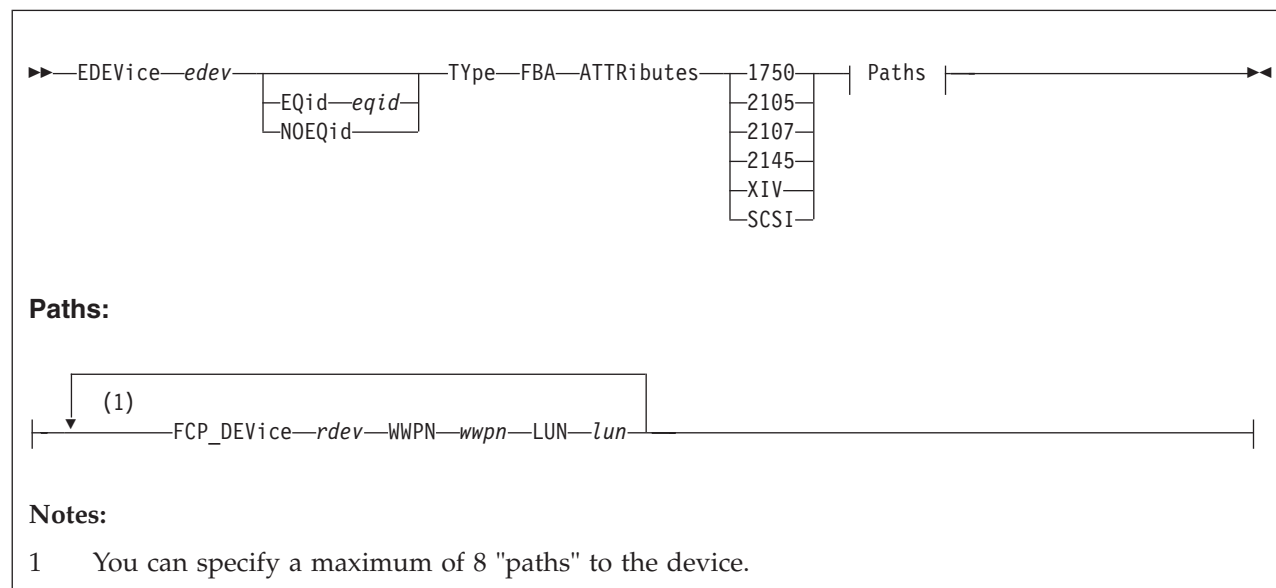
If the CP-owned volume SYSPG1 fell into the range of drained devices, you would see:

Vol-ID	Rdev	Draining:	PAGE	Links	SPool	TDisk
.						
.						
.						
SYSPG1	0777		No	Yes	Yes	Yes
.						
.						
.						

If the CP-owned volume SYSPG1 had a real device number of X'0700', you would see:

Vol-ID	Rdev	Draining:	PAGE	Links	SPool	TDisk
.						
.						
.						
SYSPG1	0700		No	No	Yes	Yes
.						
.						
.						

EDEVICE Statement



Purpose

Use the EDEVICE statement to define an emulated device that represents a real SCSI device.

How to Specify

Include as many EDEVICE statements as needed; they are optional and can be placed anywhere in the system configuration file. If you specify more than one statement with the real device number, CP uses the last statement. For example, if you specify:

```
RDEvice 0500 Type AFP
```

```
.
```

```
.
```

```
.
```

```
EDEVICE 0500 TYpe FBA ATTR 2105 FCP_DEV 2000 WWPN 5005076300CE04DA,  
LUN 6100000000000000
```

CP defines an emulated FBA DASD at real device number 0500, and not an advanced function printer.

Operands

edev

specifies the device number that is associated with the emulated device. The *edev* must be a 1 - 4 digit hexadecimal number between X'0000' and X'FFFF'. The *edev* number corresponds directly with an *rdev* number. Thus, a new *edev* number cannot be defined where an *rdev* number already exists.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the EDEV. The *eqid* is a string

EDEVICE

of 1–8 alphanumeric characters. Note that when VARYing this device online, a system-generated EQID will override this equivalency ID if one can be generated.

NOEQid

removes a previously assigned EQID from this EDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place. If the CLEAR option is specified, the NOEQID option is not necessary.

TyPe

specifies the emulated device type, selected by the immediately following parameter.

FBA

identifies the emulated device as an FBA DASD.

ATTRibutes

specifies the name of an attribute set to be associated with the real device.

1750

specifies that IBM 1750 device attributes are to be used for the real device that is being emulated. See Usage Note 4 on page 135 for more information.

2105

specifies that IBM 2105 device attributes are to be used for the real device that is being emulated.

2107

specifies that IBM 2107 device attributes are to be used for the real device that is being emulated.

2145

specifies that IBM 2145 device attributes are to be used for the real device that is being emulated. See Usage Note 5 on page 136 for more information.

XIV

specifies that IBM XIV device attributes are to be used for the real device that is being emulated.

SCSI

specifies that general SCSI device attributes are to be used for the real device that is being emulated.

Note: When specifying this value, you should exercise caution in defining more than one path to the device. Be sure that the device actually supports multiple paths. Defining multiple paths to a device that does not support multiple paths could result in data-integrity problems on the device.

FCP_DEVICE *rdev*

specifies the real device number of the FCP device to be used for a specific path to a SCSI device. The *rdev* must be a 1 - 4 digit hexadecimal number between X'0000' and X'FFFF'.

WWPN *wwpn*

specifies the world wide port name for a specific path to a SCSI device. The *wwpn* must be a 16 digit hexadecimal number between X'0000000000000000' and X'FFFFFFFFFFFFFFFF'.

If fewer than 16 digits are specified for the *wwpn*, the number will be padded with leading zeros to make it a 16 digit number.

LUN *lun*

specifies the logical unit number for a specific path to a SCSI device. The *lun* must be a 16 digit hexadecimal number between 'X'0000000000000000' and 'X'FFFFFFFFFFFFFFF'. Note, however, that the number of digits recognized by the SCSI device may vary by manufacturer, type and model.

If fewer than 16 digits are specified for the *lun*, the number will be padded with leading zeros to make it a 16 digit number, but this will almost certainly produce an invalid value. You must be careful to specify all 16 digits, using *trailing zeros*, as per the note below.

Attention

Because CP cannot know how many digits your device recognizes, you must enter *all 16 digits*. If your SCSI device is identified by fewer than 16 digits, you should use *trailing zeros* to fill out the 16 digit *lun*. Note that if you enter nonzero digits following the digits identifying the SCSI device, those extra digits may be ignored by your device. It is therefore possible to define multiple EDEVs that differ only in their rightmost unsupported digits, and the EDEVs will in fact represent the same SCSI device. (For example, if your device recognizes a 4 digit *lun*, 5A51888811221122 and 5A51999933443344 would both represent the same device.) This could lead to unintended device sharing and hence might introduce data-integrity exposures. **Always identify your SCSI device by its actual logical unit number as defined in your storage-area network, padded on the right with zeros.**

Usage Notes

1. When defining emulated devices to represent real SCSI devices, there should be a one-to-one relationship between an emulated device and a real SCSI device. All paths defined for an emulated device should represent paths to the same real SCSI device. If the paths for one emulated device are associated with more than one real SCSI device, or if more than one emulated device is associated with the same real SCSI device, then data integrity problems could occur.
2. Path validation for an emulated device occurs when the emulated device is varied online. Any invalid path will be deleted from the EDEV. A path is considered to be invalid for any of the following reasons:
 - The device specified by the FCP_DEVICE parameter does not exist.
 - The device specified by the FCP_DEVICE parameter is not an FCP device.
 - The device specified by the FCP_DEVICE parameter is an offline FCP device.
 - The device specified by the FCP_DEVICE parameter is dedicated to a virtual machine.
 - The value specified by the WWPN parameter is not a valid world wide port name in your configuration.
 - The value specified by the LUN parameter is not a valid logical unit number for the specified world wide port name.
3. You can add paths and change the attribute name associated with a SCSI system residence volume by specifying an EDEVICE statement for it. The EDEVICE statement must specify the path already associated with the device (passed from SAPL) in order to be valid. By default a SCSI system residence volume is associated with the general SCSI attributes.
4. Devices (LUNs) on an IBM 1750 (DS6000™) storage controller can be configured through any of the I/O ports on the controller, but the access times for a given device through different ports can be different. For a given device, half of the ports will provide faster access times than the other half of the ports. The

channel paths connected to the ports with faster access are called "preferred paths" for the device, and the remaining channel paths are called "non-preferred paths".

Previous releases of z/VM required knowledge of the preferred/non-preferred value for each path on a SET EDEV command when using the 1750 attribute. Now, z/VM is able to determine during device initialization which paths are preferred and which are not, so operands on the SET EDEV command that explicitly state the preferred/non-preferred value for such a device will be ignored. Preferred paths will still be given preference over non-preferred paths during the path selection for an I/O request.

5. When using an IBM 2145, a host that has a LUN mapping for a virtual disk will normally be able to access that virtual disk via any of the ports connected to either of the two nodes in the I/O group supporting that virtual disk. Each virtual disk has a set of preferred ports. These ports will give slightly better performance than the ports that are non-preferred. By default, the cache component assigns ownership of even numbered virtual disks to one node of a caching pair and the ownership of odd numbered virtual disks to the other node. To provide flexibility, the ownership for a given virtual disk can be explicitly assigned to a given node when the virtual disk is created. A node that is explicitly assigned as an owner of a virtual disk is known as the preferred node.

Previous releases of z/VM required knowledge of the preferred/non-preferred value for each path on a SET EDEV command when using the 2145 attribute. Now, z/VM is able to determine during device initialization which paths are preferred and which are not, so operands on the SET EDEV command that explicitly state the preferred/non-preferred value for such a device will be ignored. Preferred paths will still be given preference over non-preferred paths during the path selection for an I/O request.

6. If an EQID is specified along with the CLEAR parameter, the EQID is ignored and the EDEV is cleared without setting an EQID.
7. When setting an EQID for an EDEV, no other device can have the same EQID assigned to it. Furthermore, when the device is brought online, if a system-generated EQID can be assigned to the device, the user-defined EQID will be removed and the system-generated ID will be used.
8. If the system cannot generate a unique EQID for this device, CP will issue the following message:

HCP048E

A unique EQID cannot be generated for EDEV *edev* based upon the hardware information provided.

9. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

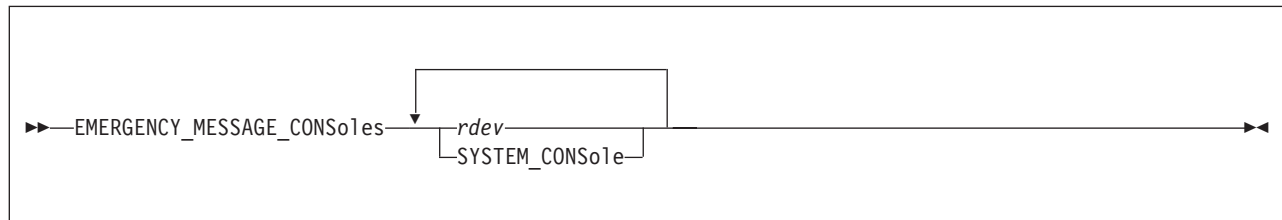
Examples

1. To define an emulated device 8181 for a 2105 SCSI device with one path, enter the following:

```
edev 8181 type fba attr 2105,  
      fcp_dev 900 wwpn 200400A0B80BA987 lun 0002000000000000
```
2. To define an emulated device 4343 for a general SCSI device with two paths, enter the following:

```
edev 4343 type fba attr scsi,  
    fcp_dev 800 wwpn 200400A0B80BA687 lun 0001000000000000,  
    fcp_dev 801 wwpn 200400A0B80BA688 lun 0001000000000000
```

EMERGENCY_MESSAGE_CONSOLES Statement



Purpose

Use the EMERGENCY_MESSAGE_CONSOLES statement to define the list of console addresses which CP notifies when there is a system emergency (for example, an impending abend, shutdown, or dump). During initialization, CP creates a list of valid emergency consoles from the ones you have defined on this statement. The maximum number of unique console IDs that you can specify is 100. If CP abends, or if a software re-IPL occurs, CP sends messages to all the consoles on the list it created.

How to Specify

This statement is optional and you can place it anywhere in the system configuration file. Although you can include as many statements as needed, we recommend you only specify one. This statement defines the entire list of consoles that CP uses to notify you of impending abends or other system emergencies. If you specify more than one statement, CP redefines the list each time and only uses the list of consoles specified on the very last EMERGENCY_MESSAGE_CONSOLES statement that you specify. CP will not combine multiple statements into one comprehensive list of consoles.

Operands

rdev

adds the real device number or numbers to the list of CP emergency consoles that are sent emergency messages. The variable *rdev* must be a hexadecimal number between X'0000' and X'FFFF', and they must be locally-attached 3270-type supported displays. (See *z/VM: General Information* for a complete list of supported 3270-type displays.)

SYSTEM_CONSOLE

adds the system console to the list of consoles that are sent emergency messages. For more information about how to view the messages that are produced on the system console, see *z/VM: System Operation*.

Usage Notes

1. If an IODF statement is defined in the system configuration file with the *osconfig* parameter specified, then the software I/O configuration will be controlled by HCD. In this case, the EMERGENCY_MESSAGE_CONSOLES statement is ignored if it is specified. Refer to "IODF Statement" on page 173 for more information.
2. 2250 and 3250 displays are not valid emergency message consoles.
3. If you do not specify an EMERGENCY_MESSAGE_CONSOLES statement, CP sends all emergency messages to the operator consoles that you listed on the

OPERATOR_CONSOLES statement in the system configuration file before IPL. During IPL, CP checks all the consoles in this list to see if they are operational. If they are, CP includes them in the list of operator consoles. For more information about the OPERATOR_CONSOLES statement, see “OPERATOR_CONSOLES Statement” on page 208.

4. If the CONS=*addr* or CON=*addr* parameter was specified on the Stand-Alone Program Loader (SAPL) panel to specify a console address and this console address is not already specified on the EMERGENCY_MESSAGE_CONSOLES statement, it is added to the list of emergency message consoles.

There will be a total of 101 emergency message consoles if the maximum number of 100 is specified on the EMERGENCY_MESSAGE_CONSOLES statement and the additional console address is added to the list.

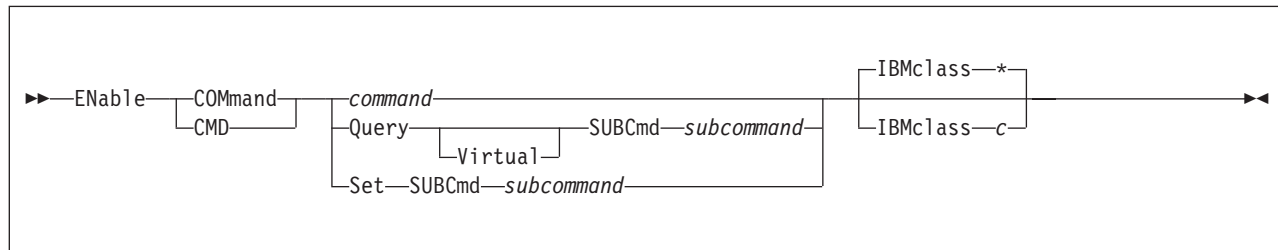
5. The system console is automatically added to the list of emergency message consoles if it is not already in the list. For more information about how to view the messages that are produced on the system console, see *z/VM: System Operation*.

Examples

1. To have CP send emergency messages to the operator's and system programmer's consoles, use the following EMERGENCY_MESSAGE_CONSOLES statement:

```
Emergency_Message_Consoles 0bc0 0bc1 /* Oper and SysProg consoles */
```

ENABLE COMMAND / CMD Statement



Purpose

Use the ENABLE COMMAND or CMD statement to permit CP to process requests for the specified CP command during and after initialization.

You can also permit processing of CP commands after initialization using the ENABLE COMMAND or CMD commands. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place ENABLE COMMAND or CMD statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

command

is the name of the command that you are enabling. The variable *command* is a 1-character to 12-character alphanumeric string.

Query SUBCmd *subcommand*

tells CP the name of the CP QUERY subcommand that you are enabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

Query Virtual SUBCmd *subcommand*

tells CP the name of the CP QUERY VIRTUAL subcommand that you are enabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

Set SUBCmd *subcommand*

tells CP the name of the CP SET subcommand that you are enabling. The variable *subcommand* is a 1-character to 12-character alphanumeric string.

IBMclass *

tells CP to enable all versions of the specified command or subcommand. If omitted, IBMCLASS * is the default.

IBMclass *c*

tells CP to enable a specific version of the specified command or subcommand. The variable *c* can be any 1 of the following:

- A** this is a system-control command to be used by the primary system operator.
- B** this is a command for operational control of real devices.
- C** this is a command to alter host storage.

- D** this is a command for system-wide control of spool files.
- E** this is a command to examine host storage.
- F** this is a command for service control of real devices.
- G** this is a general-use command used to control the functions of a virtual machine.
- 0** (zero) this command has no specific IBM class assigned.

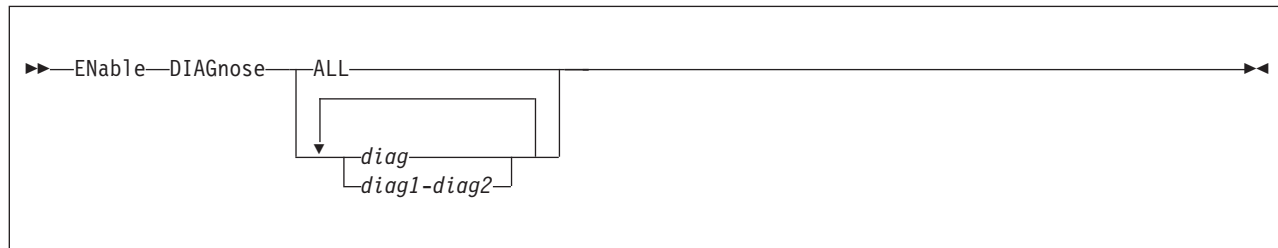
Usage Notes

1. To load the command processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
2. To activate a CP command while defining it, use the ENABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command. For more information about the DEFINE COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
3. To deactivate a CP command:
 - While defining it, use the DISABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command.
 - After defining it, use the DISABLE COMMAND or CMD statement (see “DISABLE COMMAND / CMD Statement” on page 122) or command.
 For more information about the DEFINE or DISABLE COMMAND or CMD commands, see the *z/VM: CP Commands and Utilities Reference*.
4. To change the definition of an existing CP command, use the MODIFY COMMAND or CMD statement (see “MODIFY COMMAND / CMD Statement” on page 181) or command. For more information about the MODIFY COMMAND or CMD command, see the *z/VM: CP Commands and Utilities Reference*.
5. To display the address of the CP command table entry block, the current IBM class, and the current privilege class for a specified CP command, use the LOCATE CMDBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To remove the command processing code from CP's system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. For more information about enabling and disabling commands, see the *z/VM: CP Exit Customization* book.

Examples

1. To activate the CP SHUTDOWN command (after a prior DISABLE COMMAND statement had deactivated it), use the following:
 Enable Command shutdown
2. To activate the class <ANY> version of the CP SET PRIVCLASS command (after a prior DISABLE COMMAND statement had deactivated it), use the following:
 Enable Command Set SubCmd privclass IBMclass 0

ENABLE DIAGNOSE Statement



Purpose

Use the ENABLE DIAGNOSE statement to permit CP to process requests for one or more locally-developed DIAGNOSE codes during and after initialization.

You can also permit processing of locally-developed DIAGNOSE codes after initialization using the ENABLE DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place ENABLE DIAGNOSE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ALL

tells CP to enable all existing DIAGNOSE codes.

Note: This operand enables all DIAGNOSE codes: the locally-defined ones, the IBM-supplied ones, and any supplied by third-party software vendors.

diag

diag1-diag2

is the number of the DIAGNOSE code that you are enabling. Each *diag* must be a hexadecimal number between X'0000' and X'03FC' and must be a multiple of 4. You can specify a single DIAGNOSE code, a range of DIAGNOSE codes, or any combination thereof.

Usage Notes

1. To define a new DIAGNOSE code, use the DEFINE DIAGNOSE statement (see “DEFINE DIAGNOSE Statement” on page 93) or command. For more information about the DEFINE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
2. To load the DIAGNOSE processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. If you do not specify the ENABLE operand, a new DIAGNOSE code is initially in a disabled state after being defined. CP treats disabled DIAGNOSE codes as if they were never defined. If you try to use a disabled DIAGNOSE code in a program, CP will give you a program check specification exception.

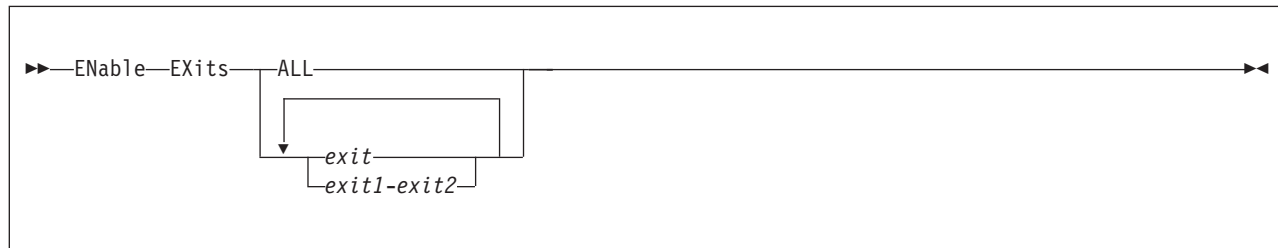
4. To change the definition of an existing DIAGNOSE code, use the MODIFY DIAGNOSE statement (see “MODIFY DIAGNOSE Statement” on page 185) or command. For more information about the MODIFY DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
5. To display information about a DIAGNOSE code (status, entry point name, and privilege class) after initialization, use the QUERY DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To display the address of the CP DIAGNOSE code table block for a DIAGNOSE code, use the LOCATE DGNBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To deactivate a DIAGNOSE code:
 - While defining it, use the DISABLE operand of the DEFINE DIAGNOSE statement (see “DEFINE DIAGNOSE Statement” on page 93) or command.
 - After defining it, use the DISABLE DIAGNOSE statement (see “DISABLE DIAGNOSE Statement” on page 124) or command.

For more information about the DEFINE or DISABLE DIAGNOSE commands, see the *z/VM: CP Commands and Utilities Reference*.
8. To remove the DIAGNOSE processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
9. Many external security managers (ESMs) do not support DIAGNOSE codes above X'03FC'. For this reason, CP does not support DIAGNOSE codes above X'03FC'. The DIAGNOSE codes between X'0000' and X'03FC' are divided as follows:
 - X'0000' to X'00FC'**
Reserved for IBM use
 - X'0100' to X'01FC'**
Reserved for customer use
 - X'0200' to X'03FC'**
Reserved for IBM use.
10. For more information about user-defined DIAGNOSE codes, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP enable DIAGNOSE code X'100', use the following:
Enable Diagnose 100
2. To have CP enable all DIAGNOSE codes on your system, use the following:
Enable Diagnose All
3. To have CP enable all locally-defined DIAGNOSE codes, use the following:
Enable Diagnose 100-1fc
4. To have CP enable all locally-defined DIAGNOSE codes, except DIAGNOSE code X'180', use the following:
Enable Diagnose 100-17c 184-1fc

ENABLE EXITS Statement



Purpose

Use the ENABLE EXITS statement to permit CP to call all entry points and external symbols associated with one or more exit points during and after initialization.

You can also permit CP to call the entry points and external symbols associated with an exit point after initialization using the ENABLE EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place ENABLE EXITS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ALL

tells CP to enable all existing CP exit points.

exit

exit1-exit2

is the number of the exit point (or exit points) that you want CP to start using. Each *exit* must be a hexadecimal number between X'0000' and X'FFFF'. You can specify a single exit point number, a range of exit point numbers, or any combination thereof.

Usage Notes

1. To load the exit point code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
2. To associate one or more entry points or external symbols with a specific exit point and to enable or disable that exit point, use the ASSOCIATE EXIT statement (see “ASSOCIATE EXIT Statement” on page 59) or command. (For more information about the ASSOCIATE EXIT command, see the *z/VM: CP Commands and Utilities Reference*.) You can also use the ASSOCIATE EXIT statement to change the entry points and external symbols associated with a specific entry point.
3. If the list of entry points and external symbols associated with this exit point contain any entry points or external symbols that CP does not know about, CP just ignores them and continues normal processing. That is, CP will

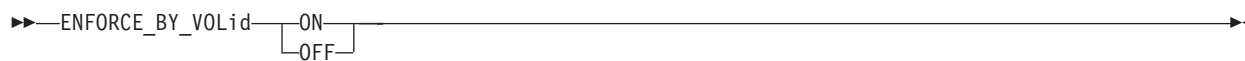
continue to process the other members of the list associated with this exit point. CP does not ignore an exit point because it cannot find one entry point or external symbol in the list. CP only ignores an exit point if it cannot find all the entry points and external symbols in the list.

4. To display whether there are any unknown entry points or external symbols associated with an exit point after initialization, use the QUERY UNRESOLVED command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
5. To display status and usage statistics information about a specific exit point after initialization, use the QUERY EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To display the address of the CP exit block for a specific exit point, use the LOCATE XITBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To display the address of the CP indirect call locator block for a specific exit point, use the LOCATE ICLBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
8. To change the definition of an existing dynamic exit point, or remove the exit point from the system, use the MODIFY EXIT statement (see “MODIFY EXIT Statement” on page 188) or command. For more information about the MODIFY EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
9. To stop CP from calling all the entry points and external symbols associated with one or more exit points after defining those exit points, use the DISABLE EXITS statement (see “DISABLE EXITS Statement” on page 126) or command. For more information about the DISABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.
10. To remove the exit point code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
11. For more information about user-defined exit points, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP start using the entry points and external symbols associated with CP Exit 99 after initialization, use the following:
Enable Exits 99
2. To have CP start using the entry points and external symbols associated with all CP exit points after initialization, use the following:
Enable Exits All

ENFORCE_BY_VOLID Statement



Purpose

Use the ENFORCE_BY_VOLID configuration statement to enforce attachment of DASD devices by their VOLIDs on the ATTACH command.

How to Specify

The ENFORCE_BY_VOLID statement is optional. If you do not specify the statement, CP will not enforce attachment of DASD devices by their VOLIDs. If you specify the statement more than once, CP will use the last ENFORCE_BY_VOLID statement entered.

Operands

ON tells CP to enforce attachment of DASD devices by VOLID only.

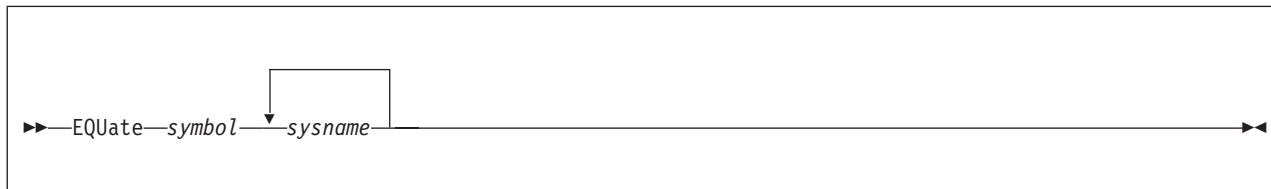
OFF

tells CP not to enforce attachment of DASD devices by VOLID only.

Usage Notes

1. When the ENFORCE_BY_VOLID ON statement is specified, the VOLIDs for all DASD devices must be specified on the CP ATTACH command and the DEDICATE directory statement. For more information about the CP ATTACH command, see the *z/VM: CP Commands and Utilities Reference* book. For more information about the DEDICATE statement, see the “DEDICATE Directory Statement” on page 491.

EQUATE Statement



Purpose

Use the EQUATE statement to create nicknames for systems or groups of systems. After creating a nickname, you can use it as a record qualifier in the system configuration file to limit the scope of the statement and to group systems that have common properties. This allows you to create generic system configuration files that can be shared across multiple systems.

How to Specify

Include as many statements as needed; they are optional. You must define a nickname before you use it, so place your EQUATE statements anywhere in the system configuration file before any statements using those nicknames. If you specify more than one statement with the same nickname, CP uses the last statement. CP will not combine multiple statements with the same nickname into one comprehensive group.

Operands

symbol

is the nickname for a system or group of systems that you are grouping together because they have similar properties and should therefore be treated the same way when CP processes the system configuration file. Each *symbol* is a 1- to 16-character alphanumeric nickname with no imbedded blanks.

sysname

is the name of the system (or systems) you want included in the specified nickname group. You can use generic system names to request a specific subset of systems. A generic system name is a 1- to 8-character string with asterisks (*) in place of one or more arbitrary characters and percent signs (%) in place of exactly one arbitrary character. For example:

```
Equate yorktown y%tvm*
```

creates a nickname that includes all systems that start with Y and have TVM as their third, fourth, and fifth characters.

Usage Notes

1. A *sysname* must be defined on a SYSTEM_IDENTIFIER statement (see "SYSTEM_IDENTIFIER Statement" on page 268) before it can be included in a nickname group.
2. You can use multiple names in an EQUATE statement and still distinguish between the systems. For example:

```
Equate vm3 sys1 sys2 sys4
```

EQUATE

creates the nickname VM3 for systems SYS1, SYS2, and SYS4. If you later have statements using these names:

```
Sys4: ...  
Sys1: ...  
Vm3: ...
```

The statement starting with Sys4: only applies to system SYS4; the statement starting with Sys1: only applies to system SYS1; and the statement starting with Vm3: applies to systems SYS1, SYS2, and SYS4.

Examples

1. If you have five systems set aside for business and five set aside for research, you can use an EQUATE statement to give each of the two groups a nickname. Then you can use the nicknames as record qualifiers on other statements in the system configuration file.

For example:

```
Equate business atlanta boston, /* Define BUSINESS nickname */  
                chicago cleveland,  
                newyork  
Equate research maine raleigh, /* Define RESEARCH nickname */  
                rdsys1 testsys,  
                yorktown  
  
.  
.  
.  
Business: Features Disable Set_PrivClass /* Don't let users set */  
                                           /* their own privilege */  
                                           /* classes */  
  
.  
.  
.  
Research: Features Enable Set_PrivClass /* Let users set their */  
                                         /* own privilege classes */
```

allows the users on the five research systems to change their own privilege classes and allows the system operator on those system to change the privilege classes of any users logged on those systems. It also prevents the users and system operators on the five business systems from changing privilege classes.

EXTERNAL_SYNTAX Statement

```
▶▶—EXTERNAL_SYNTAX—EPName—epname—◀◀
```

Purpose

Use the EXTERNAL_SYNTAX statement to add locally-developed system configuration file statements to the system without modifying the system configuration file processor, HCPZSC ASSEMBLE.

How to Specify

Include as many statements as needed; they are optional. You can place EXTERNAL_SYNTAX statements anywhere in the system configuration file, as long as they appear before the first invocation of the new configuration file statement. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

EPName *epname*

tells CP the name of the external symbol that identifies the start of your syntax definition. This would be the label that is generated or coded on the HCPDOSYN macro which defines the syntax of your locally-developed system configuration file statement.

Usage Notes

1. If your locally-developed system configuration file statement has the same name (or minimum abbreviation) as a system configuration file statement shipped by IBM, your statement will override the existing statement.

Examples

1. To define and use your own system configuration file statement during initialization, use the following:

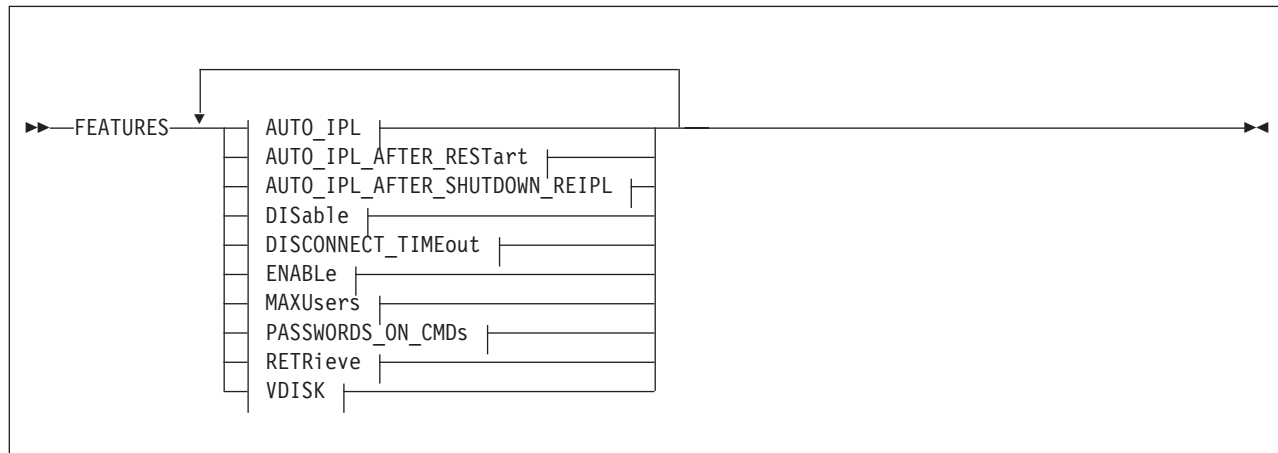
```
CPXLoad tttsyn text a          /* Load the module          */
      Temporary,             /* ... in case we must unload it later */
      NoControl,             /* ... to unload without more checking */
      Nodelay,               /* ... load immediately from parmdisk */
      Lock                   /* ... make sure all of it is in storage */
                               /* if it is > 4K. (Not necessary, */
                               /* unless you are paranoid, like me!) */

/* Let us hook into the front of the standard syntax definitions */
```

```
External_Syntax EPName tttsyntx
```

In this example, the module TTTSYN contains your syntax tree, which starts at label TTTSYNTAX. This example shows how you would get CP to load the module and make CP consider it additional syntax during initialization.

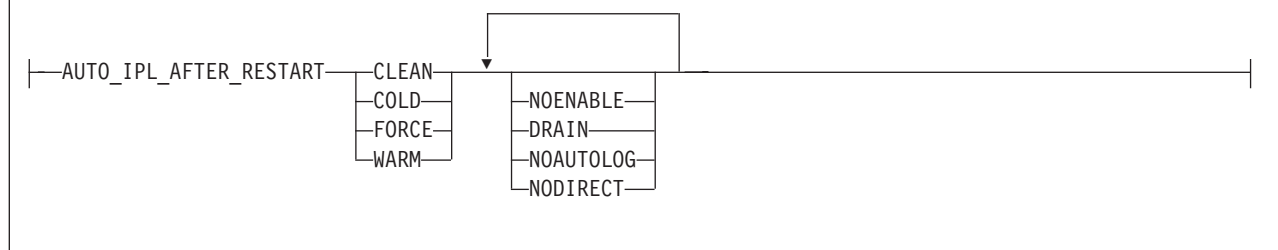
FEATURES Statement

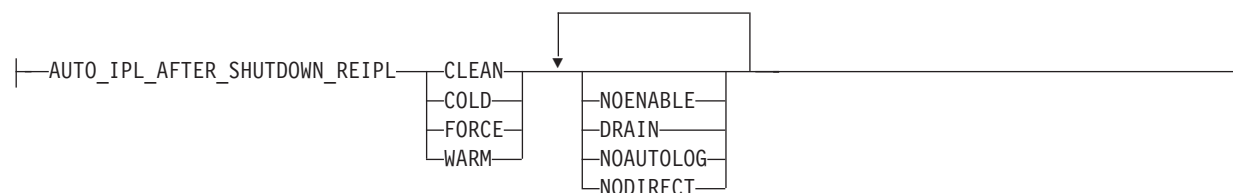
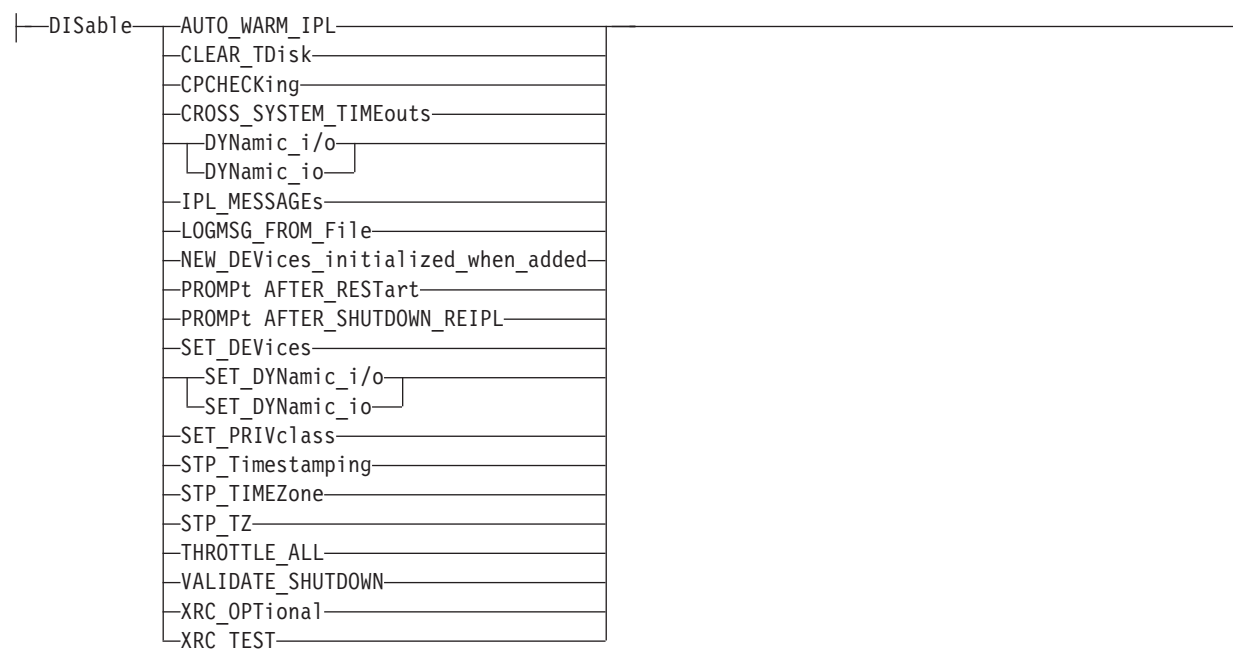


AUTO_IPL:



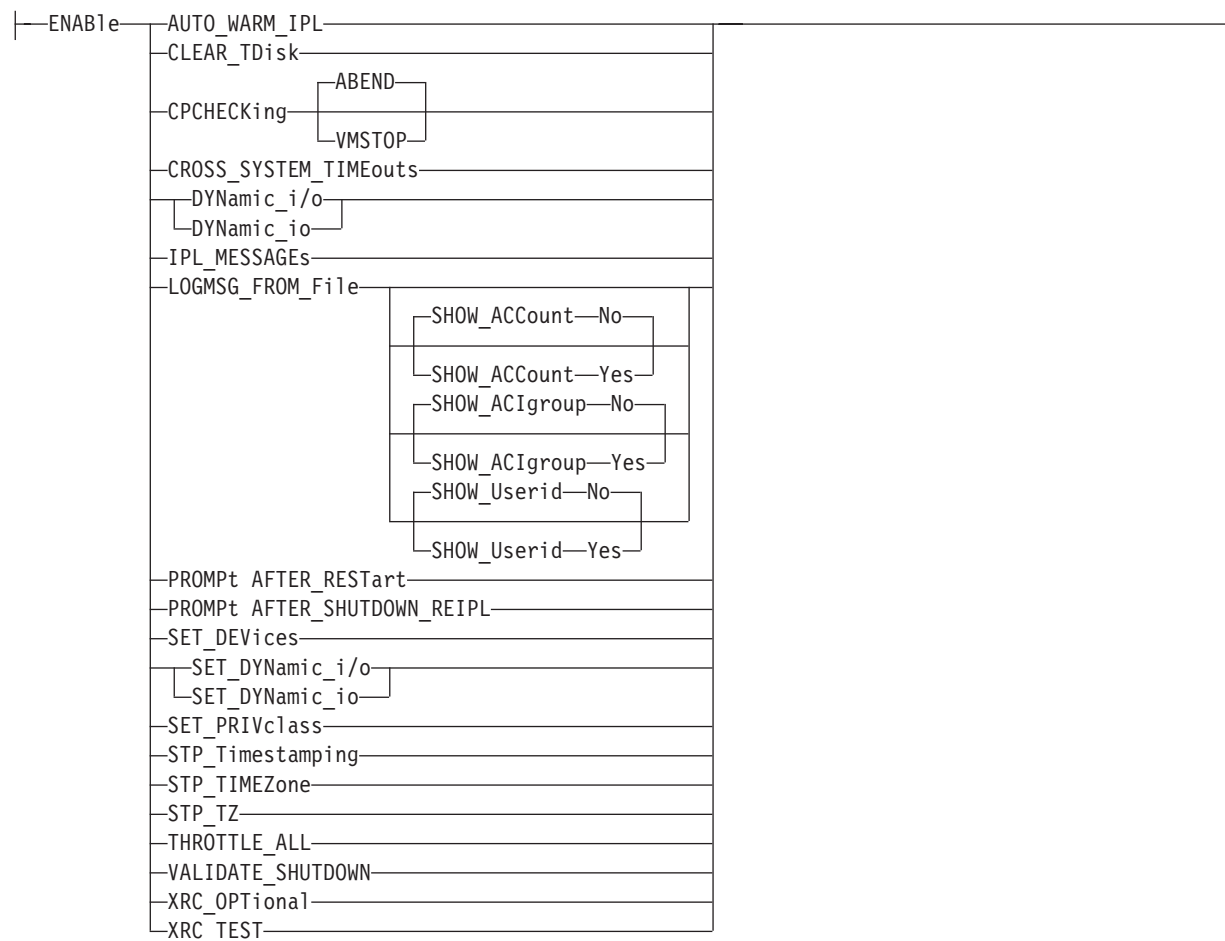
AUTO_IPL_AFTER_RESTART:



AUTO_IPL_AFTER_SHUTDOWN_REIPL:**DISable:****DISCONNECT_TIMEout:**

FEATURES

ENABLE:



MAXUsers:

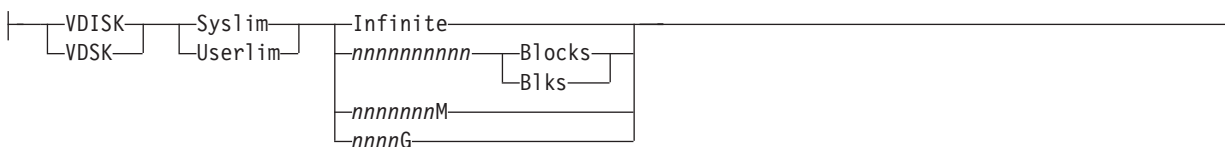




- ### RETRieve:



- VDISK:**



Use the **FEATURES** statement to set certain attributes of the system at system initialization.

Chapter 6. The System Configuration File 153

Operands

AUTO_IPL

defines the kind of start to be performed when the system is initialized. The system will be started without prompting the system operator and without changing the TOD clock.

AUTO_IPL_AFTER_REStart

defines the kind of start to be performed when the system is initialized after a system restart. The system will be restarted without prompting the system operator and without changing the TOD clock

AUTO_IPL_AFTER_SHUTDOWN_REIPL

defines the kind of start to be performed when the system is initialized after a SHUTDOWN REIPL. The system will be restarted without prompting the system operator and without changing the TOD clock.

COLD

tells CP to perform a cold start. This will purge all spool files, accounting records, error recording records, symptom records, and the system log message. System data files will not be purged.

If spooling errors that could result in the loss of system data files (NSS, DCSS, TRF, IMG, UCR, NLS) are encountered, the system operator will be prompted and given the opportunity to stop. If no spooling errors are encountered, the system operator will not be prompted and there will be no opportunity to stop.

CLEAN

tells CP to perform a clean start. This will purge all spool files, system data files, accounting records, error recording records, symptom records, and the system log message. The system operator will not be prompted and there will be no opportunity to stop.

FORCE

tells CP to perform a force start. If spooling errors are encountered, the spool files and system data files in error will be purged. The system operator will not be prompted and there will be no opportunity to stop.

WARM

tells CP to perform a warm start. If spooling errors are encountered, the system operator will be prompted and given the opportunity to stop.

NOENABLE

tells CP not to enable terminal access after system initialization.

DRAIN

tells CP to drain unit-record devices after system initialization.

NOAUTOLOG

tells CP to bypass automatic logon of virtual machines after system initialization.

NODIRECT

tells CP to bring up the system without a User Directory.

DISable

disables the following system attributes during IPL. Note that initially, each option is disabled until enabled using the ENABLE operand.

AUTO_WARM_IPL

tells CP to go through all the usual prompts in the IPL process.

CLEAR_TDisk

tells CP to clear only cylinder 0 or the first eight blocks on the temporary minidisk when it detaches the minidisk.

CPCHECKing

tells CP that internal CP checking is not to be executed.

CROSS_SYSTEM_TIMEouts

specifies that timeouts detected at the device and logical link level within the ISFC inter-system communications component are ignored. Also, in an SSI cluster environment, CROSS_SYSTEM_TIMEOUTS specifies that missing or late heartbeat signals between members in the SSI cluster are ignored. Disabling CROSS_SYSTEM_TIMEOUTS prevents the SSI member from recognizing unresponsive member systems and from initiating normal error recovery.

This option is intended for use in diagnostic situations only—typically, when running members of an SSI cluster as z/VM guests, in which a member might be stopped for long periods of time when using the CP TRACE command or similar facilities to debug code within the CP nucleus or a CPXLOADED nucleus extension. Without this option in effect, manual commands such as SET SSI DOWN, DEACTIVATE ISLINK, and ACTIVATE ISLINK might be required to restore proper operation.

In order to join an SSI cluster, a member's CROSS_SYSTEM_TIMEOUTS setting (either ENABLE CROSS_SYSTEM_TIMEOUTS or DISABLE CROSS_SYSTEM_TIMEOUTS) must be the same as that of the first member who joined; a nonconforming member is not permitted to join the cluster.

DYNamic_i/o**DYNamic_io**

tells CP not to allow dynamic I/O changes on this processor.

IPL_MESSAGES

tells CP not to display IPL or SHUTDOWN messages or prompts during system initialization.

If IPL_MESSAGES are disabled and spooling errors are encountered during an automatic WARM or COLD IPL, wait state HCP2516W will be issued.

LOGMSG_FROM_File

tells CP not to look for any LOGMSG files on disk. Instead, CP should use information from the class B CP SET LOGMSG command. For more information on the CP SET LOGMSG command, see the *z/VM: CP Commands and Utilities Reference*.

NEW_DEVICES_initialized_when_added

tells CP to create a real device control block (RDEV) for a new I/O device, but not to initialize (bring online) that device when your system receives an I/O machine check (IOMCK) for adding a new device to the system. To bring the device online, use the CP VARY (Real Device) command. For more information about the CP VARY (Real Device) command, see the *z/VM: CP Commands and Utilities Reference*.

PROMPt AFTER_REStart

tells CP not to force a prompt to the operator when CP bounces.

PROMPt AFTER_SHUTDOWN_REIPL

tells CP not to force a prompt to the operator when CP is performing a SHUTDOWN REIPL.

SET_DEVICES

tells CP not to allow users to execute CP SET DEVICES commands to change the way the way CP handles specific real devices after initialization. For more information about the CP SET DEVICES command, see the *z/VM: CP Commands and Utilities Reference*.

SET_DYNAMIC_i/o

SET_DYNAMIC_io

tells CP not to allow users to execute CP SET DYNAMIC_I/O commands to enable or disable CP's ability to dynamically change the processor's I/O configuration after initialization. For more information about the CP SET DYNAMIC_I/O command, see the *z/VM: CP Commands and Utilities Reference*.

SET_PRIVclass

tells CP not to give end users the authority to use the CP SET PRIVCLASS command to change their own privilege classes, and tells CP not to give the system operator the authority to use the CP SET PRIVCLASS command to change the privilege classes of users logged on to the system. For more information about the CP SET PRIVCLASS command, see the *z/VM: CP Commands and Utilities Reference*.

STP_Timestamping

tells CP not to enable the STP protocol for timestamping purposes.

STP_TIMEZone / STP_TZ

tells CP not to enable the STP protocol in order to obtain timezone information automatically from the STP server.

THROTTLE_ALL

tells CP to allow throttling of ALL devices on the system except CP OWNED DASD.

VALIDATE_SHUTDOWN

tells CP that the SYSTEM operand on the SHUTDOWN command is not required. This is the default.

XRC_OPTIONal

tells CP not to allow non-timestamped I/O to be issued whenever STP is in an unsynchronized state.

XRC_TEST

tells CP not to timestamp I/O when CP is running as a virtual machine guest.

DISCONNECT_TIMEout nnnnnn

sets the interval between a forced disconnect of a virtual machine and its logoff to the specified number of minutes. The default is 15 minutes.

DISCONNECT_TIMEout OFF

disables the automatic logoff of a virtual machine that is forcibly disconnected.

ENABLE

enables the following system attributes during IPL. Note that initially, each option is disabled until it is enabled.

AUTO_WARM_IPL

tells CP to attempt a warm start without changing the TOD clock. If there is no warm start data, if the TOD clock is not set, or if spooling errors are encountered, CP will prompt the operator for more information.

CLEAR_TDisk

tells CP to automatically clear all previously written data and directory areas on TDISK DASD space. CP will change TDISK DASD space to binary zeros during CP initialization, when attaching a CP-owned volume that contains TDISK allocations, and when a user detaches a TDISK minidisk. By clearing this space, you prevent users from accidentally accessing old temporary disk space and provides your system with additional security.

CPCHECKing

tells CP to activate internal CP checking to confirm assertions established in the CP code and take the appropriate action based on whether ABEND or VMSTOP is specified.

ABEND

Indicates that an abend should occur. Whether it is a hard abend or a soft abend is controlled by the specific assertion case. It is typically a hard abend. This is the default when internal CP checking is activated.

VMSTOP

This parameter is permitted only when CP is itself running in a virtual machine, and is generally useful only for debugging CP. Specifying this parameter causes CP to issue DIAGNOSE code X'8' when an untrue assertion is encountered, specifying a command string length of zero. This causes the virtual machine to stop and for CP to post a read to the console. A message is sent to the console (using DIAGNOSE code X'8' and the CP MESSAGE * command) providing information about the cause of the stop.

CROSS_SYSTEM_TIMEouts

specifies that timeouts caused by device and logical link failures within the ISFC inter-system communications component are treated as errors. Also, in an SSI cluster environment, CROSS_SYSTEM_TIMEOUTS causes error processing to occur for missing or late heartbeat signals between members.

This option is the default setting and is what should be used in a production environment in order to ensure that the ISFC collection or SSI cluster reacts properly to network and member failures.

In order to join an SSI cluster, a member's CROSS_SYSTEM_TIMEOUTS setting (either ENABLE CROSS_SYSTEM_TIMEOUTS or DISABLE CROSS_SYSTEM_TIMEOUTS) must be the same as that of the first member who joined; a nonconforming member is not permitted to join the cluster.

DYNAmic_i/o**DYNAmic_io**

tells CP to allow dynamic I/O changes on this processor.

IPL_MESSAGES

tells CP to display IPL or SHUTDOWN messages and prompts during system initialization (the default).

LOGMSG_FROM_File

tells CP to display the contents of the SYSTEM LOGMSG file on the lowest accessed CP disk. You can optionally choose to have CP read and display additional files at a user's terminal using one or more of the following operands:

SHOW_ACCOUNT No

(the default) tells CP not to display a file called *accountid* LOGMSACC (*accountid* is the account ID of a specific user) in response to a CP QUERY LOGMSG command.

SHOW_ACCOUNT Yes

tells CP to display a file called *accountid* LOGMSACC (*accountid* is the account ID of a specific user) in response to a CP QUERY LOGMSG command.

SHOW_ACIGroup No

(the default) tells CP not to display a file called *acigroup* LOGMSACI (*acigroup* is the ACI group of a specific user) in response to a CP QUERY LOGMSG command.

SHOW_ACIGroup Yes

tells CP to display a file called *acigroup* LOGMSACI (*acigroup* is the ACI group of a specific user) in response to a CP QUERY LOGMSG command.

SHOW_Userid No

(the default) tells CP not to display a file called *userid* LOGMSUSR (*userid* is the user ID of a specific user) in response to a CP QUERY LOGMSG command.

SHOW_Userid Yes

tells CP to display a file called *userid* LOGMSUSR (*userid* is the user ID of a specific user) in response to a CP QUERY LOGMSG command.

For more information about the CP QUERY LOGMSG command, see the *z/VM: CP Commands and Utilities Reference*.

NEW_DEVICES_initialized_when_added

tells CP to automatically create a real device control block (RDEV) and initialize (bring online) the associated I/O device when you add a new device, causing an I/O machine check (IOMCK).

PROMPT AFTER_REStart

tells CP to force a prompt to the operator when CP bounces, so that REIPL can be stopped or the type of start desired (WARM, FORCE, etc.) can be specified.

PROMPT AFTER_SHUTDOWN_REIPL

tells CP to force a prompt to the operator when CP is performing a SHUTDOWN REIPL, so that REIPL can be stopped or the type of start desired (WARM, FORCE, etc.) can be specified.

Note that in this case, the user will not be prompted to change the Time of Day (TOD) clock.

SET_DEVICES

tells CP to allow users to execute CP SET DEVICES commands to change the way the way CP handles specific real devices after initialization. For more information about the CP SET DEVICES command, see the *z/VM: CP Commands and Utilities Reference*.

SET_DYNAMIC_i/o

SET_DYNAMIC_io

tells CP to allow users to execute CP SET DYNAMIC_I/O commands to enable or disable CP's ability to dynamically change the processor's I/O

configuration after initialization. For more information about the CP SET DYNAMIC_I/O command, see the *z/VM: CP Commands and Utilities Reference*.

SET_PRIVclass

tells CP to give end users the authority to use the CP SET PRIVCLASS command to change their own privilege classes, and tells CP to give the system operator the authority to use the CP SET PRIVCLASS command to change the privilege classes of users logged on to the system. For more information about the CP SET PRIVCLASS command, see the *z/VM: CP Commands and Utilities Reference*.

STP_Timestamping

tells CP to enable the STP protocol (if the STP facility is installed) and apply timestamps to all XRC-capable DASD devices.

STP_TimeZone / STP_TZ

tells CP to enable the STP protocol (if the STP facility is installed) and obtain timezone information automatically from the STP server.

THROTTLE_ALL

tells CP to allow throttling of ALL devices on the system including CP OWNED DASD.

VALIDATE_SHUTDOWN

tells CP to require the user to specify the SYSTEM operand on the SHUTDOWN command.

XRC_OPTIONal

when STP_Timestamping is also enabled, this will allow non-timestamped I/O to be issued whenever STP is in an unsynchronized state, as opposed to deferring I/O until STP synchronization completes.

XRC_TEST

tells CP to timestamp I/O regardless of STP availability. This option is meant only for vendor and testing purposes, and can only be specified for systems running within a virtual machine.

MAXusers NOlimit

(the default) tells CP that the number of users who can log on at one time is not limited by the installation. Therefore, the system-defined limit of 99,999 logged on users is the maximum number allowed.

MAXusers nnnnn

defines the maximum number of users who can log on to the system at one time. The variable *nnnnn* is a decimal number from 1 through 99999.

PASSWORDS_ON_CMDs

tells CP whether to accept passwords in the command syntax (in clear text) when users issue the CP AUTOLOG, XAUTOLOG, LINK, or LOGON commands. If the setting is NO, CP accepts the command only without the password, then prompts the user for the password and masks the input field.

AUTOLog No

(the default) tells CP to not accept passwords entered by users who are issuing the CP AUTOLOG or XAUTOLOG command.

AUTOLog Yes

tells CP to accept passwords entered by users who are issuing the CP AUTOLOG or XAUTOLOG command. For AUTOLOG, users *must* enter the password as part of the command.

LINK No

(the default) tells CP to not accept passwords entered by users who are issuing the CP LINK command.

LINK Yes

tells CP to accept passwords entered by users who are issuing the CP LINK command.

LOGon No

(the default) tells CP to not accept passwords entered by users who are issuing the CP LOGON command.

LOGon Yes

tells CP to accept passwords entered by users who are issuing the CP LOGON command.

For more information about the CP AUTOLOG, XAUTOLOG, LINK, and LOGON commands, see the *z/VM: CP Commands and Utilities Reference*.

RETRieve

defines the default and maximum number of retrieve buffers allowed per user on your system. These numbers determine how many console input lines a user can retrieve. Before retrieving a buffer, users must define a program function (PF) key as a retrieve key, using the CP SET PFnn RETRIEVE command. After defining a retrieve key, users can press that PF key when they want to retrieve a command that they issued previously. For more information about the CP SET PFnn RETRIEVE command, see the *z/VM: CP Commands and Utilities Reference*.

DEFault nnn

tells CP to define *nnn* default retrieve buffers per user on your system. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is 7.

Note: The number of default retrieve buffers must be less than or equal to the number of maximum retrieve buffers.

MAXimum nnn

tells CP to define *nnn* maximum retrieve buffers per user on your system. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is 7.

VDISK**VDSK**

defines installation defaults for the system and user limits on the maximum amount of host storage available for allocation as virtual disks in storage. If an installation default is not defined, CP uses a built-in default.

You can supersede the installation or built-in default by using the CP SET VDISK command to set the current system limit or user limit. The DEFAULT operand on the SET VDISK command resets the current limit to the installation default, or, if none is defined, to the built-in default. The CP QUERY VDISK command displays current and default system and user limits. For more information about the CP SET and QUERY VDISK commands, see the *z/VM: CP Commands and Utilities Reference*.

Note: Use of virtual disks in storage increases the load on system paging, so you should set limits in proportion to the availability of paging space.

Syslim

sets the total resource available for allocating virtual disks in storage on the system.

If an installation default is not defined, CP calculates the built-in default from the available host storage. It takes 2050 non-pageable pages of page and segment data tables to support each gigabyte of address space for virtual disks in storage. The limit is set so these non-pageable structures can consume no more than 1/4 of the DPA pages. The limit is further reduced, if necessary, so the virtual storage pages used for address spaces for virtual disks in storage can consume no more than 1/4 of the total available paging space.

Userlim

sets the maximum resource available for virtual disks in storage created by a single user using the CP DEFINE command. This limit does not apply to virtual disks in storage defined by MDISK statements in the directory. If an installation default is not defined, the built-in default is 0.

Infinite

indicates that there is no limit. All available host storage may be allocated to virtual disks in storage.

nnnnnnnnnn Blocks**nnnnnnnnnn Blks**

specifies the number of 512-byte blocks of storage available for virtual disks in storage. If the number specified is equal to or greater than 2147483648, the limit is set to INFINITE.

nnnnnnnnM

specifies the number of megabytes of storage available for virtual disks in storage. If the number specified is equal to or greater than 1048576, the limit is set to INFINITE.

nnnnnG

specifies the number of gigabytes of storage available for virtual disks in storage. If the number specified is equal to or greater than 1024, the limit is set to INFINITE.

Usage Notes

1. If an IODF statement is defined in the system configuration file, then the hardware I/O configuration will be controlled by HCD. In this case, the following FEATURES statements are ignored if they are specified:
 - FEATURES ENABLE DYNAMIC_I/O
 - FEATURES ENABLE DYNAMIC_IO
 - FEATURES ENABLE SET_DYNAMIC_I/O
 - FEATURES ENABLE SET_DYNAMIC_IO
 - FEATURES DISABLE DYNAMIC_I/O
 - FEATURES DISABLE DYNAMIC_IO
 - FEATURES DISABLE SET_DYNAMIC_I/O
 - FEATURES DISABLE SET_DYNAMIC_IO

If the *osconfig* parameter is specified on the IODF statement, then the software I/O configuration will be controlled by HCD. In this case, the following FEATURES statements are ignored if they are specified:

- FEATURES ENABLE SET_DEVICES
- FEATURES DISABLE SET_DEVICES

Refer to “IODF Statement” on page 173 for more information.

2. FEATURES ... SET_PRIVCLASS sets the parameters for the CP SET PRIVCLASS command, which general users can use to change their privilege classes to be all or a subset of the classes specified in their virtual machine definitions. For more information about the CP SET PRIVCLASS command, see the *z/VM: CP Commands and Utilities Reference*.
3. At logon, CP gives each user enough storage for the default number of retrieve buffers. If users want to retrieve more than the default number of console input lines, they can use the CP SET RETRIEVE command to increase their number of retrieve buffers to some number less than or equal to the maximum number of retrieve buffers that you are defining for the system using this FEATURES statement. To find out the maximum number of retrieve buffers allowed on a running system, users can issue the CP QUERY RETRIEVE command. For more information about the CP QUERY and SET RETRIEVE commands, see the *z/VM: CP Commands and Utilities Reference*.
4. If you enable AUTO_WARM_IPL and no warm start data has been saved, or if invalid warm start data is encountered, CP will only ask the operator whether it should try a FORCE start instead.
5. If you enable AUTO_WARM_IPL in the system configuration file and you want to go through the full series of prompts during the IPL, you can specify the PROMPT keyword as part of the IPL parameters on the Stand-Alone Program Loader (SAPL). For more information about the Stand-Alone Program Loader (SAPL) and the IPL parameters, see Chapter 4, “Using the Stand-Alone Program Loader,” on page 31.
6. To change whether new devices are initialized when they are added to the system after IPL, use the CP SET NEW_DEVICES command. For more information about the SET NEW_DEVICES command, see the *z/VM: CP Commands and Utilities Reference*.
7. To allow users to dynamically change a device's I/O configuration after IPL, you must specify the ENABLE DYNAMIC_I/O operand on the FEATURES statement in the system configuration file or you must issue the CP SET DYNAMIC_I/O ON command after IPL. If you do not turn this function on either during or after IPL, CP will reject all attempts to dynamically change the I/O configuration. This means that CP rejects the following dynamic I/O commands:

DEFINE CHPID	DEFINE CU	DEFINE DEVICE
DELETE CHPID	DELETE CU	DELETE DEVICE
MODIFY CHPID	MODIFY CU	MODIFY DEVICE
DEFINE PATH	DEFINE CNTLUNIT	DEFINE IODEVICE
DELETE PATH	DELETE CNTLUNIT	DELETE IODEVICE
MODIFY PATH	MODIFY CNTLUNIT	MODIFY IODEVICE
QUERY CONFIGMODE		QUERY DYNAMIC_I/O
SET CONFIGMODE	SET DEVICES	SET DYNAMIC_I/O

8. To change whether I/O operations from guest operating systems can be limited (or controlled) after IPL, use the CP SET DEVICES command. For more information about the SET DEVICES command, see the *z/VM: CP Commands and Utilities Reference*.
9. Because the SYSLimit does not apply during system initialization, it is possible to find more LAN segments in the system than the number defined as the system limit.
10. Although the PASSWORDS_ON_CMDs operand can be set to prevent passwords from being entered with the commands (in clear text) on the terminal screen, passwords may still be included on the command line by

REXX execs using the DIAG() and DIAGRC() functions. If you require access security without the possibility of passwords being stored in clear text, you should consider installing an external security manager (ESM).

11. In order to use the STP_Timestamping feature, STP must be set up on the Central Processor Complex (CPC), where the CPC is either a member of an STP-only Collaborative Timing Network (CTN) or a stratum 2 or higher member of a mixed CTN. In order to use the STP_TIMEZone / STP_TZ feature, STP must be set up on the CPC, and the CPC must be a member of an STP-only CTN.
12. The ENABLE and DISABLE options control attributes during IPL. This is defined as an IPL from the HMC. These attributes might not apply during CP bounce processing (that is, as initiated by the SHUTDOWN REIPL command, or restarting after an abend). For example, if you disable the AUTO_WARM_IPL attribute, you will be prompted for the type of start you want to perform and given the opportunity to change the TOD clock, but only if you have IPLed from the HMC.

Examples

1. To have CP:
 - Enable all log message support
 - Allow end users and the operator to issue the SET PRIVCLASS command
 - Clear all temporary disk space after users are through with it
 - Allow operators to dynamically change the I/O configuration
 - Prompt the operator for startup information after a software restart (bounce)
 - Allow operators to limit the I/O operations from guest operating systems
 - Initialize new devices when they are added to the system
 - Disable the automatic warm start feature
 - Give users a default of 7 retrieve buffers and let them go up to a maximum of 255 buffers
 - Allow an unlimited number of users to be logged on at one time
 - Prompt users for passwords on the CP AUTOLOG, XAUTOLOG, and LOGON commands, but not the CP LINK command
 - Set the installation default system limit on space for virtual disks in storage to '32GB' and the installation default user limit to 800 blocks

use the following FEATURES statement:

```
/*----- Features Statement -----*/
Features,

Enable,

    Logmsg_From_File,      /* Allow log messages from files      */
        Show_ACCount Yes, /* If account logmsg exists, show it */
        Show_ACIGroup Yes, /* If acigroup logmsg exists, show it */
        Show_Userid Yes,  /* If userid logmsg exists, show it */

    Set_Privclass,         /* Let the SET PRIVCLASS command be
                           executed. If this option is disabled,
                           then the SET PRIVCLASS command is not
                           allowed. */

    Clear_Tdisk,           /* Clear all temporary disk space after
                           use */

    Dynamic_I/O,           /* Allow dynamic I/O changes on this
                           system */
```


FEATURES

```
Prompt_on_Bounce,      /* If CP bounces, prompt operator for
                        startup conditions */

Throttling,            /* Allow people to limit I/O from guests */

New_Devices_Initialized_when_Added, /* Initialize devices if we get
                        an IPI I/O machine check */

Disable,

    Auto_Warm_Ipl,      /* Do not perform Auto_Warm_IPL's, let
                        operator see the CP start-up message
                        prompts and time message */

/* Set some additional features ... */

Retrieve,

    Default 7,          /* Give each user 7 default retrieve buffers */
    Maximum 255,        /* Set the maximum system buffers per user to 255 */

MaxUser NoLimit,       /* Don't set a maximum number of user limit */

Passwords_On_Cmds,

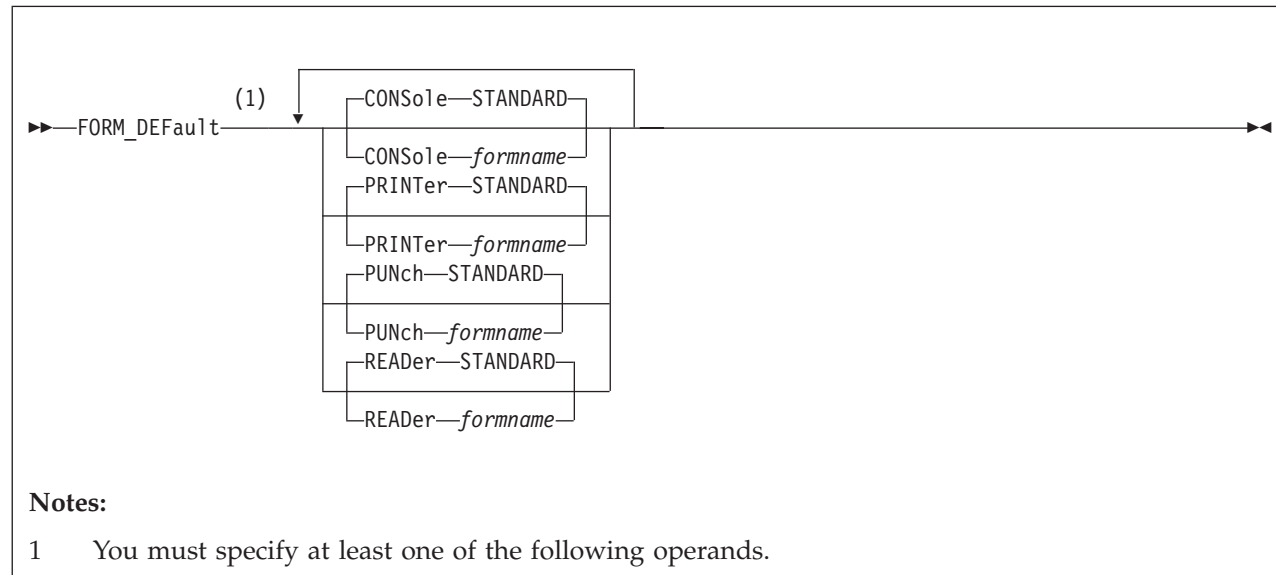
    AutoLog No,         /* Prompt user for password on AUTOLOG command */
    Link Yes,           /* Do not prompt for password on LINK command */
    Logon No,           /* Prompt user for password on LOGON command */

Vdisk,

    Syslim 32G,         /* Set total virtual disks in storage to 32GB */
    Userlim 800 Blks,   /* User can define max 800 blocks using DEFINE */

/*----- End of Features Statement -----*/
```


FORM_DEFAULT Statement



Purpose

Use the FORM_DEFAULT statement to define default user form names for CP to use when it creates files on virtual printers, virtual punches, virtual consoles, or real card readers.

How to Specify

Include as many statements as needed; they are optional. You can place FORM_DEFAULT statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

CONSOLE *formname*

defines the default user (and, implicitly, operator) forms for virtual console spool files. If omitted, the default is STANDARD.

PRINTER *formname*

specifies the default user form for virtual printer spool files. If omitted, the default is STANDARD.

PUNCH *formname*

specifies the default user form for virtual punch spool files. If omitted, the default is STANDARD.

READER *formname*

specifies the default user (and, implicitly, operator) forms for files created on a real card reader. If omitted, the default is STANDARD.

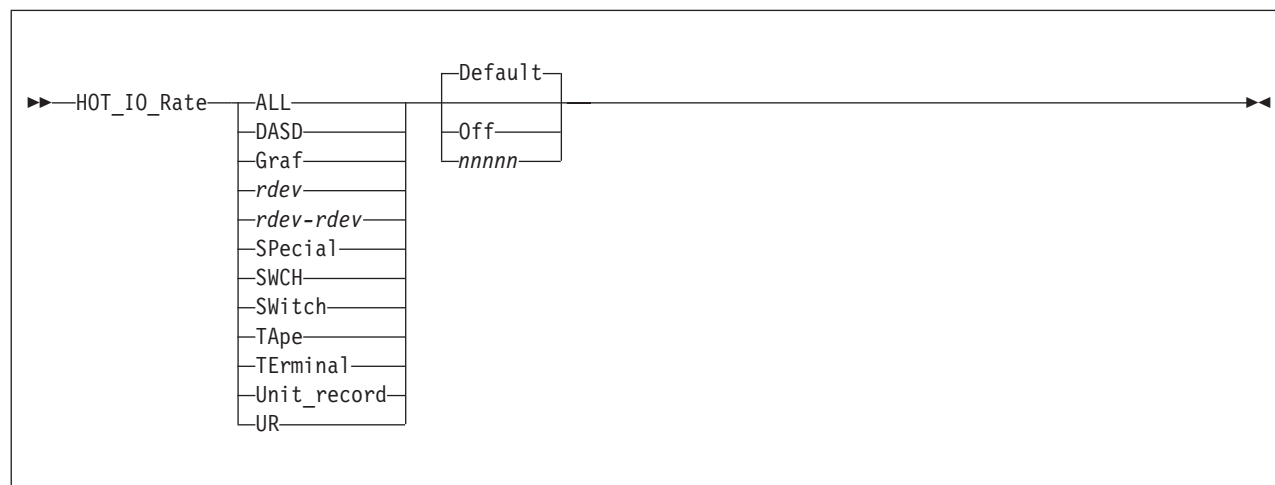
Examples

1. To have CP use the form name STANDARD for the console, printer, punch, and reader user form names, use the following FORM_DEFAULT statement:

FORM_DEFAULT

```
Form_Default,          /* Set up user form defaults */
  Console STANDARD,    /* so they are all set to */
  Printer STANDARD,    /* the default ... STANDARD */
  Punch STANDARD,
  Reader STANDARD
```

HOT_IO_RATE Statement



Purpose

Use the HOT_IO_RATE statement to define the maximum number of consecutive, unsolicited interrupts per second that CP should allow from an I/O device (the hot I/O rate) before refusing to accept input from it.

How to Specify

Include as many statements as needed; they are optional. You can place HOT_IO_RATE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ALL

tells CP to define the hot I/O rate for all devices in the active I/O configuration.

DASD

tells CP to define the hot I/O rate for all DASDs in the active I/O configuration.

Graf

tells CP to define the hot I/O rate for all graphic display devices in the active I/O configuration.

rdev

tells CP to define the hot I/O rate for a device at a specific real device number in the active I/O configuration. The variable *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

rdev-rdev

tells CP to define the hot I/O rate for devices in a range of specific real device numbers in the active I/O configuration. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

SPecial

tells CP to define the hot I/O rate for all special devices (3088s, CTCAs, 37x5s) in the active I/O configuration.

SWCH

SWitch

tells CP to define the hot I/O rate for all switching devices in the active I/O configuration.

TApe

tells CP to define the hot I/O rate for all tape drive devices in the active I/O configuration.

TErминаl

tells CP to define the hot I/O rate for all terminals in the active I/O configuration.

Unit_record

UR

tells CP to define the hot I/O rate for all unit record devices in the active I/O configuration.

Default

tells CP to use the default rate of 16 unsolicited interrupts per second for the specified device or devices.

Off

turns hot I/O detection off and tells CP to accept all unsolicited interrupts for the specified device or devices.

Attention: We do not recommend that you specify the OFF operand to turn off the hot I/O detection for a device or devices for any length of time. Hot I/O detection protects CP from broken hardware that floods the system with unsolicited interrupts. If you turn hot I/O detection off, you may experience performance degradation or a system abend.

nnnnn

tells CP how many unsolicited interrupts per second to accept for the specified device or devices before CP stops accepting input from the device or devices. The variable *nnnnn* is a decimal number from 1 to 62500.

Usage Notes

1. If an IODF statement is defined in the system configuration file with the *osconfig* parameter specified, then the software I/O configuration will be controlled by HCD. In this case, the HOT_IO_Rate statement is ignored if it is specified. Refer to “IODF Statement” on page 173 for more information.
2. CP processes HOT_IO_RATE statements sequentially for each device before bringing it online. For example, if you specify:

```
Hot_IO_Rate  DASD      100
Hot_IO_Rate  200-300   50
```

CP accepts 100 unsolicited interrupts per second for all DASD and 50 unsolicited interrupts per second for all devices with real device numbers between 200 and 300, inclusive. If there are any DASD defined in the 200-300 real device number range, those DASD will have an unsolicited interrupt rate of 50, not 100.

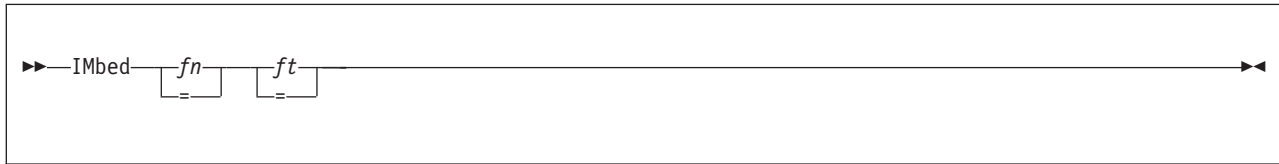
3. **Attention:** We do not recommend that you specify the OFF operand to turn off the hot I/O detection for a device or devices for any length of time. Hot I/O detection protects CP from broken hardware that floods the system with unsolicited interrupts. If you turn hot I/O detection off, you may experience performance degradation or a system abend.
4. If you need to change the hot I/O rate after IPL, use the CP SET HOTIO command. To check the current hot I/O rates, use the CP QUERY HOTIO command. For more information about the CP SET HOTIO and QUERY HOTIO commands, see the *z/VM: CP Commands and Utilities Reference*.

Examples

1. To specify a global unsolicited interrupt rate of 100 for all I/O devices, override the global rate for all DASDs, and override the global DASD rate for a specific range of DASD, use the following HOT_IO_RATE statements:

```
Hot_IO_Rate  All          100      /* Set rate for all devices to
                                   make sure none affect the
                                   system too much.                */
Hot_IO_Rate  DASD         200      /* Allow DASD a few more errors */
Hot_IO_Rate  0280-028f    50      /* Third party DASD string    */
```

IMBED Statement



Purpose

Use the IMBED statement to tell CP to imbed a file into the main system configuration file during an IPL. All imbedded files must reside on the same disk as the main system configuration file.

How to Specify

Include as many statements as needed; they are optional. You can place IMBED statements anywhere in the main system configuration file and in any files that are imbedded into the main system configuration file. You can nest imbedded files as deep as you like.

Operands

fn is the file name of the file you want imbedded. An = tells CP to imbed a file with the same file name.

ft is the file type of the file you want imbedded. An = tells CP to imbed a file with the same file type.

Usage Notes

1. If you specify a file name or file type of `-SYSTEM-`, CP uses the name of the system being IPLed as that file name or file type. For example, if your system name is `VMSYS3` and you have the following IMBED statement in your system configuration file:

```
Imbed -system- config
```

CP looks for a file named `VMSYS3 CONFIG` on the parm disk. If found, CP imbeds the file and processes the statements within it. If CP does not find the file, the IMBED statement fails and CP continues processing with the statement after the IMBED.

2. An imbed will not succeed if the `-SYSTEM-` variable is included and no system name exists to replace it. This situation arises when you do not specify `SYSTEM_IDENTIFIER` and `SYSTEM_IDENTIFIER_DEFAULT` statements in the system configuration file before the IMBED statement.
3. This statement will not accept imbed loops. If the system configuration file includes an imbed of the file `SAMPLE CONFIG`, and the `SAMPLE CONFIG` file includes an imbed of the file `SAMPLE2 CONFIG`, then CP will generate an error message if the `SAMPLE2 CONFIG` file tries to imbed the `SAMPLE CONFIG` file.

Examples

1. If you list your RDEVICE statements in a file separate from the master system configuration file, you can use the following IMBED statement to include the RDEVICE statements:

```
Imbed rdev config /* Pull in RDEVICE statements */
```

2. If you have several systems with similar system configuration files, you can use the IMBED statement to create a master system configuration file that contains the common statements and imbed files that contain the system-specific statements. For example, suppose you had three systems (BOSTON, MAINE, and NEWYORK) that had very similar system configuration files with the following exceptions:

- BOSTON lets end users change their privilege classes
- MAINE wants to manually answer all the prompts during an IPL
- NEWYORK limits the number of logged on users to 1000.

You can create a main system configuration file with the following IMBED statement:

```
Imbed -system- config /* Pull in the system-specific
                        information */
```

Each of the three systems has a copy of this main system configuration file and each has a system-specific configuration file. For example, on the BOSTON system, there is a file called BOSTON CONFIG which contains the following statement:

```
Features Enable Set_PrivClass /* Let the users and the system
                                operator change command
                                privilege classes */
```

On the MAINE system, there is a file called MAINE CONFIG which contains the following statement:

```
Features Disable Auto_Warm_IPL /* Perform manual IPLs */
```

And on the NEWYORK system, there is a file called NEWYORK CONFIG which contains the following statement:

```
Features MaxUsers 1000 /* Do not let more than
                        1000 users log on */
```

Note: You can also process system-specific information without using the IMBED statement. You can use the EQUATE statement (see “EQUATE Statement” on page 147) to set up nicknames for systems and use those nicknames in the main system configuration file to limit the scope of the statements they preface.

In the previous example, you could have defined nicknames for the three systems and used those nicknames to preface the FEATURES statements:

```
.
.
.
Equate Marketing boston
Equate University maine
Equate Research newyork
.
.
.
Marketing: Features Enable Set_PrivClass
University: Features Disable Auto_Warm_IPL
Research: Features MaxUsers 1000
.
.
.
```

INIT_MITIME Statement

►►—INIT_MITime—ss—◄◄

Purpose

Use the INIT_MITIME statement to change the MITIME (the time interval at which a device is checked for missing interrupts) that is in effect during device initialization at system IPL time.

How to Specify

The INIT_MITIME statement is optional. Since there is only one MITIME value used at IPL time, there should never be a need for more than one INIT_MITIME statement. However, if you specify more than one INIT_MITIME statement, CP uses the value from the last statement. If no INIT_MITIME statement is specified, CP uses the default value of 15 seconds.

Operands

ss is the time interval in seconds at which the device should be examined for missing interrupts. The number of seconds specified must be a value from one to 60, and the value is rounded up to the next multiple of five seconds.

Usage Notes

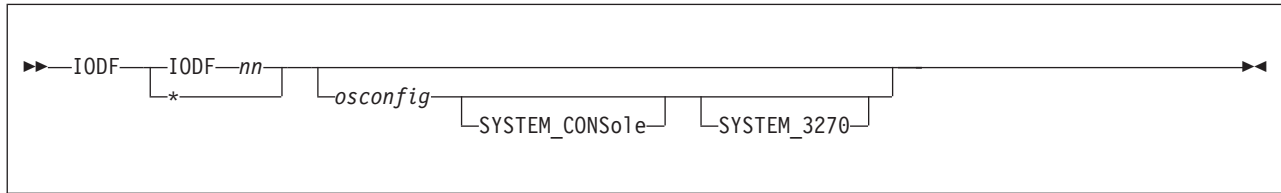
1. Lowering the initialization MITIME value below the default value of 15 seconds may cause certain devices to not come online during IPL due to timeout errors. These devices may be able to be brought online with the VARY ON command after the IPL has completed.
2. When using the INIT_MITIME statement to raise the MITIME value, take into consideration the fact that this could result in a slower IPL due to CP waiting longer for I/O interrupts to come in from devices.

Examples

1. To set the initialization MITIME to 45 seconds, use the following INIT_MITIME statement:

```
Init_Mitime 45
```


IODF Statement



Purpose

Use the IODF statement to indicate that HCD will be used to control the I/O hardware and/or software configuration.

How to Specify

The IODF statement is optional. If specified, it must contain at least the `IODFnn` operand to indicate the filename of the production IODF from which configuration information will be read.

You can place the IODF statement anywhere in the system configuration file. Only the first IODF statement that is found in the system configuration file is honored. If additional IODF statements are specified, they are ignored.

Operands

IODFnn

specifies the filename of the production IODF to be used. The filename must be specified in the form `IODFnn` and the filetype that will be used with that filename is `PRODIODF`. This file must be located on the system parameter disk (SYSPARM) at system IPL time.

- * specifies that the filename of the production IODF to be used is the one currently stored in the hardware configuration token in the HSA. The filename must be in the form of `IODFnn` and the filetype that will be used with that filename is `PRODIODF`. This file must be located on the parameter disk (SYSPARM) at system IPL time.

Note: In order for this to be used, the hardware configuration token must contain the name of the production IODF file (in the form of `IODFnn`) in the descriptor field 2 portion of the token.

osconfig

specifies the OS configuration ID of the VM I/O configuration that is defined in the IODF. If specified, this configuration is used to build the software view of the I/O configuration, and the statements that are normally used in the system configuration file to build this view are ignored.

SYSTEM_CONSOLE

specifies that the Operating System Messages panel on the IBM Hardware Management Console (HMC) can serve as a system operator console. This can only be specified when an OS configuration ID is specified.

SYSTEM_3270

specifies that the integrated 3270 console on the HMC can serve as a system operator console. This can only be specified when an OS configuration ID is specified.

Usage Notes

1. If an error occurs during the processing of an IODF statement which would result in the system coming up without the I/O configuration being defined as expected, then CP will enter a disabled wait state. This wait state could occur for any of the following reasons:
 - the specified IODF name is not valid
 - the IODF could not be opened
 - the IODF could not be read
 - the data in the IODF was not valid
 - an *osconfig* name was specified, but no matching OSR record was found in the IODF
2. Once an IODF statement has been processed in the system configuration file, HCD is in control of the hardware and/or software I/O configuration. Because of this, any system configuration file statements that affect the I/O configuration are nullified. Any of these statements occurring prior to the IODF statement (meaning they have already been processed) are undone, and any of these statements which occur after the IODF statement are ignored. The following list shows the I/O configuration statements that are always undone or ignored, as well as which I/O configuration statements are only undone or ignored when HCD is controlling the software configuration (i.e. when an *osconfig* name has been specified):
 - IODF
 - FEATURES DISABLE/ENABLE DYNAMIC_IO
 - FEATURES DISABLE/ENABLE SET_DYNAMIC_IO
 - RDEVICE (if *osconfig* name specified)
 - DEVICES ACCEPTED/NOTACCEPTED (if *osconfig* name specified)
 - DEVICES DYNAMIC_I/O/NOTDYNAMICI/O (if *osconfig* name specified)
 - DEVICES OFFLINE_AT_IPL/ONLINE_AT_IPL (if *osconfig* name specified)
 - DEVICES SENSED/NOTSENSED (if *osconfig* name specified)
 - DEVICES SHARED/NOTSHARED (if *osconfig* name specified)
 - HOT_IO_RATE (if *osconfig* name specified)
 - OPERATOR_CONSOLES (if *osconfig* name specified)
 - EMERGENCY_MESSAGE_CONSOLES (if *osconfig* name specified)
 - FEATURES DISABLE/ENABLE SET_DEVICES (if *osconfig* name specified)
3. Once a system is IPLed with HCD in control of the I/O configuration, there is a one-way mechanism to take that control away from HCD and give it back to VM. The DISABLE HCD command provides this one-way escape from having HCD control the I/O configuration. It will shut down HCD's capabilities for the rest of the current IPL, and will attempt to give VM the capability to dynamically change the I/O configuration through its dynamic I/O command interface.

Examples

1. To have HCD control only the hardware I/O configuration, as specified in the IODF01 PRODIODF production IODF file, use the following IODF statement in the system configuration file:

```
IODF IODF01
```

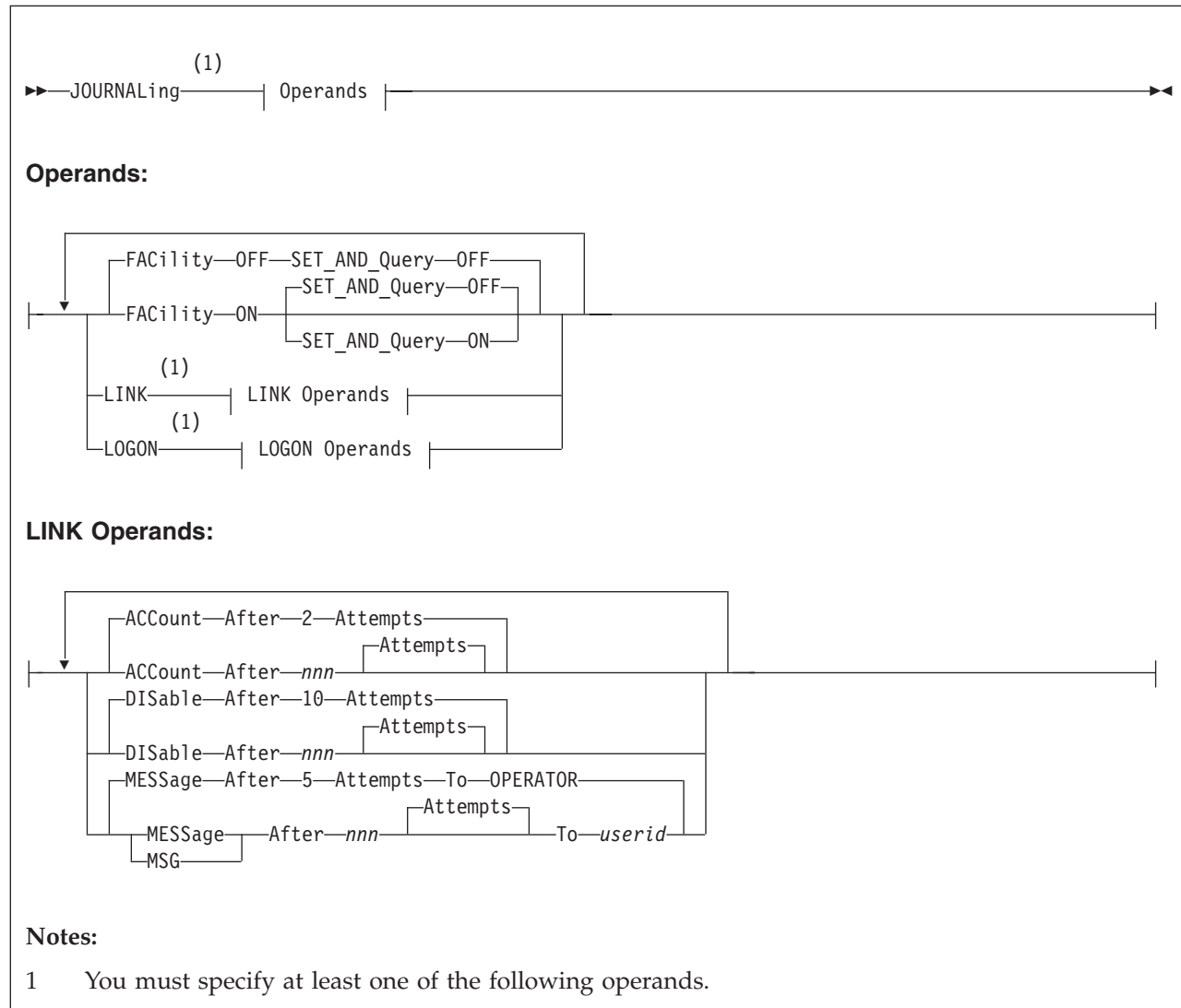
2. To have HCD control both the hardware and software I/O configuration, as specified in the IODF02 PRODIODF file (which contains the CONFIG04 operating system configuration), use the following IODF statement in the system configuration file:

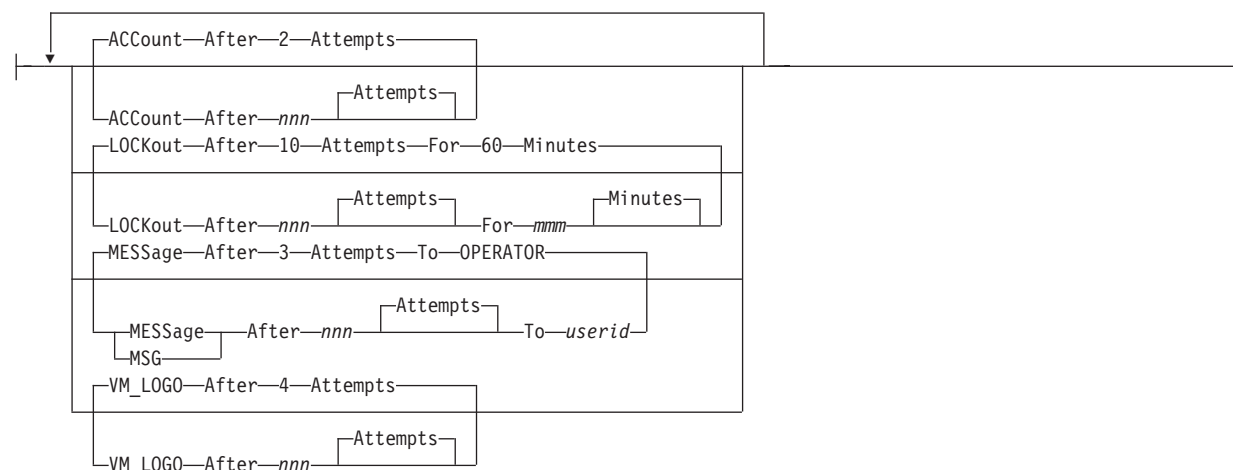
```
IODF IODF02 CONFIG04
```

3. To have HCD control both the hardware and software I/O configuration, as specified in the IODF02 PRODIODF file (which contains the CONFIG04 operating system configuration), and to have the system console as a possible operator console, use the following IODF statement in the system configuration file:

```
IODF IODF02 CONFIG04 SYSTEM_CONSOLE
```

JOURNALING Statement



LOGON Operands:**Purpose**

Use the JOURNALING statement to tell CP whether to include the journaling facility, whether to enable the system being initialized to set and query the journaling facility, and what to do if someone tries to log on to the system or link to a disk without a valid password.

How to Specify

Include as many statements as needed; they are optional. You can place JOURNALING statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands**FACility OFF**

tells CP to disable the journaling facility for this system. This is the initial setting.

FACility ON

tells CP to enable the journaling facility for this system.

SET_AND_Query OFF

tells CP to prevent people from using the CP SET and QUERY commands to set and query the journaling function for this system.

SET_AND_Query ON

tells CP to allow people to use the CP SET and QUERY commands to set and query the journaling function for this system.

LINK

tells CP that you want to define what should happen when users try to link to a minidisk with the wrong password. These settings only apply to a single user ID for a single logon session.

ACCount After *nnn* Attempts

tells CP to generate a type 06 accounting record after someone tries *nnn*

times to use a CP LINK command with an invalid password and to generate a type 06 accounting record each time that person issues a subsequent CP LINK command with an invalid password. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is ACCOUNT AFTER 2 ATTEMPTS.

DISable After *nnn* Attempts

tells CP to disable the CP LINK command for a user that tries *nnn* times to use the CP LINK command with an invalid password. The variable *nnn* is a decimal number from 1 to 255. If omitted, the default is DISABLE AFTER 10 ATTEMPTS.

MESSage After *nnn* Attempts To *userid*

MSG After *nnn* Attempts To *userid*

tells CP to send a message to a specific user ID when a user tries *nnn* times to use the CP LINK command with an invalid password. If the specified *userid* is disconnected or logged off, CP sends the message to the system operator. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is MESSAGE AFTER 5 TO OPERATOR.

LOGON

tells CP that you want to define what should happen when users try to log on with the wrong password.

ACCount After *nnn* Attempts

tells CP to generate a type 04 accounting record after someone tries *nnn* times to log on with an invalid password and to generate a type 04 accounting record each time that person issues a subsequent CP AUTOLOG, LOGON, or XAUTOLOG command with an invalid password. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is ACCOUNT AFTER 2 ATTEMPTS.

LOCKout After *nnn* Attempts For *mmm* Minutes

tells CP to issue an error message to the terminal, lock the terminal, and lock the user ID after someone tries (unsuccessfully) more than *nnn* times to log on to a specific user ID or terminal. No one can log on to that user ID or use that terminal for *mmm* minutes; anyone who tries receives another error message. The variable *nnn* is a decimal number from 1 to 255 and the variable *mmm* is a decimal number from 0 to 255. If omitted, the default is LOCKOUT AFTER 10 ATTEMPTS FOR 60 MINUTES.

MESSage After *nnn* Attempts To *userid*

MSG After *nnn* Attempts To *userid*

tells CP to send a message to a specific user ID when a user tries more than *nnn* times to log on to a user ID with an invalid password. If the specified *userid* is disconnected or logged off, CP sends the message to the system operator. The variable *nnn* is a decimal number from 0 to 255. If omitted, the default is MESSAGE AFTER 3 ATTEMPTS TO OPERATOR.

VM_LOGO After *nnn* Attempts

tells CP to display a new VM logon screen and allow a new logon sequence to be started after someone tries more than *nnn* times to log on with an invalid password from a single terminal. The variable *nnn* is a decimal number from 1 to 255. If omitted, the default is VM_LOGO AFTER 4 ATTEMPTS.

Examples

1. To have CP:
 - Enable the journaling facility

- Allow the QUERY and SET journaling commands to be issued
- Send a message to the operator after someone tries 3 times to log on with the wrong password and after someone tries 5 times to link to a minidisk with the wrong password
- Generate a type 04 accounting record after someone tries 5 times to log on with the wrong password (and to generate a type 04 accounting record for each subsequent attempt)
- Generate a type 06 accounting record after someone tries 6 times to link to a minidisk with the wrong password
- Display a new logo screen on a terminal after someone tries 7 times to logon with the wrong password
- Lock a terminal and user ID for 10 minutes after someone tries 9 times to log on with the wrong password
- Disable the LINK command for a specific user ID for the rest of their logon session when they try to link to a minidisk 8 times with the wrong password

use the following JOURNALING statement:

```
Journaling,          /* Set Up Journaling Facility          */
  Facility      on,    /*      Turn On Journaling          */
  Set_and_Query on,    /*      Allow Set & Query Journaling Commands */

  Logon,            /*      Set Up Logon Journaling Values      */

    Message after 3 attempts to operator,
    Account after 5 attempts,
    VM_Logo after 7 attempts,
    Lockout after 9 attempts for 10,

  Link,            /*      Set Up Link Journaling Values      */

    Message after 5 attempts to operator,
    Account after 6 attempts,
    Disable after 8 attempts
```

LOGO_CONFIG Statement

```
►►—LOGO_CONFIG—fn—ft—◄◄
```

Purpose

Use the LOGO_CONFIG statement to specify the file name and file type of a logo configuration file.

How to Specify

The LOGO_CONFIG statement is optional. Because there is only one logo configuration file, you need only one LOGO_CONFIG statement. If you specify more than one LOGO_CONFIG statement, CP uses the last one specified. You can place LOGO_CONFIG statements anywhere in the system configuration file.

If you do not specify a LOGO_CONFIG statement, looks for a file named on the parm disk. If this file does not exist on the parm disk, CP uses the information in HCPBOX ASSEMBLE to build the logos.

Operands

fn is the file name of the logo configuration file.

ft is the file type of the logo configuration file. This file must be on the same disk as the system configuration file.

Usage Notes

1. If you specify a file name or file type of -SYSTEM-, CP uses the name of the system being IPLed as that file name or file type. For example, if your system name is VMSYS3 and you have the following LOGO_CONFIG statement in your system configuration file:

```
Logo_Config -system- config
```

CP looks for a file named VMSYS3 CONFIG on the parm disk.

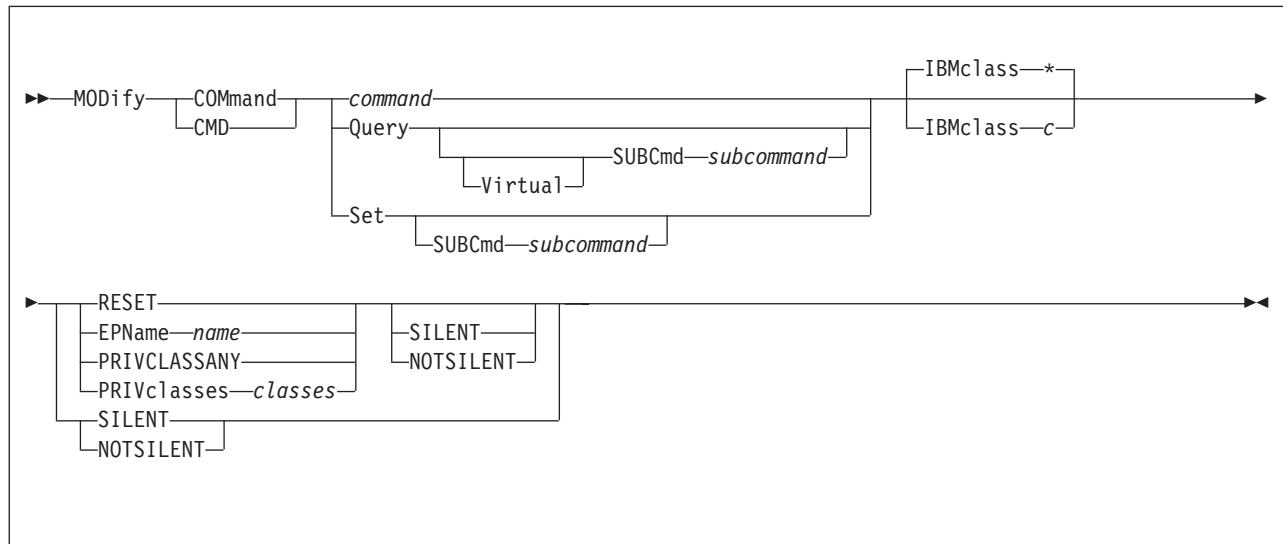
2. CP will not read a logo configuration file if the -SYSTEM- variable is included and no system name exists to replace it. This situation arises when you do not specify SYSTEM_IDENTIFIER and SYSTEM_IDENTIFIER_DEFAULT statements in the system configuration file before the LOGO_CONFIG statement.

Examples

1. To have CP read a logo configuration file called LOGO CONFIG during IPL, use the following LOGO_CONFIG statement:

```
Logo_Config logo config
```


MODIFY COMMAND / CMD Statement



Purpose

Use the MODIFY COMMAND or CMD statement to redefine an existing CP command on the system during initialization.

You can also redefine an existing CP command after initialization using the MODIFY COMMAND or MODIFY CMD commands. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place MODIFY COMMAND or CMD statements anywhere in the system configuration file. If you specify more than 1 statement with the same command or subcommand name, CP uses only the first statement. Subsequent MODIFY COMMAND or CMD statements do not redefine the command.

Operands

command

is the name of the existing CP command that you are overriding. The variable *command* is a 1-character to 12-character alphanumeric string.

Query

tells CP that you are overriding a CP QUERY command.

Virtual

tells CP that you are overriding a CP QUERY VIRTUAL subcommand.

SUBCmd *subcommand*

is the name of the CP QUERY subcommand that you are overriding. The variable *subcommand* is a 1-character to 12-character alphanumeric string. For more information about specifying generic subcommand names, see Usage Note 1 on page 183.

Set

tells CP that you are overriding a CP SET command.

MODIFY COMMAND / CMD

SUBCmd *subcommand*

is the name of the CP SET subcommand that you are overriding. The variable *subcommand* is a 1-character to 12-character alphanumeric string. For more information about specifying generic subcommand names, see Usage Note 1 on page 183.

IBMclass *

tells CP to redefine all versions of the specified command or subcommand. If omitted, IBMCLASS * is the default.

IBMclass *c*

tells CP to redefine a specific version of the specified command or subcommand. The variable *c* can be any 1 of the following:

- A** this is a system-control command to be used by the primary system operator.
- B** this is a command for operational control of real devices.
- C** this is a command to alter host storage.
- D** this is a command for system-wide control of spool files.
- E** this is a command to examine host storage.
- F** this is a command for service control of real devices.
- G** this is a general-use command used to control the functions of a virtual machine.
- 0** (zero) this command has no specific IBM class assigned.

RESET

tells CP to stop using the customer-written CP command and return to using the existing CP command that was shipped with the z/VM product.

EPName *name*

tells CP the name of the entry point that contains the code to process the command. The variable *name* must be a 1-character to 8-character string. The first character must be alphabetic or one of the following special characters: dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the four special characters (\$, #, _, and @), or any combination thereof.

PRIVCLASSANY

tells CP that users with any privilege class can issue the command that you are redefining.

PRIVclasses *classes*

tells CP that only users with 1 or more of the specified privilege classes can issue the command that you are redefining. Whatever you specify on this operand will replace the current privilege classes. The variable *classes* is 1 or more privilege classes in the range A through Z, 1 through 6, or an asterisk (*). Privilege class * indicates all privilege classes (A-Z and 1-6).

Note: If you want more than one privilege class, specify your classes in one string of characters. Do not separate the classes with blank spaces. For example, specify "privclasses abc123", not "privclasses a b c 1 2 3".

SILENT

tells CP that the responses from the command you are redefining can be suppressed by invoking it using the SILENTLY command. For more information, see the z/VM: CP Commands and Utilities Reference.

Note: Response suppression is supported only for the ATTACH, DETACH, and GIVE commands.

NOTSILENT

tells CP that the responses from the command you are redefining cannot be suppressed.

Usage Notes

1. If you are making similar changes to several QUERY (or SET) subcommands and those subcommands share common characters, you can use a generic subcommand name rather than specifying multiple MODIFY COMMAND or CMD statements (or commands). A generic subcommand name is a 1-character to 12-character alphanumeric string with asterisks (*) in place of one or more characters and percent signs (%) in place of exactly one character. For example:

```
modify command query tr*c% ...
```

redefines all QUERY commands that start with TR and have C as their next-to-last character.

2. To define a new CP command or a new version (by IBM class) of an existing CP command, use the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command. For more information about the DEFINE COMMAND or CMD commands, see the *z/VM: CP Commands and Utilities Reference*.
3. To define a new alias for an existing CP command, use the DEFINE ALIAS statement (see “DEFINE ALIAS Statement” on page 84) or command. For more information about the DEFINE ALIAS command, see the *z/VM: CP Commands and Utilities Reference*.
4. Once defined, COMMANDS, SUBCOMMANDS, ALIASES, and DIAGNOSE codes cannot be deleted. They can be altered in various appropriate ways but they remain in existence until a SHUTDOWN or RESTART IPL is done.
5. To load the command processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
6. To activate a CP command:
 - While defining it, use the ENABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command.
 - After defining it, use the ENABLE COMMAND or CMD statement (see “ENABLE COMMAND / CMD Statement” on page 140) or command.

For more information about the DEFINE or ENABLE COMMAND or CMD commands, see the *z/VM: CP Commands and Utilities Reference*.

7. To display the address of the CP command table entry block, the current IBM class, and the current privilege class for a specified CP command, use the LOCATE CMDBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
8. To deactivate a CP command:
 - While defining it, use the DISABLE operand of the DEFINE COMMAND or CMD statement (see “DEFINE COMMAND / CMD Statement” on page 87) or command.
 - After defining it, use the DISABLE COMMAND or CMD statement (see “DISABLE COMMAND / CMD Statement” on page 122) or command.

For more information about the DEFINE or DISABLE COMMAND or CMD commands, see the *z/VM: CP Commands and Utilities Reference*.

MODIFY COMMAND / CMD

9. To remove the command processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
10. For more information about user-defined commands, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP change the CP SHUTDOWN command from privilege class A to privilege class S, use the following:

```
Modify Command shutdown,      /* Put tighter controls on who can */
privclasses s                 /* shut down the system.          */
```

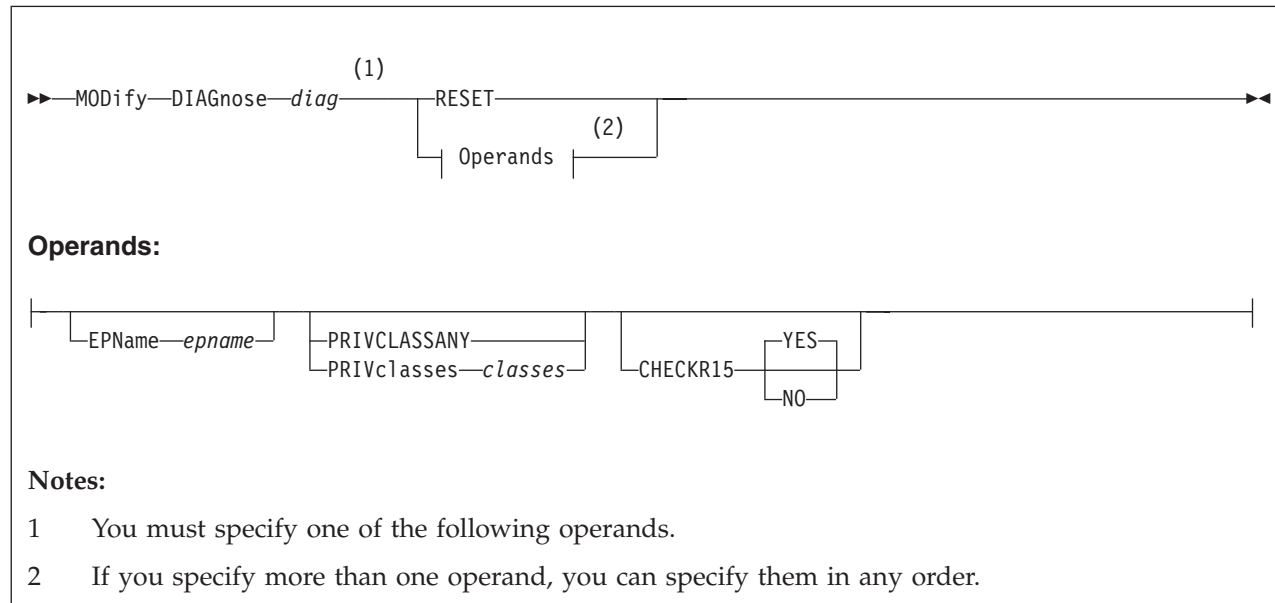
2. To have CP change the version of the CP SET PRIVCLASS command that allows users with any privilege class to issue the command to a version that allows only users with privilege class G and Z to issue the command, use the following:

```
Modify Command Set SubCmd privclass, /* Make sure only a few can */
IBMclass 0,                          /* issue SET PRIVCLASS      */
PrivClasses gz
```

3. To have CP change all IBM class E QUERY subcommands to privilege class G, use the following:

```
Modify Command Query SubCmd *,      /* Make sure anyone can use */
IBMclass e,                        /* the Queries to check     */
PrivClasses g                      /* system storage           */
```

MODIFY DIAGNOSE Statement



Purpose

Use the MODIFY DIAGNOSE statement to redefine an existing DIAGNOSE code on the system during initialization.

You can also redefine an existing DIAGNOSE code after initialization using the MODIFY DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

How to Specify

Include as many statements as needed; they are optional. You can place MODIFY DIAGNOSE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

diag

is the number of the DIAGNOSE code that you are redefining. The variable *diag* must be a hexadecimal number between X'0100' and X'01FC' and must be a multiple of 4. All other DIAGNOSE code numbers are reserved for IBM use only.

RESET

tells CP to stop using the customer-written DIAGNOSE code and return to using the existing DIAGNOSE code that was shipped with the z/VM product.

EPName *name*

tells CP the name of the entry point that contains the code to process the DIAGNOSE code. The variable *name* must be a 1- to 8-character string. The first character must be alphabetic or one of the following special characters:

MODIFY DIAGNOSE

dollar sign (\$), number sign (#), underscore (_), or at sign (@). The rest of the string can be alphanumeric characters, the 4 special characters (\$, #, _, and @), or any combination thereof.

PRIVCLASSANY

tells CP that users with any privilege class can issue the DIAGNOSE code that you are redefining.

PRIVclasses classes

tells CP that only users with 1 or more of the specified privilege classes can issue the DIAGNOSE code that you are redefining. Whatever you specify on this operand will replace the current privilege classes. The variable *classes* is 1 or more privilege classes in the range A through Z, 1 through 6, or an asterisk (*). Privilege class * indicates all privilege classes (A-Z and 1-6).

Note: If you want more than one privilege class, specify your classes in one string of characters. Do not separate the classes with blank spaces. For example, specify “privclasses abc123”, not “privclasses a b c 1 2 3”.

CHECKR15 YES

CHECKR15 NO

indicates whether the diagnose router should check register 15 upon return from the diagnose handler.

Usage Notes

1. To define a new DIAGNOSE code, use the DEFINE DIAGNOSE statement (see “DEFINE DIAGNOSE Statement” on page 93) or command. For more information about the DEFINE DIAGNOSE command, see the *z/VM: CP Commands and Utilities Reference*.
2. To load the DIAGNOSE processing code into the system execution space, use the CPXLOAD statement (see “CPXLOAD Statement” on page 77) or command. For more information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. If you do not specify the ENABLE operand, a new DIAGNOSE code is initially in a disabled state after being defined. CP treats disabled DIAGNOSE codes as if they were never defined. If you try to use a disabled DIAGNOSE code in a program, CP will give you a program check specification exception.
4. To activate a new DIAGNOSE code:
 - While defining it, use the ENABLE operand of the DEFINE DIAGNOSE statement (see “DEFINE DIAGNOSE Statement” on page 93) or command.
 - After defining it, use the ENABLE DIAGNOSE statement (see “ENABLE DIAGNOSE Statement” on page 142) or command.

For more information about the DEFINE or ENABLE DIAGNOSE commands, see the *z/VM: CP Commands and Utilities Reference*.

5. To display information about a DIAGNOSE code (status, entry point name, and privilege class) after initialization, use the QUERY DIAGNOSE command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
6. To display the address of the CP DIAGNOSE code table block for a DIAGNOSE code, use the LOCATE DGNBK command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. To deactivate a DIAGNOSE code:
 - While defining it, use the DISABLE operand of the DEFINE DIAGNOSE statement (see “DEFINE DIAGNOSE Statement” on page 93) or command.

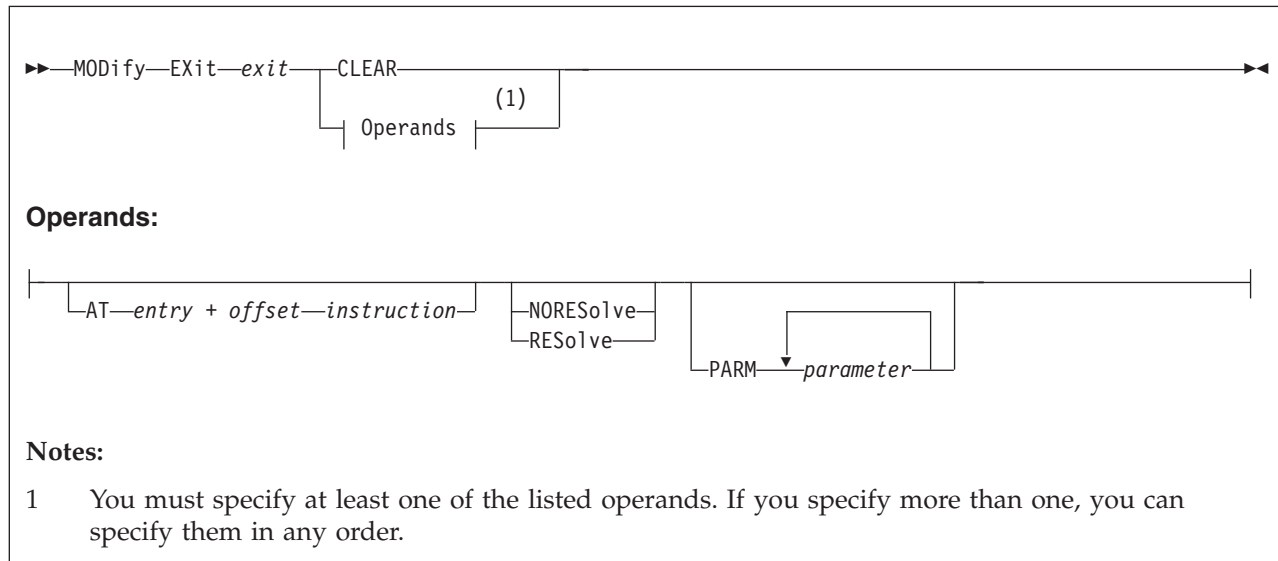
- After defining it, use the DISABLE DIAGNOSE statement (see “DISABLE DIAGNOSE Statement” on page 124) or command.
For more information about the DEFINE or DISABLE DIAGNOSE commands, see the *z/VM: CP Commands and Utilities Reference*.
- 8. To remove the DIAGNOSE processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
- 9. Many external security managers (ESMs) do not support DIAGNOSE codes above X'03FC'. For this reason, CP does not support DIAGNOSE codes above X'03FC'. The DIAGNOSE codes between X'0000' and X'03FC' are divided as follows:
 - X'0000' to X'00FC'**
Reserved for IBM use
 - X'0100' to X'01FC'**
Reserved for customer use
 - X'0200' to X'03FC'**
Reserved for IBM use.
- 10. When CHECKR15 YES is specified, the diagnose router will check register 15 on return from the diagnose handler. If register 15 contains:
 - RC = 0**
Processing was successful. Complete the guest instruction.
 - RC = 4**
Processing failed due to a condition which would cause a guest program check. Simulate guest program interruption passed in R0.
 - RC = 8**
Nullify the instruction.
 - RC = 12**
Present the machine check then nullify the instruction. R2 will contain the address of the MCRBK which will contain the machine check information.
 - RC = 16**
Generate machine check for processing damage, then go to HCPENDOP to terminate the instruction.
 - RC = 20**
Present the machine check, then go to HCPENDOP to terminate the instruction. R2 will contain the address of the MCRBK, which contains machine check information.
 - RC = 24**
Issue error message or softabend for paging I/O error, then nullify the instruction. R1 has the message or abend number.

If a return code is invalid (negative, not a multiple of 4 or too big (RC > 24)), then a softabend will occur.
- 11. For more information about user-defined DIAGNOSE codes, see the *z/VM: CP Exit Customization* book.

Examples

1. To have CP change the privilege class for DIAGNOSE code X'7C' from “any” to R, use the following:
 Modify Diagnose 7c PrivClasses r

MODIFY EXIT Statement



Purpose

Use MODIFY EXIT to redefine or remove an existing dynamic exit point during initialization.

You can also redefine or remove an existing dynamic exit point after initialization using the MODIFY EXIT command. For more information, see the *z/VM: CP Commands and Utilities Reference* book.

How to Specify

Include as many statements as needed; they are optional. You can place MODIFY EXIT statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

exit

is the number of the exit point you are redefining or removing. This value must be a hexadecimal number between X'0' and X'FFFF'. The recommended value is between X'F000' and X'FFFF', because that range is reserved for customer use. All other exit numbers are reserved for IBM, vendor, or general use.

CLEAR

tells CP to remove the exit.

AT *entry + offset instruction*

identifies the new location for the exit point you are redefining and the instruction that is located at the exit point. The variable *entry* must be a 1-to-8-character string. The first character must be alphabetic or one of the following special characters: \$ (dollar sign), # (number sign), _ (underscore), or @ (at sign). The rest of the string can be alphabetic or numeric characters, the four special characters (\$, #, _, or @), or any combination. The variable *offset*

must be a 1-to-4-character even hexadecimal number between X'0' and X'FFFE'. The variable *instruction* must be a 2-, 4-, or 6-character hexadecimal number.

NOREsolve

tells CP to resolve the entry points associated with this exit number the first time they are called.

RESolve

tells CP to resolve the entry points associated with this exit number when the association is first established. Any existing associated entry points are resolved immediately.

PARM *parameter*

is a list of one or more parameters to be supplied to the exit. Five kinds of tokens can be used to define a parameter:

1. Addresses: strings up to eight characters long, consisting of the hexadecimal digits 0 through 9 and A through F.
2. General Registers: strings beginning with G or R, followed by a decimal number between 0 and 15 or a hexadecimal digit, designating the contents of a general register.
3. Indirection: a percent sign (%), which causes the contents of an address or the contents of an address in a register to be used instead of the address or register contents itself.
4. Arithmetic: a plus sign (+) or minus sign (-).
5. Displacement: strings of up to four hexadecimal digits.

Each parameter string specifies how to combine these tokens to generate a parameter value to be passed to an exit routine. The following is a Backus-Naur definition of the syntax of a parameter:

```
<parameter> ::= <anchor> | <anchor><vector>
<anchor> ::= <reg> | 0...FFFFFFFF | <anchor>%
<vector> ::= <modifier> | <vector>% | <vector><modifier>
<modifier> ::= +<disp> | -<disp> | +<reg> | -<reg>
<reg> ::= G<digit> | R<digit>
<digit> ::= 0...15 | 0...9, A...F
<disp> ::= 0...7FFF
```

Usage Notes

1. To define a new dynamic exit point, use the DEFINE EXIT statement (see "DEFINE EXIT Statement" on page 97) or command. For information about the DEFINE EXIT command, see the *z/VM: CP Commands and Utilities Reference*.
2. To load the exit processing code into the system execution space, use the CPXLOAD statement (see "CPXLOAD Statement" on page 77) or command. For information about the CPXLOAD command, see the *z/VM: CP Commands and Utilities Reference*.
3. To activate a new exit point, use the ENABLE EXITS statement (see "ENABLE EXITS Statement" on page 144) or command. For information about the ENABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.
4. To display information about an exit point (status, entry point name, and parameters), use the QUERY EXITS command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
5. To deactivate an exit point, use the DISABLE EXITS statement (see "DISABLE EXITS Statement" on page 126) or command. For information about the DISABLE EXITS command, see the *z/VM: CP Commands and Utilities Reference*.

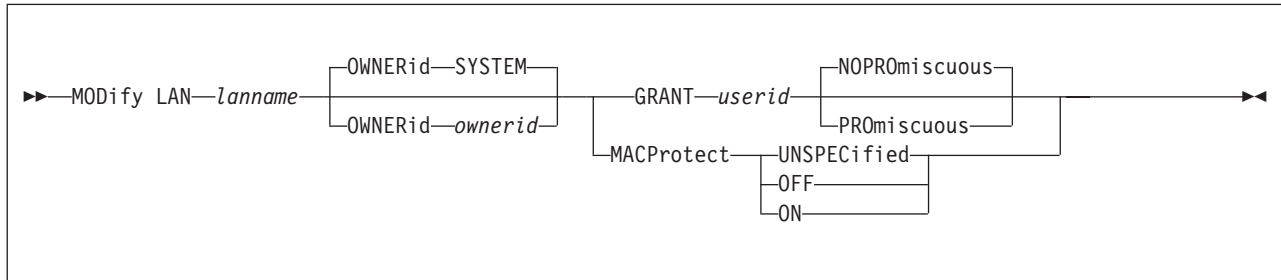
MODIFY EXIT

6. To remove the exit processing code from the system execution space, use the CPXUNLOAD command. For more information, see the *z/VM: CP Commands and Utilities Reference*.
7. Exit numbers are allocated as follows:
 - X'0000' to X'7FFF' are reserved for IBM use.
 - X'8000' to X'FFFF' are reserved for vendor and general use.
 - X'F000' to X'FFFF' are reserved for private customer use.
8. The RESOLVE option ensures that the entry names associated with an exit point are defined.
9. Each exit is passed a parameter list that begins with three standard parameters, as described in the *z/VM: CP Exit Customization* book. Additional parameters, specified by the PARM operand, are optional and follow the first three in the order in which they are specified.
10. Errors (for example, addressing exceptions) during evaluation of user-defined parameters when an exit is being invoked cause CP to abend.
11. For more information about user-defined exits, see the *z/VM: CP Exit Customization* book.

Examples

1. To change the location of exit point X'F422' to HCPXGMSM + 4, enter the following:
Modify Exit f422 At hcpxmgsM + 4 41700001

MODIFY LAN Statement



Purpose

Use the MODIFY LAN statement to modify the attributes of an existing guest LAN during initialization.

How to Specify

Include as many statements as needed; they are optional. You can place MODIFY LAN statements anywhere in the system configuration file following a corresponding DEFINE LAN statement.

Operands

lanname

is the name of the guest LAN to be modified. The *lanname* is a single token (1–8 alphanumeric characters). The combination of *ownerid* and *lanname* will identify the LAN. This LAN must be created by a DEFINE LAN statement in the System Configuration file.

OWNERid *ownerid*

OWNERid **SYSTEM**

specifies the owner of the LAN.

GRANT *userid*

specifies *userid* is added to the access list for this LAN. This allows *userid* to connect an adapter to LAN *lanname* if it is a RESTRICTED LAN. If an External Security Manager (ESM) is in control of the LAN, it may override the CP access list.

PROMiscuous

specifies that the *userid* from the grant is authorized for PROMISCUOUS Mode.

NOPROMiscuous

specifies that the *userid* from the grant is NOT authorized for PROMISCUOUS Mode.

MACProtect

modifies the MAC address protection for devices coupled to this guest LAN. Turning MAC address protection on prevents a guest from using a MAC address that is not assigned to the user's network device. MACPROTECT is valid only for an ETHERNET guest LAN.

There are three levels of inheritance used when determining the MAC address protection level for a MAC address assigned to a network device. The highest

MODIFY LAN

is the system level, followed by the guest LAN (or virtual switch) level. The lowest level is the protection set for a specific network data device.

The MAC address protection level assigned is determined first at the device, then guest LAN and lastly the system level. If MAC address protection is set at the device level using the SET NIC CP command, then its current setting is used. When the device is set to UNSPECIFIED, it will inherit the guest LAN's MACPROTECT setting. When the guest LAN MACPROTECT setting is set to UNSPECIFIED, the SYSTEM's MAC address protection specified by the SET VMLAN CP command or VMLAN configuration statement is assigned.

UNSPECified

allow the MAC address protection to be determined by the SYSTEM level setting. UNSPECIFIED is the default setting for a guest LAN.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set to the SYSTEM level defined by the SET VMLAN CP command or the VMLAN configuration statement.

OFF

set the MAC address protection level off for coupled devices defined with a MAC address protection set to UNSPECIFIED.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set to off.

ON set the MAC address protection level on for coupled devices defined with a MAC address protection set to UNSPECIFIED.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set on.

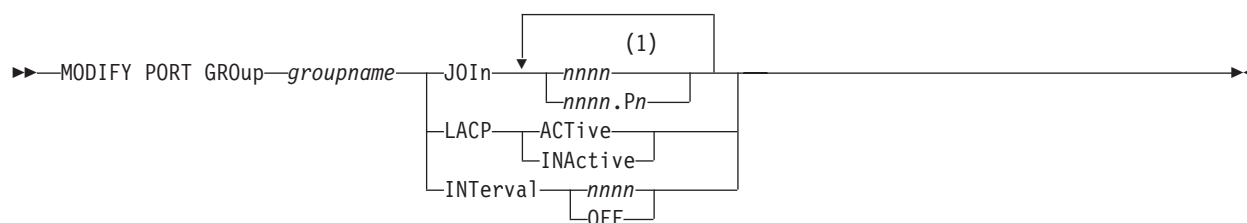
Usage Notes

1. If the guest LAN is defined with the UNRESTRICTED attribute, any user can connect a virtual adapter to that LAN. The CP access list has no meaning for an UNRESTRICTED LAN. This will be overridden if an External Security Manager (ESM) is in control of the virtual switch.
2. When a RESTRICTED LAN is defined, the owner is automatically added to the access list.

Examples

1. To modify a SYSTEM LAN named TECHINFO by adding user REYNOLDS to the access list, specify the following:
`modify lan techinfo grant reynolds`

MODIFY PORT Statement



Notes:

- 1 You can specify a maximum of 8 real device numbers.

Purpose

Use the MODIFY PORT statement to define or change the OSA-Express devices that make up a link aggregation group and to set the attributes of a link aggregation group. For more information about virtual networking options in VM, see *z/VM: Connectivity*.

How to Specify

Include as many statements as needed; they are optional. You can place MODIFY PORT statements anywhere in the system configuration file. If you specify more than one statement with the same *groupname* with the same JOIN operand, the first definition will be accepted and subsequent statements will receive an error. For other operands (LACP and INTERval), the last statement definition overrides any previous specifications.

Operands

groupname

is the name of the link aggregation group to be affected. The *groupname* is a single token (1-8 alphanumeric characters) that identifies a link a group. This *groupname* is associated with a virtual switch via the DEFINE VSWITCH command or statement in the System Configuration file. The association can be changed with the SET VSWITCH command.

JOIn

indicates that the devices (*rdev*) specified will join the specified group. If the group does not exist, it will be created and will remain until the next time z/VM is IPLed or the group name is deleted with a SET PORT *groupname* DELETE command.

nnnn

nnnn.Pn

is a real device number or a real device number and OSA-Express port number of a QDIO OSA-Express device to be affected within the specified group. Specify each real device number as a hexadecimal number between X'0001' and X'FFFF'. If specifying a real device and an OSA-Express port number, specify the real device number as a hexadecimal number between X'0001' and X'FFFF' followed by a period (.), the letter 'P' (or 'p') followed by the port number as a

MODIFY PORT

hexadecimal number between X'0' and X'F'. For example, to specify port 1 for RDEV 300, specify "300.P1". The value of the port number depends on how many ports the OSA-Express hardware feature supports. If the port number is not specified, it will default to port 0.

You can specify a maximum of 8 real device numbers. If you specify more than one device number, each must be separated from the others by at least one blank. Each real device number represents a trio of devices. For example, specifying JOIN 111 means that devices 111-113 are used to provide the connection to the real hardware LAN segment.

See Usage Note 1 for more information about the requirements for the OSA-Express devices.

LACP ACTIVE

LACP INACTIVE

LACP ACTIVE mode indicates that the virtual switch will initiate negotiations with the physical switch via the Link Aggregation Control Protocol (LACP) and will respond to LACP packets sent by the physical switch. LACP INACTIVE indicates that aggregation is to be performed, but without LACP. It is only useful when the physical switch is also operating without LACP. In this mode, there is no negotiation between the physical switch and the virtual switch.

Ensure the same LACP setting exists on both the virtual switch and the physical switch.

LACP ACTIVE is the default for a groupname until changed by a MODIFY PORT GROUP LACP command.

INTERVAL *nnnn*

INTERVAL OFF

indicates the interval to be used by the Control Program (CP) when doing load balancing of conversations across multiple links in the group. It is specified as the number of seconds between load balancing operations across the link aggregation group. It must be a decimal number between 1 and 9990 or the keyword OFF. The interval value is rounded up to the next multiple of thirty seconds. INTERVAL OFF indicates that no load balancing is done by CP.

INTERVAL 60 is the default for a groupname until changed by a MODIFY PORT GROUP INTERVAL command.

Usage Notes

1. The following restrictions pertain to the OSA devices in the specified group:
 - The OSA port must support IEEE802.3ad Link Aggregation.
 - When an OSA port is active in a link aggregated group, it can't have more than a single QDIO connection established on the adapter (CHPID). Any requests to establish a QDIO connection using another device number on the same CHPID in any logical partition will fail until the OSA port is no longer active within the group. Likewise, an OSA port with an active QDIO connection on any device number on the same CHPID will not be able to join a link aggregated group until there are no active QDIO connections on the port.
 - To aggregate multiple OSA ports within a group, all ports in the group must connect to the same physical switch, run in full-duplex mode and operate at the same speed.

- When the port group is configured as LACP Inactive, all ports in the group must support the network disablement function. Cards that do not support the network disablement function may be used only in a port group configured with LACP Active.
2. The maximum number of groups that can be defined to CP is 128.
 3. It is invalid to create a groupname of ALL.
 4. The number of devices identified by the RDEV keyword on the DEFINE or SET VSWITCH command combined with the number of devices in an associated GROUP may not exceed eight devices.
 5. When the virtual switch has been defined with the GROUP attribute, any devices identified by the RDEV keyword (on the DEFINE or SET VSWITCH command) are used for failover in the event of a real switch failure of the link aggregation group. Failover in this environment will be to a single OSA-Express device connected to a second real switch. The virtual switch will recognize when the port group is available again and will initiate recovery to the port group member(s). When the virtual switch has been defined with GROUP and RDEV NONE, it means that there is no link aggregation group failover in the event the real switch should fail.
 6. The port number specified by *nnnn.Pnn* will be used by the TCP/IP stack (controller) when initializing the device. If the port number is not specified, it will default to port 0. If the port number is not supported, initialization of the device will be terminated.

Examples

To define a group named LINGROUP that contains multiple devices, specify the following:

```
modify port group lingroup join B00 C00 D00
```



- Logging on as the primary system operator
- Intensive error recording
- Using the read function of the CP IOCP utility
- Using the write function of the CP IOCP utility
- Specifying the default user class.

Parameters

tells CP to change the privilege classes authorized to perform intensive error recording.

tells CP to change the privilege classes authorized to use the read function of the IOCP utility.

tells CP to change the privilege classes authorized to use the write function of the IOCP utility. (For more information about the IOCP utility, see the *z/VM: CP Commands and Utilities Reference*.)

tells CP to change the privilege classes which are for the primary system operator.

tells CP to change the privilege classes that are defined for users who do not have a class specified in their virtual machine definitions.

tells CP to reset the privilege classes to their original default settings.

tells CP which class or classes are to be set. The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 6.

Usage Notes

1. It is suggested that you simply use the `PRIV_CLASSES` statement to establish initial privilege class values.
2. If you previously used the `OVERRIDE` utility (no longer supported) to change the privilege classes, you can use the `CVTOVRID` utility to convert your

override file into a set of MODIFY statements. For more information about the CVTOVRID utility, see the *z/VM: CP Commands and Utilities Reference*.



Operands

switchname

is the name of the virtual switch to be modified. The *switchname* is a single token (1–8 alphanumeric characters) that identifies the virtual switch. This virtual switch was created by a DEFINE VSWITCH command or statement in the System Configuration file.

GRANT *userid*

specifies the *userid* to be added to the access list for this virtual switch. This allows *userid* to connect an adapter to *switchname*. If an External Security Manager (ESM) is in control of the virtual switch, it can override the CP access list.

This option is not allowed with a virtual switch defined as port based.

PORTType *porttype*

defines the type of connections. If the GRANT or PORTNUMBER operand is being used to add a new user or port to the access list, and the virtual switch has been defined as VLAN aware and no PORTTYPE is specified on the GRANT or PORTNUMBER, the porttype assigned to the guest or port will be the default porttype as specified on the DEFINE VSWITCH command or statement.

If the GRANT or PORTNUMBER operand is issued for a user or port that has already been added to the access list, and the virtual switch has been defined as VLAN aware and no PORTTYPE is specified on the GRANT or PORTNUMBER, the current setting of porttype for the guest or port will be used.

PORTType ACCESS

defines the type of connections that are established to be an access port. The guest is unaware of VLAN IDs and sends and receives only untagged traffic.

PORTType TRUNK

defines the type of connections that are established to be a trunk port. The guest is VLAN aware and sends and receives only tagged traffic for those VLANs to which the guest is authorized. If the guest is also authorized to the *natvid*, untagged traffic sent or received by the guest is associated with the native VLAN ID (*natvid*) of the virtual switch.

VLAN (*defvid* | *vidset*)

identifies the VLAN ID (or set of VLAN IDs) to which this user is restricted while connected to *switchname*. If VLAN is not specified, the default VLAN for this user is the default VLAN ID as specified on the DEFINE VSWITCH command or statement. Note that when a virtual switch is defined as VLAN AWARE, a default VLAN ID is not assigned. If a default VLAN ID is not assigned when the virtual switch is defined, then all inbound or outbound frames are discarded until a VLAN ID is assigned.

If VLAN is specified, each item in the *vidset* must be a valid VLAN number (between 1 and 4094, inclusive). The *vidset* may contain ranges:

Table 8. vidset Ranges

Examples:

VLAN 100-199

VLAN 100-199 1000-1099

Table 8. vidset Ranges (continued)

Examples:

VLAN 1 101-199

VLAN 1 101-199 4094

VLAN 1 2 3

VLAN 1 101 201 301

If an External Security Manager (ESM) is in control of the virtual switch, it can override the CP access list.

PROMiscuous

specifies that the user ID or port is authorized for PROMISCUOUS Mode.

NOPROMiscuous

specifies that the user ID or port is NOT authorized for PROMISCUOUS Mode.

OSDSIM

specifies whether the user ID or port is authorized to COUPLE to an IEDN or INMN type virtual switch as a type QDIO OSA Adapter.

OFF

specifies that the user ID or port must use an IEDN type NIC adapter when coupling to an IEDN virtual switch or must use an INMN type NIC adapter when coupling to an INMN virtual switch. OSDSIM OFF is the default setting for a virtual switch port.

ON specifies that a virtual NIC created by a CP DEFINE NIC TYPE QDIO command is allowed to COUPLE an IEDN or INMN type virtual switch. By using a QDIO NIC adapter, the network device seen by the operating system will appear as an OSD OSA-Express instead of an IEDN or INMN network device. A system administrator can turn this option on and create a type QDIO NIC in a virtual machine to allow an operating system without IEDN or INMN network support to communicate on the network with a typical OSA-Express device.

UPLINK

enables and specifies connectivity for a virtual switch UPLINK port. The UPLINK port is a special port that typically is used to connect the virtual switch to a physical switch -- essentially bridging the virtual switch's simulated network to a physical network.

NIC

causes the UPLINK port for a virtual switch to be connected to, or disconnect from, a virtual switch guest port. The NIC operand can be specified only when a virtual switch is in the DISCONNECT state. Setting the UPLINK port to a guest port also will set RDEV NONE and NOGROUP. Changing either of the RDEV or GROUP settings causes UPLINK NIC NONE to be set.

userid2 vdev (AUTO/portnum)

specifies that the UPLINK port is to be connected to a guest port, and that the virtual switch is not to be connected to a physical switch. In this configuration the virtual switch routes all broadcasts and destination MAC or IP Address unicast frames that cannot be resolved within the simulated LAN segment to the specified guest port. If your virtual switch is VLAN AWARE, the guest port should be configured as a TRUNK port.

- **AUTO** - CP determines the VSWITCH port number to be used.
For user based virtual switches, AUTO is the only allowed option.
For port based virtual switches: If a single user port was defined for this user by the MODIFY VSWITCH PORTNUMBER statement, then that port will be automatically used by COUPLE or CONNECT, and its port settings will be used. If there are multiple user ports defined, then the CONNECT or COUPLE command will fail.
- *portnum*
For port based virtual switches, the guest portnum may be specified. When the uplink NIC is COUPLED or CONNECTed, it is connected to the specified *portnum* on the virtual switch. The portnumber must be a valid port number (between 1 and 2048, inclusive), and must be configured with the MODIFY VSWITCH PORTNUMBER statement. If the *portnum* is not a configured port, then the command will fail. This option is only allowed for a virtual switch that was defined as port based.

NONE

disconnects the currently connected guest port from the special virtual switch UPLINK port. Until another UPLINK port is specified, all destination MAC or IP Address unicast frames that cannot be resolved within the simulated LAN segment are discarded

PATHMTUDiscovery

indicates that CP will, by default, participate in the Path MTU Discovery process in order to minimize packet loss and to maximize the size of packets sent through a defined UPLINK RDEV port device. The Path MTU Discovery process performed by CP examines and discards any IP datagrams destined for the UPLINK port that are larger than the Path MTU Discovery value allowed by the UPLINK RDEV port device. CP also sends to the datagram source an appropriate notification in the form of an ICMP or ICMPv6 message.

The MODIFY VSWITCH PATHMTUDISCOVERY option can be used to configure a user-defined Path MTU Discovery value, to indicate that CP should determine the Path MTU Discovery value (the default), or to indicate to CP that the Path MTU Discovery process is to be disabled.

These options are specified as follows:

EXternal

indicates that CP should determine the Path MTU Discovery value to assign. The value to be assigned is determined as follows:

- If the virtual switch is configured with an active UPLINK RDEV port, CP determines the Path MTU Discovery value to use from the maximum MTU value supported by the connected OSA UPLINK RDEV port device. Typically, this value is 8992 bytes.
- If the virtual switch is configured with one or more UPLINK RDEV ports but none are currently active, CP disables the Path MTU Discovery process, effectively the same as specifying the MODIFY VSWITCH PATHMTUDISCOVERY OFF option. Later, when one of the UPLINK RDEV port devices is activated, CP determines the Path MTU Discovery value to use based on the maximum MTU value supported by the active OSA UPLINK RDEV port device. Typically, this value is 8992 bytes.
- If the virtual switch is configured without an UPLINK RDEV port device, CP disables the Path MTU Discovery process,

MODIFY VSWITCH

effectively the same as specifying the MODIFY VSWITCH PATHMTUDISCOVERY OFF option. Later, when the UPLINK RDEV port device is defined and activated for the virtual switch, CP determines the Path MTU Discovery value to use based on the maximum MTU value supported by the active OSA UPLINK RDEV port device. Typically, this value is 8992 bytes.

PATHMTUDISCOVERY EXTERNAL is the default setting for the virtual switch.

VALue *nnnnn*

configures a user-defined value of *nnnnn* to be used by CP as the Path MTU Discovery value. Specifying this option can be useful if the Path MTU Discovery value of the physical network needs to be different from the Path MTU Discovery value used by CP when MODIFY VSWITCH PATHMTUDISCOVERY EXTERNAL is specified. To determine the recommended Path MTU Discovery value, see the Maximum Transmission Unit (MTU) information in the hardware documentation associated with the OSA Uplink RDEV port device. The range of values for *nnnnn* must be a minimum of 512 bytes and a maximum of 65535 bytes.

OFF indicates that the Path MTU Discovery process for this virtual switch is to be disabled by CP. This setting is not recommended when the virtual switch is defined with a Bridge Port.

See usage note 10 on page 207 for more information about the PATHMTUDISCOVERY option.

CONTroller * | *userid1*

identifies the z/VM user ID that controls the OSA-Express device connected to the virtual switch. You can specify a maximum of eight user IDs. If you specify more than one user ID, each must be separated from the others by a least one blank. CONTROLLER * means CP selects from any of the eligible z/VM TCP/IP stacks. See usage note 4 on page 205 for more information about the function of a controller.

If you specify multiple real devices on the RDEV keyword or through the GROUP keyword, then specify CONTROLLER * or allow it to default or specify a list of user IDs. The controller functions are then spread across multiple z/VM TCP/IP stacks, providing more flexibility in case of a failure. You can also specify a pool of specific controllers to be chosen from by specifying a list of user IDs after the CONTROLLER keyword with the SET VSWITCH command or the MODIFY VSWITCH statement.

MACID *macid*

is a unique identifier (up to six hexadecimal digits) used as part of the virtual switch MAC address. This MACID (three bytes) is appended to the system MACPREFIX or USERPREFIX (three bytes) to form a unique MAC address for this virtual switch. If a specified MACID is already in use the virtual switch is not changed. You must eliminate the conflict or select a different MACID. If no MACID is set for the virtual switch, CP generates a unique identifier for this virtual switch.

You cannot set the MACID for an IEDN or INMN virtual switch.

VLAN_counters

indicates whether or not detailed support is provided for VLAN counters. This affects the level of detail that should be maintained for the virtual switch network activity.

OFF

indicates that the counters required are not needed at the VLAN level. That is, transmission counters should be kept at the port level. Packet counters are kept for each port to show the number of frames received, transmitted or discarded.

ON

indicates that transmission counters should be kept at the VLAN level. This is, for each port, packet counters are maintained to show the number of frames received, transmitted or discarded for each VLAN.

VLAN_counters OFF is the default.

ISOLation

determines if guests on the virtual switch can communicate between themselves and other hosts and/or LPARs that share the same OSA-Express port with the virtual switch. With the exception of an INMN type virtual switch, ISOLATION OFF is set by default for all other virtual switch types to allow unrestricted network communications. ISOLATION ON is the default for only an INMN type virtual switch, which also prohibits ISOLATION OFF from being set.

OFF

allows guest ports to communicate with each other and with any hosts and/or LPARs that share the same OSA port. ISOLATION OFF is not supported on a type INMN virtual switch.

ON

prohibits guests from sending traffic to other guests on the same virtual switch by discarding traffic that is destined for another guest port on the virtual switch. In addition, no direct LPAR communications sharing the same OSA port is permitted with the guest ports of the virtual switch. All traffic from the virtual switch destined for any sharing hosts/LPARs on the same OSA port will be dropped. Any traffic destined for the virtual switch guest ports from hosts/LPARs sharing the same OSA port will also be dropped.

VEPA

determines the operational mode of the virtual switch with regard to forwarding guest-to-guest and guest-to-external destination communications.

OFF

allows guest ports to communicate with each other and with any hosts or LPARs or both that share the same OSA port. VEPA OFF is the default setting for a QDIO or an IEDN virtual switch.

ON

prohibits guests from sending traffic to other guests on the same virtual switch without going through an external entity by forwarding all traffic from the guest through the OSA uplink to an adjacent switch. In addition, no direct LPAR communications sharing the same OSA port is permitted with the guest ports of the virtual switch. All traffic from the virtual switch destined for any sharing hosts/LPARs on the same OSA port will be forwarded as well. Any traffic destined for the virtual switch guest ports from hosts/LPARs sharing the same OSA port will also be forwarded to the adjacent switch. VEPA ON requires an ETHERNET virtual switch (without a Bridge Port) with OSA uplink(s) that supports VEPA as a well as the partner switch must support Reflective Relay. VEPA ON may not be specified if ISOLATION is ON.

MACProtect

turns on or off MAC address protection for devices coupled to this virtual switch. Turning MAC address protection on prevents a guest from using a

MODIFY VSWITCH

MAC address that is not assigned to the user's network device. MACPROTECT is valid only for an ETHERNET virtual switch.

There are three levels of inheritance used when determining the MAC address protection level for a MAC address assigned to a network device. The highest is the system level, followed by the virtual switch (or guest LAN) level. The lowest level is the protection set for a specific network data device.

The MAC address protection level assigned is determined first at the device, then virtual switch and lastly the system level. If MAC address protection is set at the device level using the SET NIC CP command, then its current setting is used. When the device is set to UNSPECIFIED, it will inherit the MACPROTECT setting of the virtual switch. When the virtual switch MACPROTECT setting is set to UNSPECIFIED, the SYSTEM's MAC address protection specified by the SET VMLAN CP command or VMLAN configuration statement is assigned.

UNSPECified

allow the MAC address protection to be determined by the SYSTEM level setting. UNSPECIFIED is the default setting for a virtual switch.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set to the SYSTEM level defined by the SET VMLAN CP command or the VMLAN configuration statement.

OFF

set the MAC address protection level off for coupled devices defined with a MAC address protection set to UNSPECIFIED.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set off.

ON set the MAC address protection level on for coupled devices defined with a MAC address protection set to UNSPECIFIED.

If MAC address protection is set to UNSPECIFIED by the SET NIC CP command for a specific device, then the device's MAC address protection will be set on.

PORTNUMBER *portnum* USERID *userid* options

The PORTNUMBER operand defines a port for a virtual switch and associates the specified user *userid* with a virtual switch port *portnum*. This operand will also be used to specify port options including porttype, promiscuous, OSDSIM and VLAN ids. The *userid* will be added to the access list for this virtual switch. This allows *userid* to connect an adapter to *portnum* on virtual switch *switchname*. If an External Security Manager (ESM) is in control of the virtual switch, the *userid* must be authorized by the ESM, and the VLANs configured with the MODIFY VSWITCH PORTNUMBER statement must be included in the VLAN list provided by the ESM. The *portnum* must be a valid port number (between 1 and 2048, inclusive).

This option is for port based virtual switches only.

VLANID *vlanid* ADD *portset*

The ADD operand adds the port set to the specified virtual lan segment. The *vlanid* must be a valid VLAN number (between 1 and 4094, inclusive). Each item in the *portset* must be a valid port number (between 1 and 2048,

inclusive). Each port must be defined with the MODIFY VSWITCH PORTNUMBER statement before being added to a VLAN. The *portset* may contain ranges:

Table 9. portset Ranges

Examples:

1-25

1 25-50

1 25-50 2048

1 2 3

1 101 201 301

This option is for port based virtual switches only.

If an External Security Manager (ESM) is in control of the virtual switch, the VLAN ids defined with VLANID command must be included in the VLAN list provided by the ESM.

BRIDGEport BUFFERS *nnnnn*

indicates the maximum number of asynchronous requests that are allowed to be outstanding on the Bridge Port. The allowable range is 0 to 65535. The default value is 2048.

Usage Notes

1. VLAN configuration information can be found in “Planning for Guest LANs and Virtual Switches” in *z/VM: Connectivity*.
2. If the virtual switch has been defined as VLAN UNAWARE, the following are not allowed:
 - the PORTTYPE and the VLAN option on GRANT
 - the PORTTYPE and the VLAN option on PORTNUMBER
 - the VLANID option
3. If the virtual switch has been defined as VLAN aware and no VLAN membership is given with the GRANT, PORTNUMBER, or the VLANID (or provided by an external security manger), the guest is a member of the virtual switch's default VLAN ID (*defvid*) only if a defvid was assigned as part of the virtual switch definition.
4. A virtual switch's connection to a real hardware LAN segment is not operational until an eligible TCP/IP stack is selected to be the controller for the OSA-Express device. CP selects an eligible TCP/IP stack to be the controller by either:
 - It is recommended that the VSWITCH controller be at the same release level as CP, although all supported releases are allowed.
 - If CONTROLLER *userid1* is specified on the DEFINE or SET VSWITCH commands or the DEFINE or MODIFY VSWITCH system configuration statements, with either a single user ID or a list of user IDs, only those user IDs are selected.
 - If CONTROLLER * is specified or allowed to default, CP selects from any eligible TCP/IP stack.

A TCP/IP stack becomes eligible when:

 - The TCP/IP MODULE running in the controller is at a release level that supports the function required for the virtual switch.
 - An IUCV *VSWITCH statement is included in its virtual machine definition.

MODIFY VSWITCH

- The TCP/IP VSWITCH CONTROLLER statement is coded, and has defaulted to be ON or is explicitly set to ON or ENSEMBLE in the TCP/IP configuration file or through an OBEYFILE command. When using an IEDN or INMN virtual switch, at least one or more controllers must specify the ENSEMBLE keyword on the VSWITCH CONTROLLER statement. Only controllers which specify ENSEMBLE will be selected to control an IEDN or INMN virtual switch.
- The stack has completed initialization.
- The stack has virtual device numbers available for CP to attach the control device.

The virtual device range used by CP is specified in the VSWITCH CONTROLLER TCP/IP configuration statement. If no VDEV range is specified, CP uses the virtual device number (*vdev*) that matches the *rdev* number specified on the DEFINE VSWITCH or SET VSWITCH command. See *z/VM: TCP/IP Planning and Customization* for more information about the VSWITCH CONTROLLER statement.

Note: Do not code DEVICE and LINK TCP/IP configuration statements for the device. Do not attach the device to a TCP/IP controller virtual machine. These steps are handled by DEFINE VSWITCH processing when a controller is selected.

If an eligible stack is not found, or none of the *rdevs* are operational, you receive a message, and the virtual switch operates in a local LAN environment.

5. MODIFY VSWITCH VLAN_counters ON can significantly affect the rate of transmission for a virtual switch. Use this option only if there is a need to understand traffic patterns at the level of VLAN IDs. One example of when you might want VLAN_counters ON is when you are using a network management tool to analyze VLAN network traffic.
6. Detailed transmission counters are available only for a VLAN AWARE Virtual Switch with the VLAN_counters option set to ON. These values may be obtained using the Diagnose X'26C' interface.
7. IEDN virtual switch type requires at least one VLAN ID to be set before a NIC device can be connected to the virtual switch with the CP COUPLE command. For user based virtual switches, the VLAN IDs are set by the SET or MODIFY VSWITCH GRANT VLAN vidset. For port based virtual switches, the VLAN IDs are configured with the SET or MODIFY VSWITCH PORTNUMBER command or the SET or MODIFY VSWITCH VLANID commands.
8. An IEDN or INMN virtual switch with real network connectivity specified in the SYSTEM CONFIG file will only be created after the system is made an active member of an ensemble managed by the Unified Resource Manager. Only an IEDN or INMN virtual switch with the NOUPLINK option will be created during the IPL of z/VM.

Virtual switches which can connect to a real network managed by the Unified Resource Manager require resources that must be assigned by the Unified Resource Manager. The Unified Resource Manager cannot make these resources available until sometime after z/VM completes its IPL. When the system becomes an active member of the ensemble managed by the Unified Resource Manager, the virtual switch will be created. If the system is not going to be managed by the Unified Resource Manager, the virtual switch will be created immediately.

9. For port based virtual switches, all ports must be configured with the PORTNUMBER command. If the virtual switch is VLAN aware, the VLANs need to be configured with the VLANID or PORTNUMBER command. If an External Security Manager (ESM) is in control of the virtual switch, the VLANs configured with the VLANID or PORTNUMBER command must be included in the VLAN list provided by the ESM.
10. The following notes are related to the MODIFY VSWITCH PATHMTUDISCOVERY option:
 - When a PORT GROUP is defined using the SET PORT command, the PATHMTUDISCOVERY option applies to all members of the group.
 - If a virtual switch is configured with an Uplink NIC, the MODIFY VSWITCH PATHMTUDISCOVERY option is not applicable. However, it can be set for use later when an Uplink RDEV port device is defined.
 - If a virtual switch is configured with the NOUPLINK option, the MODIFY VSWITCH PATHMTUDISCOVERY option is not allowed.

Examples

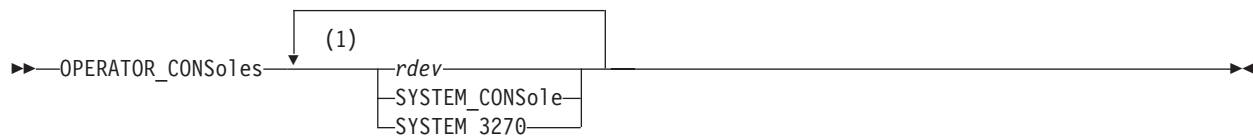
The following examples apply when CP, not an ESM, is protecting the guest LAN:

1. To allow user VMTCPIP to connect to virtual switch BIGANG and filter any incoming traffic using VLAN 9, specify the following:


```
modify vswitch bigang grant vmtcpip vlan 9
```
2. To define a port based virtual switch VSWITCH1 with multiple access ports 10 and 20 for user1, specify the following. Port 10 will be added to VLAN 11 and port 20 will be added to VLAN 21.


```
define vswitch vswitch1 portbased vlan aware
modify vswitch vswitch1 portnumber 10 userid user1
modify vswitch vswitch1 portnumber 20 userid user1
modify vswitch vswitch1 vlanid 11 add 10
modify vswitch vswitch1 vlanid 21 add 20
```

OPERATOR_CONSOLES Statement



Notes:

- 1 The maximum number of device numbers that you can specify is 500.

Purpose

Use the OPERATOR_CONSOLES statement to define a list of device numbers from which CP is to choose the system operator console. CP will log on the system operator virtual machine at the first available address or location specified with the command.

How to Specify

Include as many statements as needed; they are optional. You can place OPERATOR_CONSOLES statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

rdev

is the real hexadecimal device numbers of possible system operator consoles. These devices must be locally-attached 3270-type supported displays.

The maximum number of device numbers that you can specify is 500. When you initialize the system, CP goes sequentially through the list defined with the OPERATOR_CONSOLES statement and looks for the first operational console. When CP finds an operational console, it uses it as the system operator's console. If CP cannot find an operational console, it enters a disabled wait state with a wait state code of X'1010' in the PSW.

SYSTEM_CONSOLE

specifies that the Operating System Messages panel on the IBM Hardware Management Console (HMC) can serve as a system operator console.

SYSTEM_3270

specifies that the integrated 3270 console on the HMC can serve as a system operator console.

Usage Notes

1. If an IODF statement is defined in the system configuration file with the *osconfig* parameter specified, then the software I/O configuration will be controlled by HCD. In this case, the OPERATOR_CONSOLES statement is ignored if it is specified. Refer to "IODF Statement" on page 173 for more information.

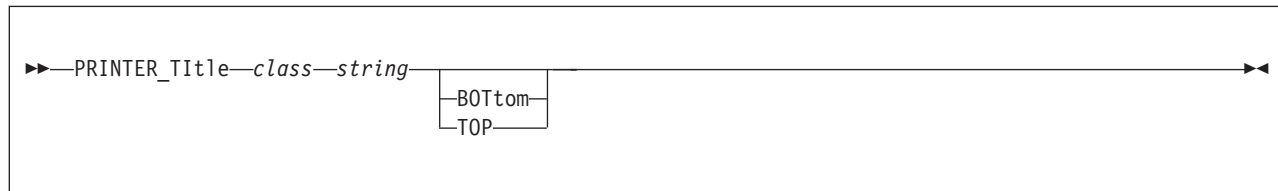
2. Consoles that CP is to notify when there is a system emergency (for example, an impending abend, shutdown, or dump) should be listed on the EMERGENCY_MESSAGE_CONSOLES statement (see “EMERGENCY_MESSAGE_CONSOLES Statement” on page 138).
3. 2250 and 3250 displays are not valid operator consoles.
4. During a software re-IPL caused by either a system incident or the CP SHUTDOWN REIPL command, CP determines whether the operator virtual machine is connected to the primary system console. If the operator virtual machine is disconnected, logged off, or logged on to a console other than the primary console, CP disconnects the operator virtual machine when the system is reinitialized, unless you specified the NODISCONNECT operand on a SYSTEM_USERIDS statement or a SYSOPER macroinstruction. This disconnection is a security measure to reduce the risk of CP's logging the operator virtual machine on to an unattended console.
5. Specifying CONS=*addr* or CON=*addr* in the IPL parameters portion of the Stand-Alone Program Loader window overrides any consoles specified with the OPERATOR_CONSOLES statement. See Chapter 4, “Using the Stand-Alone Program Loader,” on page 31.

Examples

1. The following example shows three possible device addresses for the system operator console.

```
Operator_Consoles 8e6 8e0 bc0          /* Operator Consoles in the
                                         Machine Room          */
```

PRINTER_TITLE Statement



Purpose

Use the PRINTER_TITLE statement to specify the printed output classes that are to contain classification titles. CP prints classification titles on the output separator page and, optionally, at the top or bottom of each page of output. You can specify a different classification title for each class of output (A through Z and 0 through 9).

How to Specify

Include as many statements as needed; they are optional. You can place PRINTER_TITLE statements anywhere in the system configuration file. If you specify more than one statement with the same class, the last statement overrides any previous specifications.

If you omit the PRINTER_TITLE statement, CP does not print any classification titles.

Operands

class

is a 1-character alphanumeric string specifying the spool file class.

string

is a classification title for this class. It may be up to 46 characters long, and must be enclosed in single or double quotation marks unless it is a single word entered with no imbedded blanks, in which case the entire word will be capitalized.

If you need to include a single quotation mark in the title, enclose the whole string with double quotation marks. If you need to include a double quotation mark in the title, enclose the whole string with single quotation marks. Also, you may use two consecutive double quotation marks (""") to represent a " character within a string delimited by double quotation marks. Similarly, you may use two consecutive single quotation marks (") to represent a ' character within a string delimited by single quotation marks.

BOTtom

tells CP that this title is to be printed both on the separator page and at the bottom of each page of output.

TOP

tells CP that this title is to be printed both on the separator page and at the top of each page of output.

Note: If you do not specify the TOP or BOTTOM operands, CP only prints the title on the separator pages.

Usage Notes

1. CP inserts the title line at the top or bottom of each page. To do this, CP inserts a CCW to print one space, followed by the title line before or after each skip to channel 1 CCW issued by the operating system running in the virtual machine printing the file. Inserting the title lines this way means that:
 - CP inserts the titles as the file is created. Later, if you change the file to a different class, CP does not change the titles in the file. However, the title on the separator page always reflects the true class of the file.
 - Inserting the title on the output page adds a line of output to the printed page. If the virtual machine application is counting lines, its count will be incorrect. Thus, the output listing may contain blank pages.
 - If the operating system running in the virtual machine printing the file does not use skip to channel 1, the title lines are never printed.

Examples

1. To define four printer classes as follows:
 - Class A has the title "No Security Rating" printed at the bottom of each page and on the separator pages
 - Class C has the title "COMPANY XYZ CONFIDENTIAL" printed at the top of each page and on the separator pages
 - Class Q has the title "It's not Confidential" printed on the separator pages
 - Class X has the title "Contents aren't Confidential" printed on the separator pages

use the following PRINTER_TITLE statements:

```

/*-----*/
/*   Setting up Printer Titles                               */
/*   -----                                                */
/*
/*   Class A printer files get "No Security Rating" printed on the  */
/*   bottom of each page and on the separator pages                */
/*   Class C printer files get "COMPANY XYZ CONFIDENTIAL" printed at */
/*   the top of each page and on the separator pages                */
/*   Class Q printer files get "It's Not Confidential" printed at   */
/*   the top of each page and on the separator pages                */
/*   Class X printer files get "Contents aren't Confidential" printed */
/*   at the top of each page and on the separator pages            */
/*-----*/
Printer_Title  A  'No Security Rating'          Bottom

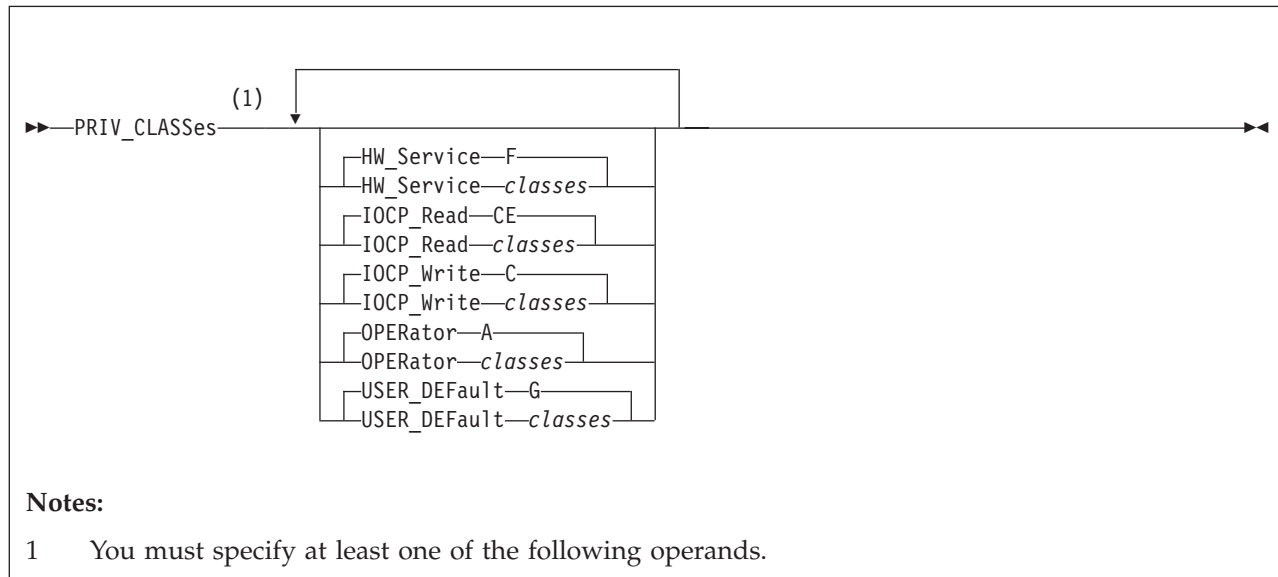
Printer_Title  C  'COMPANY XYZ CONFIDENTIAL' Top

Printer_Title  Q  'It's Not Confidential'

Printer_Title  X  "Contents aren't Confidential"

```

PRIV_CLASSES Statement



Purpose

Use the PRIV_CLASSES statement to change the privilege classes authorizing the following CP functions:

- Logging on as the primary system operator
- Intensive error recording
- Using the read function of the CP IOCP utility
- Using the write function of the CP IOCP utility
- Specifying the default user class.

How to Specify

Include as many statements as needed; they are optional. You can place PRIV_CLASSES statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

HW_Service *classes*

tells CP which class or classes are authorized to perform intensive error recording. The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 9. If omitted, the default is class F.

IOCP_Read *classes*

tells CP which class or classes are authorized to use the read function of the IOCP utility. (For more information about the IOCP utility, see the *z/VM: CP Commands and Utilities Reference* book.) The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 9. If omitted, the default is classes CE.

IOCP_Write *classes*

tells CP which class or classes are authorized to use the write function of the

IOCP utility. (For more information about the IOCP utility, see the *z/VM: CP Commands and Utilities Reference* book.) The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 9. If omitted, the default is class C.

OPERator *classes*

tells CP which class or classes are for the primary system operator. The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 9. If omitted, the default is class A.

USER_DEFAULT *classes*

tells CP which class or classes to define for users who do not have a class specified in their virtual machine definitions. The variable *classes* is a 1- to 8-character alphanumeric string from A through Z and from 0 to 9. If omitted, the default is class G.

Examples

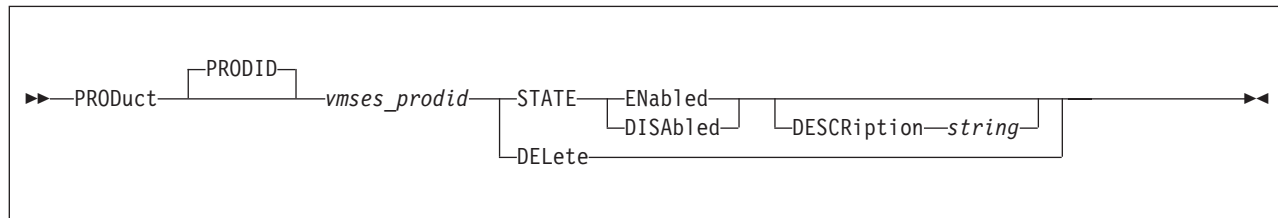
1. To authorize:

- The primary system operator for class A, C, and E commands
- Class C users to issue the IOCP READ and WRITE
- Class D users to perform intensive error recording
- All users without classes defined in their virtual machine definitions for class G commands

use the following PRIV_CLASSES statement:

```
Priv_Classes,
  Operator      ACE,          /* Classes needed to be operator */
  IOCP_Write    C,           /* Class needed for IOCDS read   */
  IOCP_Read     C,           /* Class needed for IOCDS write  */
  HW_Service    D,           /* Class needed for intensive error */
                          /* recording                      */
  User_Default  G            /* Default classes for general user */
```

PRODUCT Statement



Purpose

Use the PRODUCT statement to define a product or feature to the system.

How to Specify

Include as many statements as needed; they are optional. You can place PRODUCT statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

PRODID *vm ses _prodid*

is the identifier used by VMSES/E to install and service the given product. *vm ses _prodid* must be a 7 or 8 character identifier.

STATE ENABLED

identifies this product or feature as being licensed to run on this system.

When a product is defined with STATE ENABLED, it indicates that the product is authorized by the installation to run on this system. It does not mean that the product is installed or is being used.

STATE DISABLED

identifies this product or feature as not being licensed to run on this system. The product may or may not be physically installed on the system.

DESCRIPTION *string*

is a string of data that identifies additional information regarding the product.

string is a 1-255 character string (including any imbedded blanks and special characters) associated with the *vm ses _prodid* entered. The string may be enclosed in single or double quotation marks. The text inside the quotation marks is not translated to uppercase. The string is stored unchanged and without the delimiting quotation marks.

If string is not delimited by quotation marks, it is translated to uppercase and multiple blanks are compressed to a single blank.

If you need to include a single quotation mark in the string, enclose the whole string with double quotation marks. If you need to include a double quotation mark in the string, enclose the whole string with single quotation marks. Also, you may use two consecutive double quotation marks (""") to represent a " character within a string delimited by double quotation marks. Similarly, you may use two consecutive single quotation marks (') to represent a ' character within a string delimited by single quotation marks.

DELETE

removes from the system any definition information for the product ID, *vm ses_prodid*.

Usage Notes

1. Each product is identified by a unique *vm ses_prodid*. If a subsequent PRODUCT statement or SET PRODUCT command specifying an existing *vm ses_prodid* is issued, it overwrites all of the related data including the description data.
2. The DELETE operand is included for those installations that may choose to have a common imbed for multiple systems with specific imbed statements following for each specific system.

Examples

1. To define and enable RSCS Function Level 530 (5VMRSC30) to the system with a comment that describes what the specified product ID identifies, use the following PRODUCT statement:

```
PRODUCT 5VMRSC30 STATE ENABLED DESCRIPTION 'RSCS Networking Function Level 530'
```

2. To define PVM and explicitly disable PVM (5684100E) to the system with a comment that identifies why the product is disabled, use the following PRODUCT statement:

```
PRODUCT 5684100E STATE DISABLED DESCRIPTION 'PVM FACILITY BASE - Disabled
23-AUG-1997 after license expired.'
```

3. To delete the entry for PVM (5684100E), use the following PRODUCT statement:

```
PRODUCT 5684100E DELETE
```

A description is not allowed because all data for the product is discarded from the system when the DELETE operand is processed.

4. To define and enable DITTO (5688025A) to the system, use the following PRODUCT statement:

```
PRODUCT 5688025A STATE ENABLED
```

A description was not entered, therefore, there is no tie between the enablement statement for product ID 5688025A and DITTO.

If the above PRODUCT statements were processed in the given order, you would receive the following results after entering the Q PRODUCT command:

```
Q PRODUCT
Product State Description
5VMRSC30 Enabled RSCS Networking Function Level 530
5688025A Enabled
5735FALQ Enabled TCP/IP LEVEL 310 - TCP/IP FEATURE (BASE)
```

RDEVICE Statement

Purpose

Use the RDEVICE statement to add to the system's definition of a set of real I/O devices. The sections below describe the syntax of the RDEVICE statements for the following devices:

- Dedicated advanced function printers (see “RDEVICE Statement (Advanced Function Printers)” on page 218)
- Card punches (see “RDEVICE Statement (Card Punches)” on page 220)
- Card readers (see “RDEVICE Statement (Card Readers)” on page 222)
- Communication controllers and the line adapters (see “RDEVICE Statement (Communication Controllers)” on page 224)
- DASD (see “RDEVICE Statement (DASD)” on page 226)
- Graphic display devices (see “RDEVICE Statement (Graphic Display Devices)” on page 229)
- Impact printers (see “RDEVICE Statement (Impact Printers)” on page 233)
- Special devices (see “RDEVICE Statement (Special Devices)” on page 238)
- Tape units (see “RDEVICE Statement (Tape Units)” on page 240)
- Terminals (see “RDEVICE Statement (Terminals)” on page 242)
- Unsupported devices (see “RDEVICE Statement (Unsupported Devices)” on page 243)
- 3800 printers (see “RDEVICE Statement (3800 Printers)” on page 246).

How to Specify

Include as many statements as needed; they are optional. You can place RDEVICE statements anywhere in the system configuration file.

If you specify more than one statement with the real device number, CP uses the last statement. For example, if you specify:

```
Rdevice 0500 Type 3800 Model 1 AFP yes Chars gf10
.
.
.
Rdevice 0500 Type AFP
```

CP defines a dedicated advanced function printer at real device number 0500, not a 3800 printer.

Usage Notes

1. If an IODF statement is defined in the system configuration file with the *osconfig* parameter specified, then the software I/O configuration will be controlled by HCD. In this case, the RDEvice statement is ignored if it is specified. Refer to “IODF Statement” on page 173 for more information.
2. If you try to redefine the system residence or parm disk volume, CP will issue the following message:

HCP6751E

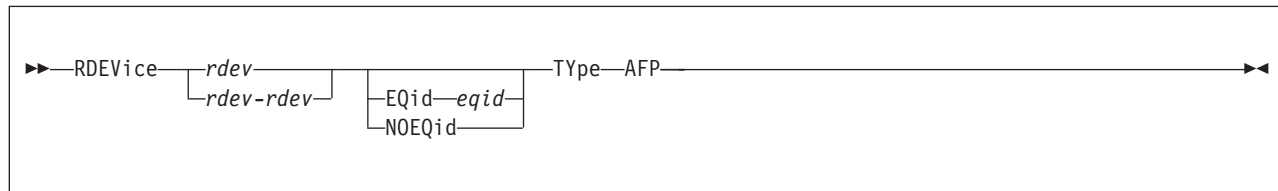
Device *rdev* cannot be defined because it is the {SYSRES|parm disk} volume.

3. The RDEVICE statement cannot be used to change a current static device definition that exists in the HCPRIO ASSEMBLE file. When this redefinition is detected, you will see the following message:

HCP6895E

RDEV *rdev* cannot be changed or deleted because it is static device definition from HCPRIO

RDEVICE Statement (Advanced Function Printers)



Purpose

Use this RDEVICE statement to define one or more dedicated advanced function printers to CP. CP supports the following advanced function printers using Advanced Function Printing licensed programs:

3800 (Supported only for models 3, 6, and 8.)
 3820 (Supported only when the 3820 printer is channel-attached.)
 3825
 3827
 3828
 3835
 3900

Note: Printers defined as advanced function printers that follow the CCU specifications can be used only as dedicated devices.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the dedicated advanced function printer that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe **AFP**

tells CP that the real device (or devices) that you are defining are dedicated advanced function printers (AFP) that follow the CCU specification. Note that printers defined as TYPE AFP can only be used as dedicated devices.

For more information about advanced function printers, see the *PSF/VM System Programming Guide*.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a dedicated advanced function printer at real device number 0110, use the following RDEVICE statement:

```
Rdevice 0110 Type AFP
```

2. To define three dedicated advanced function printers at real device numbers 0111, 0112, and 0113, use one of the following RDEVICE statements:

```
Rdevice 0111-0113      Type AFP
```

3. To define three dedicated advanced function printers at real device numbers E20, F10, and 1F00, use the following RDEVICE statements:

```
Rdevice e20 Type AFP
Rdevice f10 Type AFP
Rdevice 1f00 Type AFP
```


Classes *classes***Classes** *

defines the output spooling class or classes that the card punch may process. Each class is one alphanumeric character and you can specify up to eight classes. If you specify more than one class, do not include any blanks between classes (for example, CLASSES ABC). If omitted, the default is A. If specified as an asterisk (*), the card punch can process any file, regardless of class.

To change the spooling class without having to re-IPL, use the CP START UR command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

Form *form***Form** *

defines the 1- to 8-character spooling form number that the card punch can process. When the operator starts the device after a cold start and does not specify a form, CP uses the form specified on this RDEVICE statement. If omitted, the default is STANDARD. If specified as an asterisk (*), the card punch can process any file, regardless of form number.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a card punch at real device number 0120, use the following RDEVICE statement:

```
Rdevice 0120 Type Punch
```

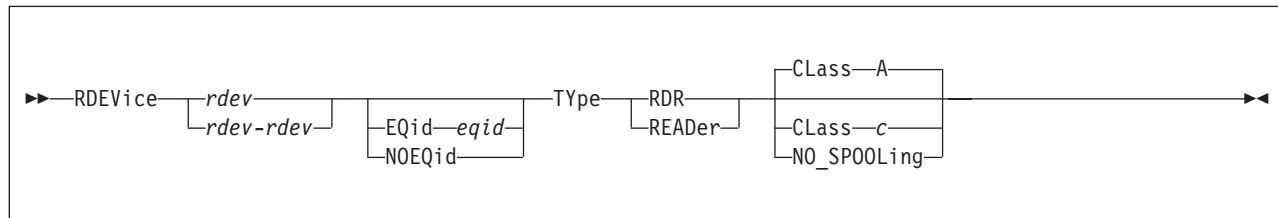
2. To define three card punches at device numbers 0121, 0122, and 0123, and to indicate that they can process any file regardless of form number, use one of the following RDEVICE statements:

```
Rdevice 0121-0123      Type Punch Form *
```

3. To define a card punch at device number 124 that processes class A files and four card punches that process files with spooling form number XYZ and class Z, use the following RDEVICE statements:

```
Rdevice 124      Type Punch      Class a
Rdevice 125-128  Type Punch Form xyz Class z
```

RDEVICE Statement (Card Readers)



Purpose

Use this RDEVICE statement to define one or more real card readers to CP. CP supports the following card readers:

3505

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the card reader that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe **RDR**

TYpe **READer**

tells CP that the real device (or devices) that you are defining are card readers.

Class *c*

defines the 1-character alphanumeric spooling class that the card reader assigns to spool files it creates. If omitted, the default is A.

To change the spooling class without having to re-IPL, use the CP START UR command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

NO_SPOOLing

tells CP not to use the card reader for spooling.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a card reader at device number 0130, use the following RDEVICE statement:

```
Rdevice 0130 Type Reader
```

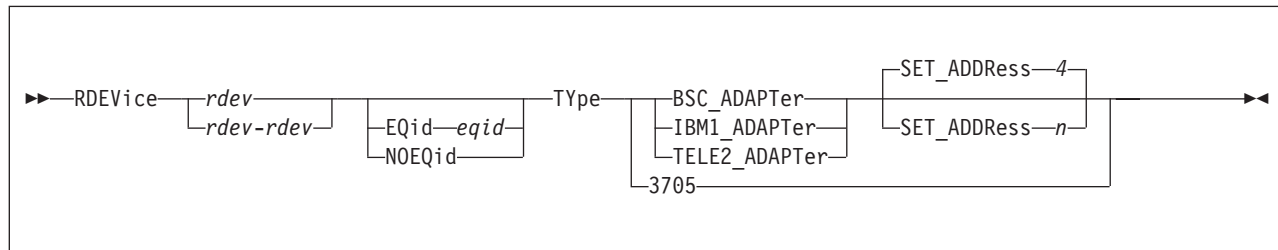
2. To define three card readers at device numbers 0131, 0132, and 0133, and to indicate that CP should not use them for spooling, use one of the following RDEVICE statements:

```
Rdevice 0131-0133      Type Reader No_Spooling
```

3. To define a card reader at device number 134 that creates class W spool files, use the following RDEVICE statement:

```
Rdevice 134 Type Reader Class w
```

RDEVICE Statement (Communication Controllers)



Purpose

Use this RDEVICE statement to define one or more real communication controllers or line adapters to CP. CP supports the 3745 communication controllers and line adapters.

Note: CP supports the BSC adapter as dedicated only.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the communication controller or line adapter that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

Type

tells CP that the real devices you are defining are:

BSC_ADAPTer

specifies an IBM Binary Synchronous Terminal Control Type II for a 3745. (The BSC adapter is supported as dedicated-only.)

IBM1_ADAPTer

specifies that an IBM Terminal Adapter Type I attaches a 2741 to a 3745.

TELE2_ADAPTer

specifies that a CPT-TWX (Models 33/35) Terminal, 3101, 3151, 3161, 3162, or 3163 attaches to a Line Interface Base Type I in a 3745.

SET_ADDRESS *n*

tells CP which set address (SAD) command to enter for a

telecommunication line attached to a control unit. The variable *n* is a 1-character decimal number between 0 and 4, with a default of 4. The variable *n* can be:

- 0 tells CP to enter a SADZERO command.
- 1 tells CP to enter a SADONE command.
- 2 tells CP to enter a SADTWO command.
- 3 tells CP to enter a SADTHREE command.
- 4 (the default) tells CP not to enter a SAD command.

3705

defines the base address used to load the 3745 communications controller.

Usage Notes

1. For all emulated lines running EP or NCP (PEP), you must have an RDEVICE statement for every line and the lines must be in the DEVICES NOT_SENSED list.

If you do not want to use RDEVICE statements in your system configuration file, you can use the CP SET RDEVICE command. However, the emulated lines must still be in the DEVICES NOT_SENSED list. If you fail to do this, the lines may not come online and you will not be able to correct this situation without IPLing the system again.

2. Because emulator lines cannot be sensed dynamically, you should define all EP or NCP (PEP) emulator lines using either an RDEVICE statement or the CP SET RDEVICE command. The valid line types are:

- BSC_ADAPTER
- IBM1_ADAPTER
- TELE2_ADAPTER

3. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

4. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define an IBM Terminal Adapter Type 1 at device number 01F0, use the following RDEVICE statement:

```
Rdevice 01F0 Type IBM1_Adapter
```

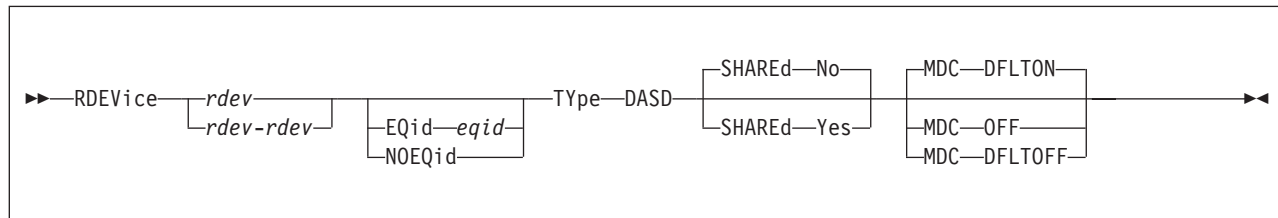
2. To define three BSC Terminal Control Type II adapters at device numbers 01F1, 01F2, and 01F3, use one of the following RDEVICE statements:

```
Rdevice 01F1-01F3 Type BSC_Adapter
```

3. To define six 3161, 3162, and 3163 lines at device addresses 030 through 035, use the following RDEVICE statement:

```
Rdevice 030-035 Type TELE2_Adapter      /* 316x ASCII lines */
```

RDEVICE Statement (DASD)



Purpose

Use this RDEVICE statement to define one or more real direct access storage devices (DASD) to CP. CP supports the following DASD:

3380

3390

9336

These DASD types do respond to the sense ID request instruction; you need to specify RDEVICE statements for them only if you want to specify the SHARED YES, the MDC OFF, or the MDC DFLTOFF options.

A Note About the 3850 Mass Storage System

VM/ESA release 1.1 was the last release to support the IBM 3850 Mass Storage System. Therefore, the system configuration file does not support the 3850. When devices are no longer supported, you may find that the existing code has not been removed from the product. If you have a 3850, you may still be able to use it by coding an RDEVICE macroinstruction in the HCPRIO ASSEMBLE file. For information about the RDEVICE macroinstruction, see the z/VM V6.2 (or previous) edition of this document.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the DASD that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe **DASD**

tells CP that the real device (or devices) that you are defining are DASD.

SHARED

tells CP whether you want the device or devices to be shared concurrently among multiple real systems.

In an SSI cluster, this setting specifies whether the device or devices are to be shared outside the SSI cluster. For more information, see usage note 4.

No (the default) tells CP not to share the device or devices among multiple real systems.

Yes

tells CP to share the device or devices among multiple real systems. This setting tells CP not to cache data on the real device in the minidisk cache. For more information on sharing DASDs, see Chapter 22, "DASD Sharing," on page 665.

MDC

tells CP whether you want the device or devices to be cached in the minidisk cache.

DFLTON

(the default if the SHARED option is not specified or the SHARED NO option is specified) tells CP to cache data on the real device in the minidisk cache except for minidisks that have caching specifically disabled by the MINIOPT NOMDC directory statement or the SET MDCACHE MDISK OFF command.

OFF

(the default if the SHARED YES option is specified) tells CP not to cache data on the real device in the minidisk cache.

DFLTOFF

tells CP to not cache data on the real device in the minidisk cache except for minidisks that have caching specifically enabled by the MINIOPT MDC directory statement or the SET MDCACHE MDISK ON command.

Usage Notes

1. Not all DASD types are eligible for caching in the minidisk cache. If you specify MDC DFLTON or MDC DFLTOFF for a device that is not cache eligible, data on that device will not be cached.
2. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

3. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

4. Table 10 on page 228 shows how the RDEV SHARED setting affects reserve/release, MDCACHE, and link in an SSI cluster.

RDEVICE (DASD)

Table 10. Effects of RDEV SHARED in an SSI cluster

CONDITION	RESERVE/RELEASE	MDCACHE	LINK
RDEV SHARED YES	Real reserve/release issued for fullpack minidisks with V mode suffix in both an SSI cluster and a non-SSI system. Virtual reserve/release issued for non-fullpack minidisks in an SSI cluster and a non-SSI system, but it affects only the system where the reserve/release is issued.	Minidisks not eligible for cache.	Always do link conflict checking with all systems in the SSI cluster, regardless of the SHARED setting.
RDEV SHARED NO	Real reserve/release issued for fullpack minidisks with V mode suffix in an SSI cluster. Virtual reserve/release issued for fullpack minidisks with V mode suffix in a non-SSI system, and for non-fullpack minidisks with V mode suffix in both an SSI cluster and a non-SSI system, but it affects only the system where the reserve/release is issued.	Minidisks are eligible for cache. Cache will be automatically turned OFF/ON when write links are granted/released on other systems in the SSI cluster.	Always do link conflict checking with all systems in the SSI cluster, regardless of the SHARED setting.

Examples

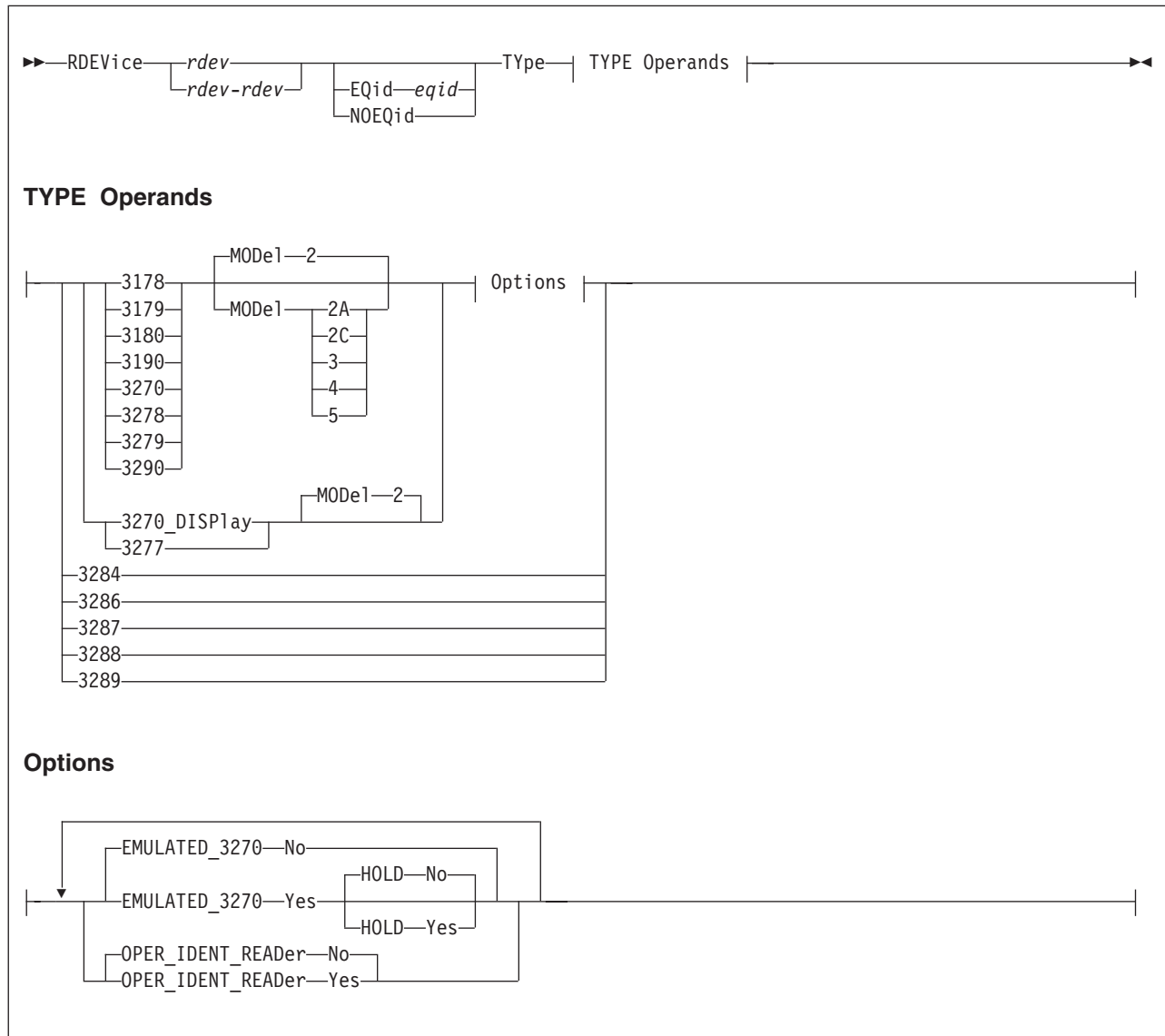
- To define a shared DASD with minidisk caching off at device number 0410, use the following RDEVICE statement:

```
Rdevice 0410 Type DASD Shared yes
```
- To define 64 shared DASDs with minidisk caching off at device numbers 100 through 13F and 32 shared DASDs at device numbers 140 through 15F, use the following RDEVICE statements:

```
Rdevice 100-13f Type Dasd Shared yes /* 3390 Dasd shared with */
/* other 2064 ... */
Rdevice 140-15f Type Dasd Shared yes /* 3380 Dasd shared with */
/* 2064 ... */
```
- To define a nonshared DASD with minidisk caching on, no RDEVICE statement is necessary.
- To define a nonshared DASD at device number 500 with minidisk caching enabled on a device only for those minidisks that have specifically enabled caching, use the following RDEVICE statement:

```
Rdevice 500 Type Dasd MDC DFLT0FF
```


RDEVICE Statement (Graphic Display Devices)



Purpose

Use this RDEVICE statement to define one or more graphic display devices to CP.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the graphic display devices that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and

RDEVICE (Graphic Display Devices)

OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TType 3178, 3179, 3180, 3190, 3270, 3278, 3279, or 3290

tells CP that the real device (or devices) that you are defining are graphic display devices. CP can determine dynamically all of these graphic display devices during initialization or when you vary on the device. You only need to specify these graphic display devices if you want to specify the extended attributes.

MODe1 2, 2A, 2C, 3, 4, or 5

is the model number of the graphic display device. If omitted, the default is Model 2.

TType 3270_DISPLAY or 3277

tells CP that the real device (or devices) that you are defining are graphic display devices. CP can determine dynamically all of the 3270 graphic display devices during initialization or when you vary on the device. You only need to specify the 3270 graphic display devices if you want to specify the extended attributes.

Note: The 3270-PC is supported in control-unit terminal mode and distributed-function terminal (DTF) mode when defined as a 3270.

You must specify the 3277 display because its device type cannot be determined.

MODe1 2

is the model number of the graphic display device. If omitted, the default is Model 2.

TType 3284, 3286, 3287, 3288, or 3289

tells CP that the real device (or devices) that you are defining are graphic printer devices. CP can determine dynamically all of the graphic printer devices during initialization or when you vary on the device; therefore, you do not need to specify them.

Note: CP cannot sense these devices when they are attached either to a 3174 or a 3274 control unit. If these devices are attached to a 3174 or a 3274 control unit, each device must be defined in the system configuration file using the RDEVICE statement.

EMULATED_3270 No

(the default) tells CP that this device (or devices) is not a TTY ASCII display terminal connected to the system through a 7171 ASCII DACU or ASCII Subsystem (an emulated 3270).

EMULATED_3270 Yes

tells CP that this device (or devices) is a TTY ASCII display terminal connected to the system through a 7171 ASCII DACU or ASCII Subsystem (an emulated 3270).

Note: The 3101 must be connected to a 7171 Control Unit. You must also specify EMULATED_3270 YES.

HOLD No

(the default) tells CP not to keep the display terminal telecommunications connection to the 7171 ASCII DACU or ASCII Subsystem after the virtual machine logs off or disconnects.

HOLD Yes

tells CP keep the display terminal telecommunications connection to the 7171 ASCII DACU or ASCII Subsystem after the virtual machine logs off or disconnects.

OPER_IDENT_READER No

(the default) tells CP that the 327x display does not have an operator identification card reader.

OPER_IDENT_READER Yes

tells CP that the 327x display has an operator identification card reader. If you specify OPER_IDENT_READER YES, the virtual machine operator can gain access to the system (log on) only by inserting a magnetically encoded card. Use of a badge reader is optional for each user ID and not required for any of them. Use of a badge reader cannot replace entering a correct password but may follow a correct password as an additional security measure. If you do not want to have a card reader authorize access, do not specify OPER_IDENT_READER YES, or specify OPER_IDENT_READER NO.

Usage Notes

1. For a complete list of all graphic displays and printers supported for this release, see Chapter 5, "Defining I/O Devices," on page 41.
2. You must ensure that the device numbers specified on the statement correspond to the device numbers required for the category of display terminal in the controller.
3. Refer to the *7171 Device Attachment Control Unit Reference Manual and Programming Guide* to determine which type of device (TYPE) to specify for a TTY ASCII terminal attached to a 7171 DACU or ASCII Subsystem.
4. The 3178, 3179, 3180, 3190, 3278, 3279, 3284, 3486, 3287, 3288, 3289, and 3290 devices are defined primarily for use with second-level systems. In a second-level system, you can define a printer or display to be at a particular device number and then you can do a first-level define of the device number. If you define the device in the system configuration file, the second-level system brings that device online immediately rather than having you define a device number first-level, issue the CP SET RDEVICE command second-level, and vary on the device second-level.
5. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

6. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a 3277 display at device number 0210, use the following RDEVICE statement:

```
Rdevice 0210 Type 3277
```

RDEVICE (Graphic Display Devices)

2. To define three 3270 displays at device numbers 0211, 0212, and 0213, and to indicate that users should not be able to log on to them without an operator identification card, use the following RDEVICE statement:

```
Rdevice 0211-0213 Type 3270_Display Oper_Ident_Reader yes
```

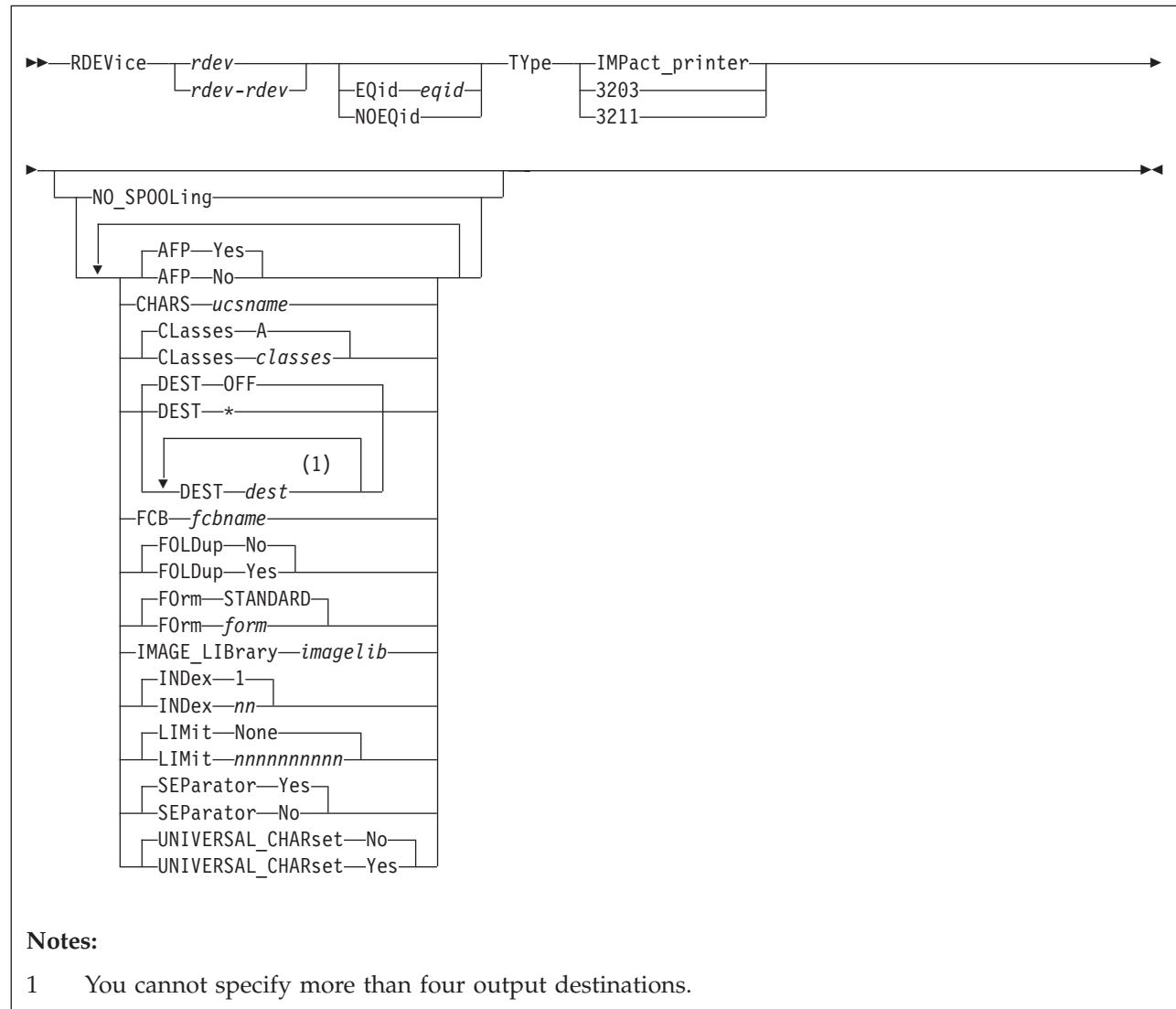
3. To define:

- 48 3270 displays at device numbers 800 through 82F
- 16 3277 displays at device numbers 830 through 83F
- 31 3278 displays at device numbers 970 through 98E
- One 3287 display at device number 98F
- One 3290 display at device number 1010
- 15 3190 displays at device numbers 1011 through 101F
- 61 3278 displays at device numbers 200 through 23C, which are TTY ASCII display terminals connected to the system through 7171 ASCII DACU or ASCII Subsystems, and which retain their connections after logging off or disconnecting

use the following RDEVICE statements:

```
Rdevice 800-82f   Type 3270_Display /* 3174 controller      */
                                     /* ... with 32 local ports */
Rdevice 830-83f   Type 3277         /* 3272 controller      */
                                     /* ... with 16 3277 displays */
Rdevice 970-98e   Type 3278         /* 3274 controller      */
                                     /* ... with 31 3178s and 3278s */
Rdevice 98f       Type 3287         /* 3287 printer         */
                                     /* ... hung off 3274 port 32 */
Rdevice 1010      Type 3290         /* 3290 information display on */
                                     /* ... port 0 of 3174 control */
                                     /* ... unit              */
Rdevice 1011-101f Type 3190         /* 15 3190s on          */
                                     /* ... 3174 control unit  */
Rdevice 200-23c   Type 3278,       /* 7171 ports looking like */
                  Emulated_3270 yes, /* ... 3278s to CP        */
                  Hold yes
```

RDEVICE Statement (Impact Printers)



Purpose

Use this RDEVICE statement to define the following system-managed, channel-attached impact printers to CP:

3203 (Only the 3203 Model 5 is supported.)

3211 (3211 printers are only supported as emulated by other printers.)

3262

4245

4248

6262

Operands

rdev

RDEVICE (Impact Printers)

rdev-rdev

is the real device number (or numbers) of the impact printer that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe IMPact_printer

TYpe 3202

TYpe 3211

tells CP that the real device (or devices) that you are defining is one of the impact printers listed above.

NO_SPOOLing

tells CP not to use the impact printer for spooling.

AFP Yes

(the default) tells CP that the impact printer can process files with advanced function printer (AFP) characteristics, XABs, or X'5A' CCWs.

AFP No

tells CP that the impact printer cannot process files with advanced function printer (AFP) characteristics, XABs, or X'5A' CCWs.

CHARS *uciname*

For a printer with the UNIVERSAL_CHARSET feature, CHARS *uciname* specifies the 1- to 4-character suffix of the name of the default universal character set (UCS) buffer image. The variable *uciname* must correspond to one of the UCS images stored in the image library. For example, if you specify:

```
Rdevice 0003 Type 3203 Chars an
```

The image library must contain a member named 3203AN.

Classes *classes*

defines the output spooling class or classes that the impact printer can print. Each class is 1 alphanumeric character and you can specify up to 8 classes. If you specify more than one class, do not include any blanks between the classes (for example, CLASSES ABC). If omitted, the default is A. If specified as an asterisk (*), the printer can process any file, regardless of class.

To change the spooling classes without having to re-IPL, use the CP START UR command. For more information about the CP START UR command, see the *z/VM: CP Commands and Utilities Reference*.

DEST OFF

DEST *

DEST *dest*

specifies the output destination values the printer can print. Specify DEST in one of the following ways:

- By default — if you omit the DEST operand, DEST OFF is assumed.

- You can specify as many as four destination values by entering four different DEST operands, as follows:
Dest printer1 Dest printer2 Dest printer3 Dest printer4
- DEST * specifies that the printer should process files regardless of destination.

To change the spooling destinations without having to re-IPL, use the CP START UR command. For more information about the CP START UR command, see the *z/VM: CP Commands and Utilities Reference*.

FCB *fcname*

specifies the 1- to 4-character alphanumeric suffix of the name of the default forms control buffer (FCB) CP should use after a cold start or force start. This must correspond to one of the FCB images added to an image library. For example, if you specify:

```
Rdevice 0003 Type 3203 FCB fcb8
```

The image library must contain a member named 3203FCB8.

FOLDup No

(the default) tells CP not to fold (translate) lowercase into uppercase.

FOLDup Yes

tells CP to fold (translate) lowercase into uppercase.

Form STANDARD**Form** *form*

is the current spooling form number that the printer can process. This form is the default operator form for the real printer when the operator starts the device after a cold start without specifying a form. Specify FORM in one of the following ways:

- FORM *form* (*form* is a 1- to 8-character operator form number for the files the printer can process)
- FORM * indicates that the printer can process files regardless of form number
- FORM STANDARD indicates that the type of paper to be mounted on the printer is the type of paper that the installation has assigned the name STANDARD. Each installation establishes its own set of form names, assigns those form names to types of paper, and informs the operations staff and end users of the correlation between form names and types of paper.

If omitted, the default is STANDARD.

IMAGE_LIBRARY *imagelib*

tells CP which image library to use after a cold start. If omitted, the default is IMAGE_LIBRARY *nnnn* (*nnnn* is the device type number).

INDEX *nn*

specifies the position at which to start printing. The variable *nn* is a decimal number from 1 to 31. If omitted, the default is 1.

Note: The INDEX operand is only valid for 3211 printers. If you specify it for another impact printer, CP ignores the operand.

LIMit None

(the default) tells CP that this impact printer can print files with an unlimited number of records.

LIMit *nnnnnnnnnn*

tells CP that this impact printer limits the size of files it can print. The variable

RDEVICE (Impact Printers)

nnnnnnnnnn is a 1- to 10-digit decimal number that indicates the maximum number of records per file that this printer can print.

SEPARATOR Yes

(the default) tells CP to print separator pages between output files.

SEPARATOR No

tells CP not to print separator pages between output files.

UNIVERSAL_CHARSET No

(the default) tells CP that this impact printer is not a universal character set printer.

UNIVERSAL_CHARSET Yes

tells CP that this impact printer is a universal character set printer.

Note: Although UNIVERSAL_CHARSET Yes is accepted for TYPE IMPACT printer, it is only meaningful for TYPE 3203 and TYPE 3211 printers.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a 3203 printer at device number 0110 that prints only class A spool files (the default value), use the following RDEVICE statement:

```
Rdevice 0110 Type Impact_Printer
```
2. To define a 3262 printer at device number 0110 that will be dedicated to a guest, use the following RDEVICE statement:

```
Rdevice 0110 Type Impact_Printer No_Spooling
```
3. To define an impact printer at device number:
 - E0E that can print class 1, process “standard” forms, and use the normal output destination, forms control buffer FCB8, and image library 4245IMAG
 - 00E that can print class A files, use forms control buffer FCB8, and process FORM8 forms
 - 01E that can print class A files, use forms control buffer FCB8, and process FORM1 forms

use the following RDEVICE statements:

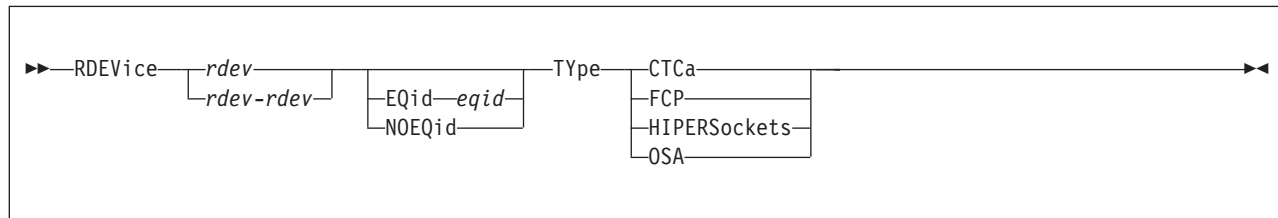
```
Rdevice e0e Type Impact_Printer,  
            Class 1,  
            Dest normal,  
            FCB fcb8,  
            Image_Library 4245IMAG,  
            Form standard
```

```
Rdevice 00e Type 3203,  
            Class a,  
            FCB fcb8,  
            Form form8
```


RDEVICE (Impact Printers)

```
Rdevice 01e Type 3211,      /* 4248 printer running in 3211 */
              Class a,      /* compatibility mode          */
              FCB fcb8,
              Form form1
```

RDEVICE Statement (Special Devices)



Purpose

Use this RDEVICE statement to define device addresses of certain types of devices to CP.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the devices that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TType CTCa

tells CP that the real device (or devices) that you are defining is a channel-to-channel device.

Note: Specify a 3737 Remote Channel-to-Channel Unit Model 2 as a CTCA.

TType FCP

tells CP that the real device (or devices) that you are defining is a Fiber-Channel-Protocol device.

TType HIPERSockets

tells CP that the real device (or devices) that you are defining is a HiperSockets device.

TType OSA

tells CP that the real device (or devices) that you are defining is an Open-Systems-Adapter device.

Usage Notes

1. CP can sense some devices. Therefore you do not need to specify them in the system configuration file, unless you are running programs in the device that do not respond to sense ID requests.

2. If the specified EQID has already been assigned to a different class of devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different class of devices.

3. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

Examples

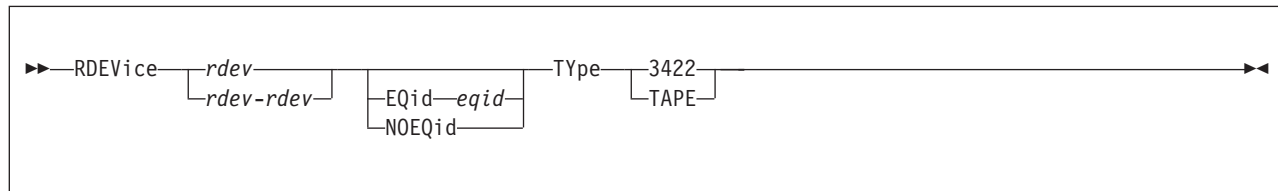
1. To define a channel-to-channel adapter at device number 0250, use the following RDEVICE statement:

```
Rdevice 0250 Type CTCA
```
2. To define an Open-Systems-Adapter device at device number 0252, use the following RDEVICE statement:

```
Rdevice 0252 Type OSA
```
3. The following RDEVICE statement defines:
 - One channel-to-channel adapter at device address 250

```
/*-----*/
/* Real CTCA to 4381, 4381 owns CTCA          */
/*-----*/
Rdevice 250 Type CTCA
```

RDEVICE Statement (Tape Units)



Purpose

Use this RDEVICE statement to define one or more tape units to CP.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the tape unit that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe 3422

tells CP that the real device (or devices) that you are defining is an IBM 3422 magnetic tape subsystem.

TYpe TAPE

specifies an IBM tape unit that can be dynamically sensed by CP (such as an IBM 3424, 3480, 3490 or 3590 tape unit).

Usage Notes

1. CP can dynamically sense most tape units at IPL time (such as the IBM 3480 and 3490 tape units), so there is no need for an RDEVICE statement for those units. However, if you decide to define one of these type of tape units to CP without it being connected to the system at IPL time, you can use the RDEVICE statement with the TYPE TAPE operand.
2. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

3. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define a 3422 tape unit at device number 0310, use the following RDEVICE statement:

```
Rdevice 0310 Type 3422
```

2. To define eight 3422 tape drives at device numbers F10 through F17, use the following RDEVICE statements:

```
/*-----*/
/* We do not have to specify RDEVICE statements for our: */
/* */
/* 3490s at 100-10F because they answer with their device type */
/* when asked (sensed). */
/* */
/* 3480s at 500-50F because they answer with their device type */
/* when asked (sensed). */
/* */
/*-----*/
```

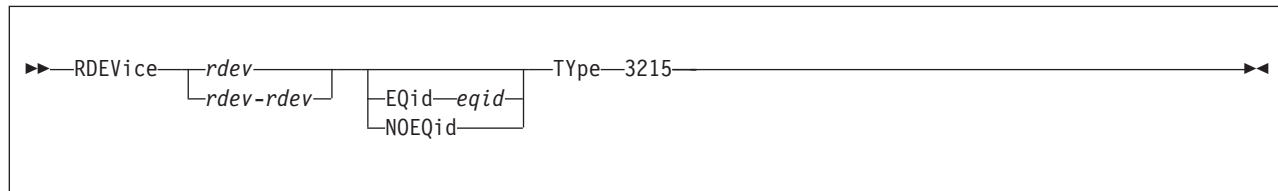
```
/*-----*/
/* Define our eight 3422s: */
/*-----*/
```

```
Rdevice f10-f17 Type 3422
```

3. To define a tape unit which can be dynamically sensed by CP at device number 0F20, use the following RDEVICE statement:

```
Rdevice 0F20 Type Tape
```

RDEVICE Statement (Terminals)



Purpose

Use this RDEVICE statement to define one or more terminals to CP.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the terminal(s) that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe 3215

tells CP that the real device (or devices) that you are defining is a 3215 terminal.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

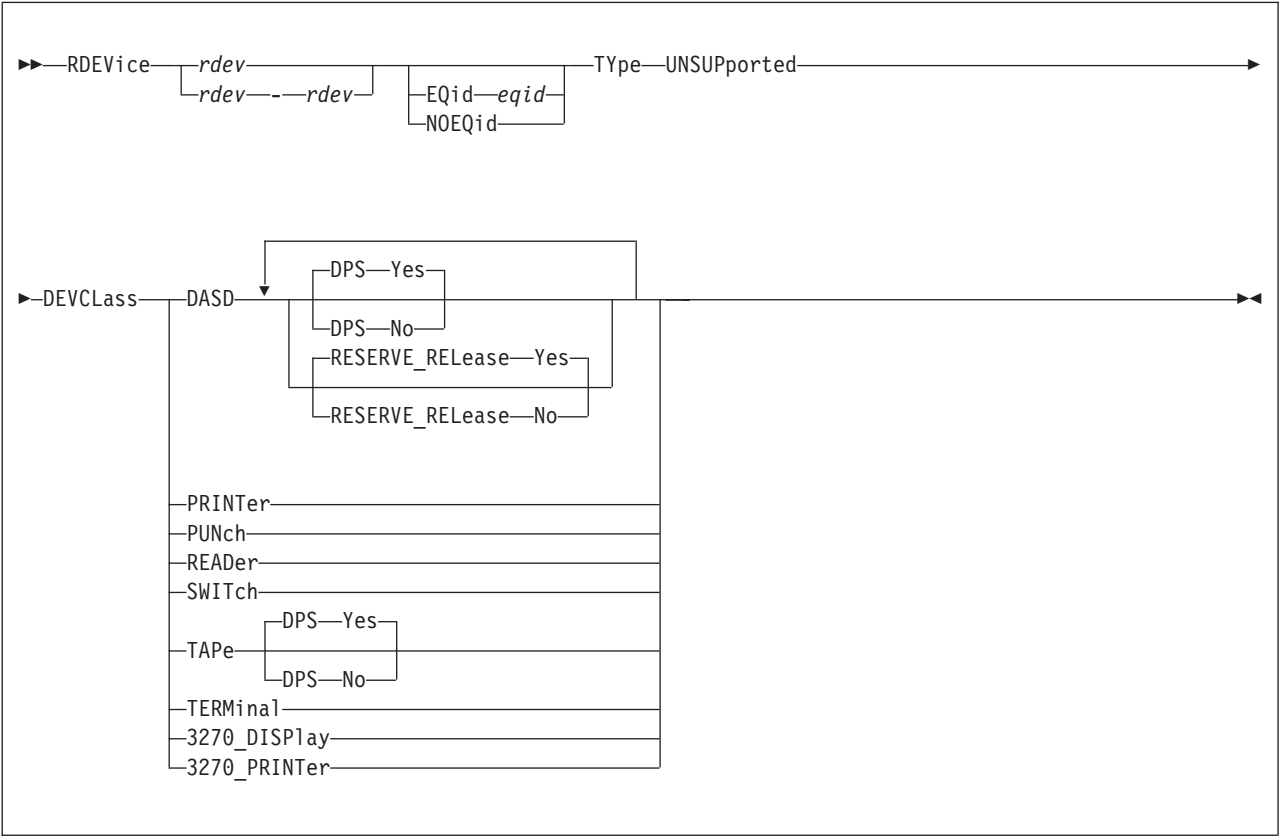
EQID must be unique for the specified device class.

Examples

1. To define a 3215 terminal at device number 0253, use the following RDEVICE statement:

```
Rdevice 0253 Type 3215
```

RDEVICE Statement (Unsupported Devices)



Purpose

Use this RDEVICE statement to define one or more unsupported devices to CP.

Note: When you define an unsupported device, you must dedicate the device to a virtual machine. To do this, specify the DEDICATE directory statement in the virtual machine's directory statement or issue the CP ATTACH command. For more information about the DEDICATE statement, see “DEDICATE Directory Statement” on page 491. For more information about the CP ATTACH command, see the *z/VM: CP Commands and Utilities Reference* book.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the unsupported device that you want defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

RDEVICE (Unsupported Devices)

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

Type UNSUPported

tells CP that this is an unsupported device type.

DEVClass

is the device class of the unsupported device. Valid classes are:

Class Unsupported Device Type

DASD

Direct access storage devices

PRINTer

Unit record printer devices

PUNch

Unit record punch devices

READer

Unit record input devices

SWITch

Dynamic switching devices.

TAPe Tape devices

TERMinal

Terminals

3270_DISPLAY

3270 display devices

3270_PRINTer

3270 printer devices

DPS Yes

(the default) tells CP that the unsupported DASD or tape device supports the dynamic path selection (DPS) function: CCW command codes X'34', Sense Path Group Identifier (SNID), and X'AF', Set Path Group Identifier (SPID).

When you specify DPS YES, CP places VM's path group identifier (PGID) in the device's control unit for each path to the control unit. This placement enables the use of a single PGID for all devices connected to the control unit, regardless of the number of guests that might be using the different devices on the control unit, how many times a given guest is re-IPLed, or how a given device might be shifted from one guest to another over time. A guest operating system, such as z/OS®, has an alternate-PGID capability so it can deal with the VM PGID on these channel paths.

DPS No

tells CP that the unsupported DASD or tape device does not support the dynamic path selection (DPS) function.

When you specify DPS NO, VM takes no action with regard to path groups or PGIDs. It is the responsibility of the guest to which the unsupported DASD or tape device is dedicated or attached to form and maintain path groups, if desired, using the guest's own PGID. The use of a guest's PGID is often cumbersome if not unworkable for DPS devices, because a PGID on a channel path to a control unit applies to all devices connected to the control unit, and a PGID can only be changed after clearing any previous PGID with a system-reset of the channel path or paths.

If the guest operating system to which the device will be dedicated or attached does not contain alternate PGID support, specify DPS NO.

RESERVE_RELEASE Yes

(the default) tells CP that the unsupported DASD supports the reserve/release function: CCW command codes X'B4', Device Reserve (RES), X'94', Device Release (REL), and X'14', Unconditional Reserve (UR).

When you specify RESERVE_RELEASE YES for an unsupported DASD, CP issues the DEVICE RELEASE CCW command to the device whenever the virtual machine to which the device is dedicated or attached is reset by the CP SYSTEM CLEAR, SYSTEM RESET, or IPL commands.

RESERVE_RELEASE No

tells CP that the unsupported DASD does not support the reserve/release function. If you specify RESERVE_RELEASE NO for an unsupported DASD that contains support for the reserve/release function, a malfunction of the guest to which the device is dedicated or attached might leave a device reservation held by the guest, preventing the device from being accessed by other sharing systems.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

Examples

1. To define an unsupported DASD, use the following RDEVICE statement:

```
Rdevice 0fff Type UnSupported DevClass DASD
```

2. To define an unsupported DASD that supports dynamic path selection, use the following RDEVICE statement:

```
Rdevice 0fe0 Type UnSupported DevClass DASD DPS yes
```

3. To define an unsupported DASD that supports both dynamic path selection and reserve/release, use the following RDEVICE statement:

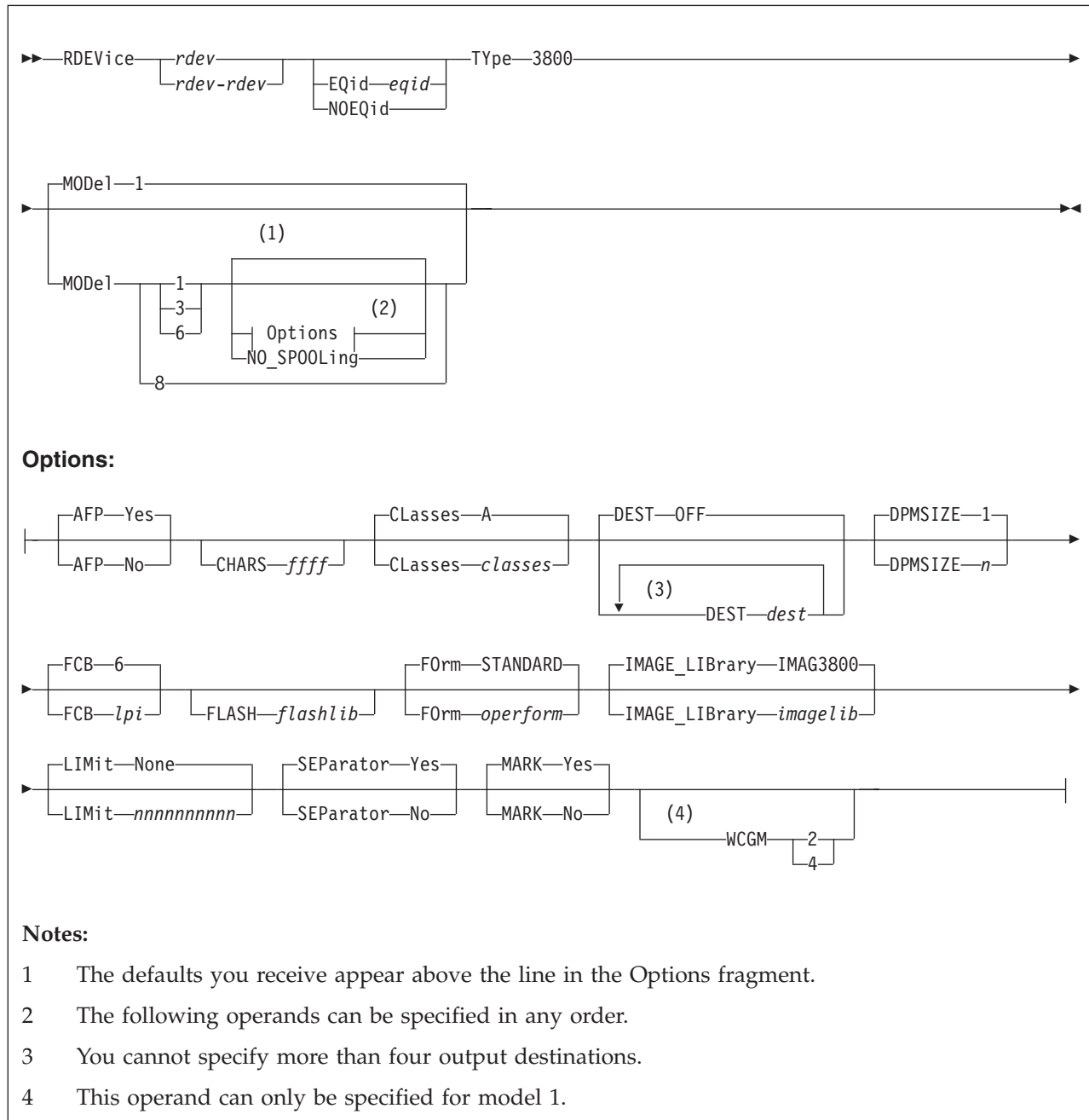
```
Rdevice 0fd0 Type UnSupported,
                DevClass DASD,
                DPS yes,
                Reserve_Release yes
```

4. To define 4 unsupported tape devices and 23 unsupported DASD that support both dynamic path selection and reserve/release, use the following RDEVICE statements:

```
Rdevice 2040-2043 Type UnSupported,      /* Unsupported tape */
                DevClass Tape           /* device           */

Rdevice 1280-1296 Type UnSupported, /* Unsupported DASD supporting */
                DevClass DASD,      /* reserve/release CCW and    */
                DPS yes,             /* dynamic path selection CCW */
                Reserve_Release yes
```

RDEVICE Statement (3800 Printers)



Purpose

Use this RDEVICE statement to define 3800 and 3900 printers to CP.

Operands

rdev

rdev-rdev

is the real device number (or numbers) of the 3800 printer that you want

defined. The maximum number of devices allowed within a range is 256. Each *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

EQid *eqid*

assigns the device equivalency ID (EQID) *eqid* to the RDEV. The *eqid* is a string of 1–8 alphanumeric characters. Note that for CTCA, FCP, HiperSocket, and OSA devices, this EQID must be unique or be shared only by other devices of the same type. For all other devices, the EQID must be unique across all devices on the system.

NOEQid

removes a previously assigned EQID from this RDEV and reverts back to a system-generated EQID. If no EQID was previously assigned by a user, no action takes place.

TYpe 3800

tells CP that the real device (or devices) that you are defining is a 3800 printer.

MODe1 1, 3, 6, or 8

tells CP the model number of the 3800 printer that you are defining. The default value is 1.

Note:

1. The 3800 Models 3 and 6 are supported in Model 1 compatibility mode, defined as a Model 1, or by using the Advanced Function Printing licensed program, defined as a Model 3 or as a Model 6. If you are using them as advanced function printers, specify AFP YES.
2. The 3800 Model 8 is supported using an Advanced Function Printing licensed program.

NO_SPOOLing

tells CP not to use the 3800 printer for spooling.

AFP Yes**AFP No**

specifies whether the printer is to process files with advanced function printer (AFP) characteristics, XABs, or X'5A' CCWs. The default is YES.

CHARS *ffff*

specifies the name of a character-arrangement table for the separator page to be used after a cold start. The default values for 3800 printers are

For Model 1, CHARS GF10.

For Model 3 or Model 6, CHARS GF12.

Classes *classes*

defines the output spooling class or classes that the 3800 Model 1, Model 3, or Model 6 printer can print. Each class is 1 alphanumeric character and you can specify up to 8 classes. If you specify more than one class, do not include any blanks between the classes (for example, CLASSES ABC). If omitted, the default is A. If specified as an asterisk (*), the printer can process any file, regardless of class.

To change the spooling classes without having to re-IPL, use the CP START UR command. For more information, see the *z/VM: CP Commands and Utilities Reference*.

DEST OFF**DEST** *dest*

specifies the output destination values the printer can print. Specify DEST in one of the following ways:

RDEVICE (3800 Printers)

- By default — if you omit the DEST operand, DEST OFF is assumed.
- You can specify as many as four destination values by entering four different DEST operands, as follows:
Dest printer1 Dest printer2 Dest printer3 Dest printer4
- DEST * specifies that the printer should process files regardless of destination.

To change the spooling destinations without having to re-IPL, use the CP START UR command. For more information about the CP START UR command, see the *z/VM: CP Commands and Utilities Reference*.

DPMSIZE *n*

specifies the maximum size of the delayed purge queue (see note 1) that the 3800 Model 1, Model 3, or Model 6 printer uses after a cold start. The default value for *n* is 1, the maximum is 9. If 0 is specified, no delayed purge queue is maintained (See note 2).

Note:

1. After the 3800 prints a file, CP places the file on the delayed purge queue if a delayed purge queue is being maintained. When the queue is full, CP purges the oldest file. This delay helps ensure that the 3800 (a) transfers the last page of the file from the page buffer in the 3800 printer to paper and (b) stacks the printed page. If the 3800 fails before CP purges a file from the delayed purge queue, CP places the file in system hold.
2. Specifying 0 for DPMSIZE saves some spool DASD space because files printed on the 3800 are purged immediately. However, this decreases the possibility of recovering a printer file which has failed during printing.

FCB *lpi*

specifies the name of the forms control buffer for the separator page to be used after a cold start. Note that you can override this value by naming a forms control buffer on the START command. The default value for *lpi* is 6.

The number of lines to be printed on the separator page is determined by the FCB loaded on the printer. The default separator page contains 58 lines of data. If the page length defined by the FCB is less than the default separator page length, the separator page data must be customized in order to fit on a single page. This may be done using CP Exit points that are provided in separator page processing. See the *z/VM: CP Exit Customization* for details.

FLASH *flashlib*

specifies the flash overlay for use with this device.

FORM *operform*

is the current spooling form number that the printer can process. This form is the default operator form for the real printer when the operator starts the device after a cold start without specifying a form. Specify this parameter in one of the following ways:

- FORM *operform*, where *operform* specifies a one- to eight-character operator form number for the files the printer can process.
- FORM *, where the asterisk specifies that the printer can process files regardless of form number.
- FORM STANDARD, where STANDARD indicates that the type of paper to be mounted on the printer is the type of paper that the installation has assigned the name STANDARD. Each installation establishes its own set of

form names, assigns those form names to types of paper, and informs the operations staff and end users of the correlation between form names and types of paper.

STANDARD is the default.

IMAGE_LIB*rary imagelib*

specifies the name of the image library to be used after a cold start. Note that you can override this value by specifying an image library name on the START command.

The default value is IMAGE IMAG3800.

LIMit None

(the default) tells CP that this 3800 printer can print files with an unlimited number of records.

LIMit *nnnnnnnnnn*

tells CP that this 3800 printer limits the size of files it can print. The variable *nnnnnnnnnn* is a 1- to 10-digit decimal number that indicates the maximum number of records per file that this printer can print.

SEParator Yes

SEParator No

specifies whether a separator is desired for output files. The default value is SEPARATOR YES.

MARK Yes

MARK No

specifies whether a 3800 printer will mark separator trailer pages with separator bars.

When 'Mark Yes' is in effect, 3 separator trailer pages are printed for each file. 'Mark No' causes only one trailer page to be printed, thus saving paper. However, using 'Mark No' could also make it more difficult to separate 3800 output, as there are no markings between files. The default is YES.

WCGM 2

WCGM 4

specifies that the 3800 has either the 2-writable-character generation module feature or the 4-writable-character generation module feature.

Note: You can only specify this option for a 3800 model 1.

For a 3800 model 1, the default is WCGM 2. For 3800 models 3, 6, and 8, the default is WCGM 4.

Usage Notes

1. If the specified EQID has already been assigned to one or more other devices, CP will issue the following message:

HCP048E

Specified EQID already assigned to a different device.

2. If the issued command attempts to assign an EQID to multiple devices and the input device type requires each device to have a unique EQID, CP will issue the following message:

HCP048E

EQID must be unique for the specified device class.

RDEVICE (3800 Printers)

Examples

1. To define a Model 3 3800 printer at device number 0500 to be dedicated to a virtual machine, use the following RDEVICE statement:

```
Rdevice 0500 Type 3800 Model 3
```

2. To define three Model 8 3800 printers at device numbers 0501, 0502, and 0503 to be dedicated to virtual machines, use the following RDEVICE statement:

```
Rdevice 0501-0503 Type 3800 Model 8
```

3. To define a 3800:

- Model 1 printer at device number 100 with a class of 1, the 4-writable-character generation module, and an image library called IMAG3800
- Model 3 printer at device number 150 driven by AFP
- Model 6 printer at device number 180 driven by AFP

use the following RDEVICE statements:

```
/*-----*/
/* What you always wanted to know about our printers, but were */
/* afraid to ask: */
/* */
/* 3800 Model 1 is a CP Spooling Printer */
/* 3800 Model 3 is driven by the AFP Program Product */
/* 3800 Model 6 is driven by the AFP Program Product */

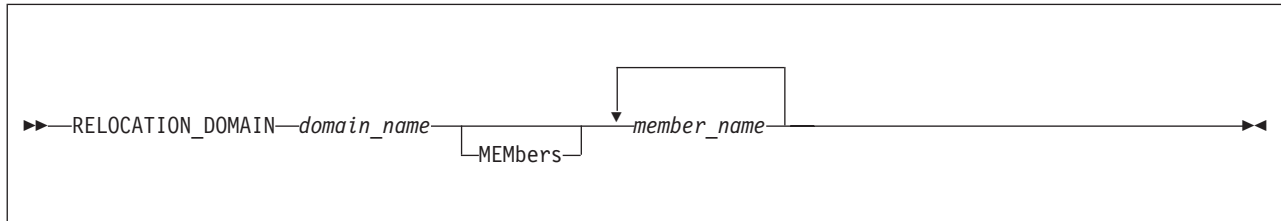
/* */
/* Note: 3800 Models 3, 6 and 8 can be specified as either: */
/*      Type 3800 */
/*      - or - */
/*      Type AFP */
/*-----*/

RDevice 100 Type 3800 Model 1,
                        Class 1,
                        WCGM 4,
                        IMAGE_Library IMAG3800

Rdevice 150 Type 3800 Model 3,
                        AFP Yes

Rdevice 180 Type AFP Model 6
```

RELOCATION_DOMAIN Statement



Purpose

Use to define subsets of the SSI membership as domains. A domain specifies the set of systems among which a guest may relocate. The domain imposes a common set of architectural characteristics that ensure a guest is presented with consistent architecture whichever member of the domain the guest runs in. When an ordinary user first logs on, its associated domain is the entire SSI. A multi-configuration virtual machine is permanently assigned to the singleton domain of the member on which it is running.

How to Specify

Include as many statements as needed; they are optional. This statement must come after the SSI statement that defines the SSI cluster. If you specify more than one statement with the same domain name, the first definition will be accepted and subsequent statements will receive an error.

Operands

domain_name

The one- to eight-character name of the domain. The reserved word “SSI” is excluded from use (see SET VMRELOCATE command). Also, the names of SSI member systems are predefined as singleton domains and may not be modified by this statement. The domain name specified here may not be the same as the name of any member in the SSI cluster. The name may consist of only A-Z and 0-9.

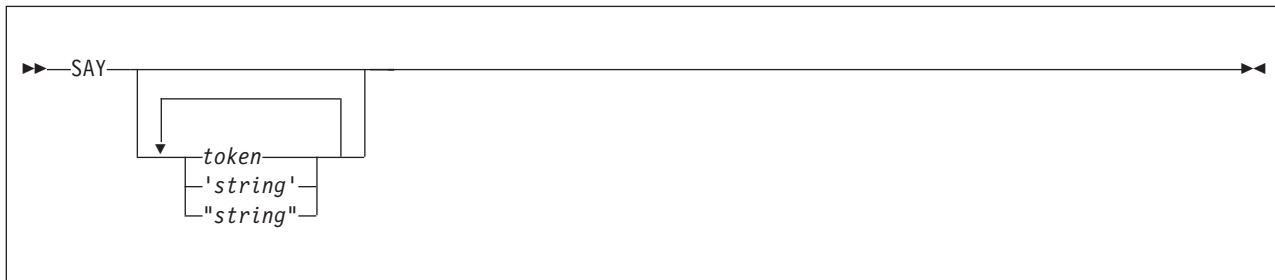
MEMbers *member_name*

A list of one or more SSI member system names comprising the domain. Member system names are one- to eight-characters in length using only A-Z and 0-9.

Usage Notes

1. For more information about relocation domains, see “Using Relocation Domains” on page 750.

SAY Statement



Purpose

Use the SAY statement to write a line of text to the operator's console during initialization.

How to Specify

Include as many statements as needed; they are optional. You can place SAY statements anywhere in the system configuration file.

Operands

token

is the text to be displayed. Because the token is not delimited by quotation marks, it will be converted to upper case when it is displayed.

'string'

"string"

is the text to be displayed. The text inside the quotation marks is not converted to upper case. The string is displayed unchanged and without the delimiting quotation marks.

Usage Notes

1. Multiple blanks not within quotation marks are compressed to a single blank.
2. Multiple blanks within quotation marks are not compressed.
3. Variable substitution does not occur for any token specified on the SAY statement.
4. A SAY statement that contains no text will cause a blank line to be displayed.
5. Use two consecutive double quotation marks ("") to represent a " character within a string delimited by double quotation marks. Similarly, use two consecutive single quotation marks ("") to represent a ' character within a string delimited by single quotation marks.
6. Each SAY statement shows up as a message on the operator's console. The messages are not displayed as they are encountered. These, as well as all the other initialization messages, are queued in storage until the operator is autologged.
7. Messages that display the SAY statement text will also appear in a spooled console listing from the IPL. Use an appropriate text length on your SAY statements to ensure the entire text is captured in the spooled console file.
The text limit for a SAY statement is approximately 1900 characters. This is the maximum amount of data that will be displayed at the operator's console. For

data written to a console file, the existing limit is 299 characters. Because the logical record length of a console file is 132, also note that any data placed in a console file may be arbitrarily split into multiple lines.

Examples

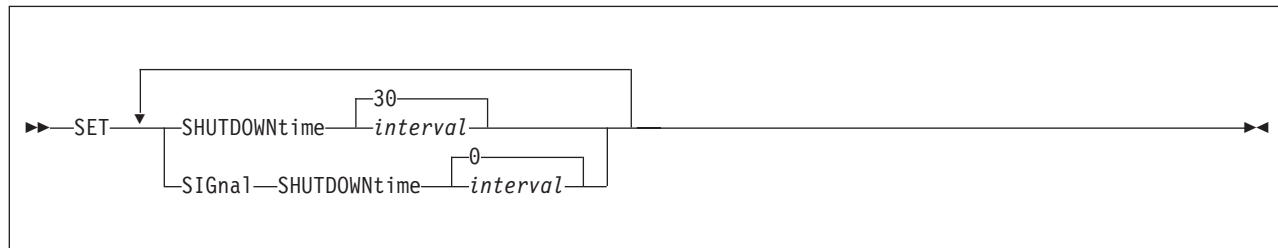
1. If your system configuration file contains the following:

```
SAY 'at line 100, a test of SAY:'
SAY "Reading file" -system- config
SAY
SAY 'Here''s my      test'   a b      c
SAY
SAY "Here''s another test"
```

Your operator would see:

```
HCPZPQ2780I At line 100, a test of SAY:
HCPZPQ2780I Reading file -SYSTEM- CONFIG
HCPZPQ2780I
HCPZPQ2780I Here's my      test A B C
HCPZPQ2780I
HCPZPQ2780I Here''s another test
```

SET Statement



Purpose

Use the SET statement to define default system configuration values.

Operands

SHUTDOWNtime *interval*

defines the amount of time reserved for a CP shutdown to be performed. The *interval* specifies a number of seconds in the range 0 - 32767. If SET SHUTDOWNTIME is not specified in the system configuration file, the default is 30 seconds.

When a SHUTDOWN command is issued or the z/VM system shuts down automatically as the result of a hardware deactivation signal, there is a time interval within which the shutdown must be completed. The SHUTDOWNTIME value specifies how much of the shutdown time interval is reserved for CP. The difference between the shutdown time interval and the time reserved for CP determines how much time, if any, is available for guest operating systems to perform their own shutdown processing.

SIGna1 SHUTDOWNtime *interval*

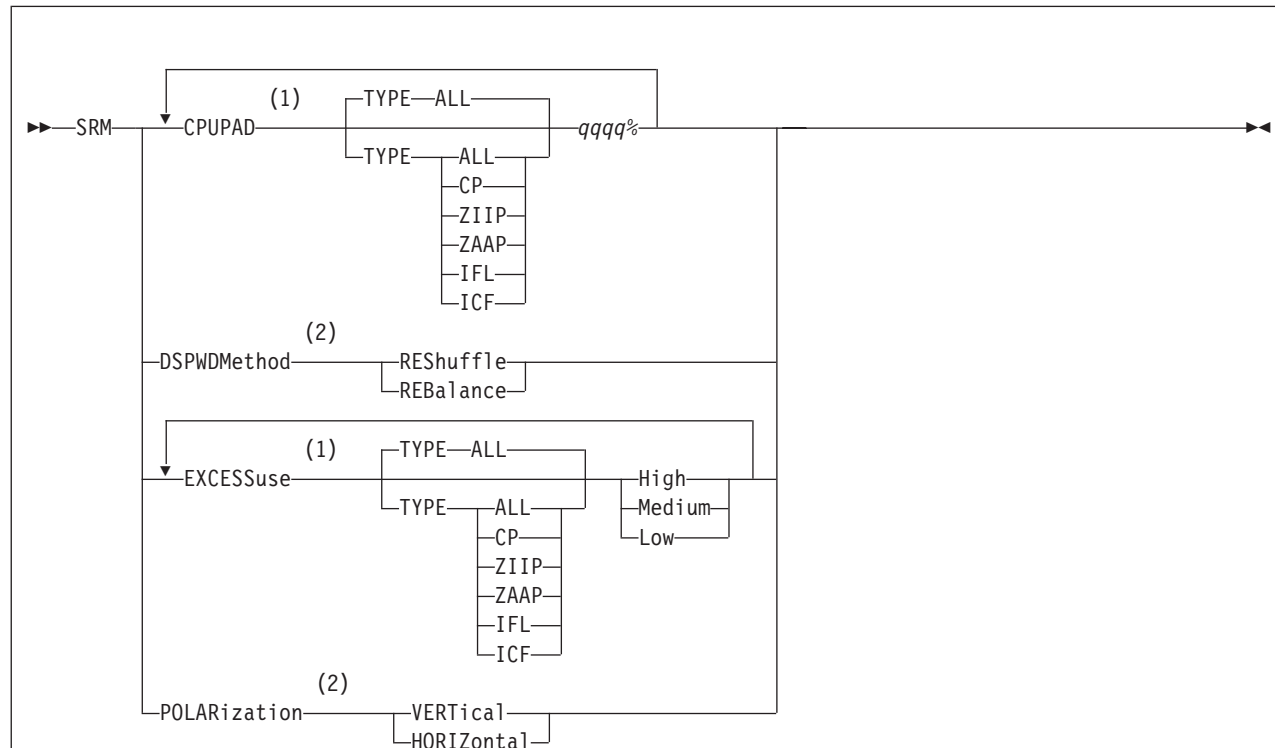
defines the duration of the system default shutdown signal timeout interval. The *interval* specifies a number of seconds in the range 0 - 32767. If SET SIGNAL SHUTDOWNTIME is not specified in the system configuration file, the default is 0 seconds.

If a SIGNAL, FORCE, or SHUTDOWN command is issued without specifying an interval, the system default shutdown signal timeout interval specifies the amount of time allowed for guest operating systems to complete their shutdown processing, and this value is used to determine the default interval for the command. If the timeout value is greater than 0, a shutdown signal is sent to enabled users. If the timeout value is 0, shutdown signals are suppressed.

Usage Notes

1. The CP shutdown interval value is an estimation used to ensure that enough time is reserved from a shutdown interval for CP to shut down cleanly. The CP shutdown interval can be dynamically reset for the current system IPL by the SET SHUTDOWNTIME command.
2. The system default shutdown signal timeout interval can be dynamically reset for the current system IPL by the SET SIGNAL command.
3. A user is enabled for shutdown signals only when a guest operating system is running in the virtual machine and has enabled to receive these signals.

SRM Statement



Notes:

- 1 The CPUPAD and EXCESSUSE operands can be specified more than once per statement, but only to specify settings for different CPU types using the TYPE operand. That is, the CPUPAD and EXCESSUSE setting for a given CPU type can be specified only once per statement.
- 2 You can specify the DSPWDMETHOD and POLARIZATION operands only once per statement.

Purpose

Use the SRM statement to change system resource manager settings related to HiperDispatch. For additional information on HiperDispatch, see Chapter 15, “z/VM HiperDispatch,” on page 431.

Operands

CPUPAD TYPE

specifies the CPU type pool to which the CPUPAD setting applies.

CPUPAD qqqq%

specifies the amount of additional CPU capacity the system should attempt to keep unparked beyond that which the system projects it will need. *qqqq* is a value from 0 through 6400, which represents the amount of additional CPU capacity as a percentage of an entire CPU. A value of 100 represents an entire CPU. This setting applies only when the system is running in vertical polarization mode. When the system's projection plus the specified amount of additional CPU capacity exceeds the partition's entitlement, this value might not be used in determining how many CPUs are unparked.

When not otherwise specified, the default CPUPAD setting for a CPU type is 100%.

DSPWDMethod REShuffle

sets the dispatcher work distribution algorithm to reshuffle. This algorithm periodically alters the home assignments of active virtual CPUs in an attempt to balance the number of virtual CPUs on all dispatch vectors. Unless a system configuration file SRM statement or a CP SET SRM command changes the work distribution algorithm, the system uses the reshuffle algorithm.

DSPWDMethod REBalance

sets the dispatcher work distribution algorithm to rebalance. This algorithm tracks virtual machine CPU utilization and periodically alters the home assignments of virtual CPUs in an attempt to balance the CPU demand on dispatch vectors. This option should be used with caution. Use this option only when specifically instructed to do so by IBM.

EXCESSuse

specifies how aggressively the system should attempt to use unentitled CPU capacity. This setting applies only when the system is running in vertical polarization mode, and affects how aggressively vertical low CPUs are used to consume unentitled CPU capacity.

EXCESSuse TYPE

specifies the CPU type pool to which the EXCESSUSE setting applies.

EXCESSuse High

indicates that the system should be aggressive in using unentitled CPU capacity.

EXCESSuse Medium

indicates that the system should be moderately aggressive in using unentitled CPU capacity.

When not otherwise specified, the default EXCESSUSE setting for a CPU type is Medium.

EXCESSuse Low

indicates that the system should not be aggressive in using unentitled CPU capacity.

POLARization VERTical

requests that z/VM and PR/SM[™] operate the partition in vertical polarization mode. In vertical polarization mode, the partition's logical CPUs have differing entitlements to physical CPU resources. Some logical CPUs are entitled to an entire physical CPU, while others are entitled to only a fraction of a physical CPU or perhaps only to the unused CPU entitlements left unconsumed by other partitions. Further, in a vertical polarization mode partition, PR/SM dispatches high entitlement logical CPUs on the same physical CPUs over and over again, thereby preserving accumulated cache contents. When z/VM runs in a vertical polarization mode partition, it tends to run the system's workload on fewer logical CPUs, tends to keep MP guests' virtual CPUs together with respect to the partition's cache topology, and tends not to move virtual CPUs among logical CPUs. In aggregate, these behaviors tend to improve system performance.

POLARization HORIZontal

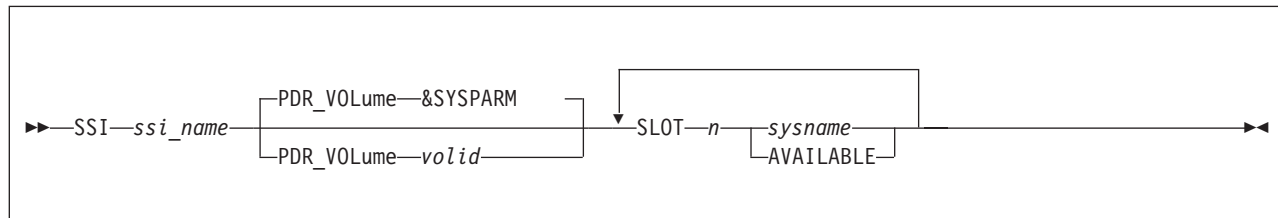
requests that z/VM and PR/SM operate the partition in horizontal polarization mode. In a horizontal polarization mode partition, each online (configured) logical CPU of a particular CPU type gets an equal portion of the partition's weight for that CPU type. For instance, if a partition with 16 online logical

| CPUs of type CP had a PR/SM weight that entitled those logical CPUs to 8
| real CPUs of type CP, then each of the 16 logical CPUs would be entitled to
| 50% of a real CPU; and when all other partitions consume their entitlement,
| these 16 will get no more than their 50% of a real CPU. Further, in a horizontal
| polarization mode partition, PR/SM puts less emphasis on holding logical
| CPUs fixed on physical CPUs, and z/VM tends to spread work evenly over
| the online logical CPUs and tends to let virtual CPUs move from one logical
| CPU to another fairly freely.

Usage Notes

- | 1. When topology information is not available (for example, when running second
| level on z/VM), the default polarization is horizontal, and it cannot be
| changed.
- | 2. When topology information is available, and the polarization type has not been
| specified with the SRM POLARIZATION configuration statement, the default
| polarization is vertical.

SSI Statement



Purpose

Use the SSI statement to define the name of the single system image (SSI) cluster and the systems that are members of the SSI cluster. The statement also identifies the location of the persistent data record (PDR).

How to Specify

SSI is an optional statement. If specified, only one statement is allowed. Subsequent SSI statements cause a message to be displayed and are ignored. Each slot can be specified only once. The SSI statement must be the same for all members in the SSI cluster.

The system initializing with a system configuration file containing the SSI statement must be one of the members of the SSI cluster. The SSI statement must be processed after the system name has been established by a previous `SYSTEM_IDENTIFIER` or `SYSTEM_IDENTIFIER_DEFAULT` statement.

Operands

ssi_name

is the name of the SSI cluster. The name can be up to eight alphanumeric characters.

PDR_VOLume *valid*

tells CP the volume label of the device that contains the persistent data record (PDR) for the SSI cluster. If omitted, the default is the volume containing the active PARM disk. The volume must be included in either the CP-owned or user volume list.

PDR_VOLume **&SYSPARM**

tells CP that the volume containing the active PARM disk is the device that contains the persistent data record (PDR) for the SSI cluster.

SLOT *n*

tells CP the number of the slot in the SSI member list. *n* must be a decimal number from 1 to 4. If any of the slots is not specified, it will automatically be defined as AVAILABLE.

sysname

AVAILABLE

is the 1- to 8-character system name of a system that is a member of the SSI cluster. The system name must be alphanumeric.

AVAILABLE tells CP the slot is available for future use.

All members in an SSI cluster must be part of the ISCF collection that contains the SSI cluster. All members in the SSI cluster participate in all SSI-defined functions and services.

Usage Notes

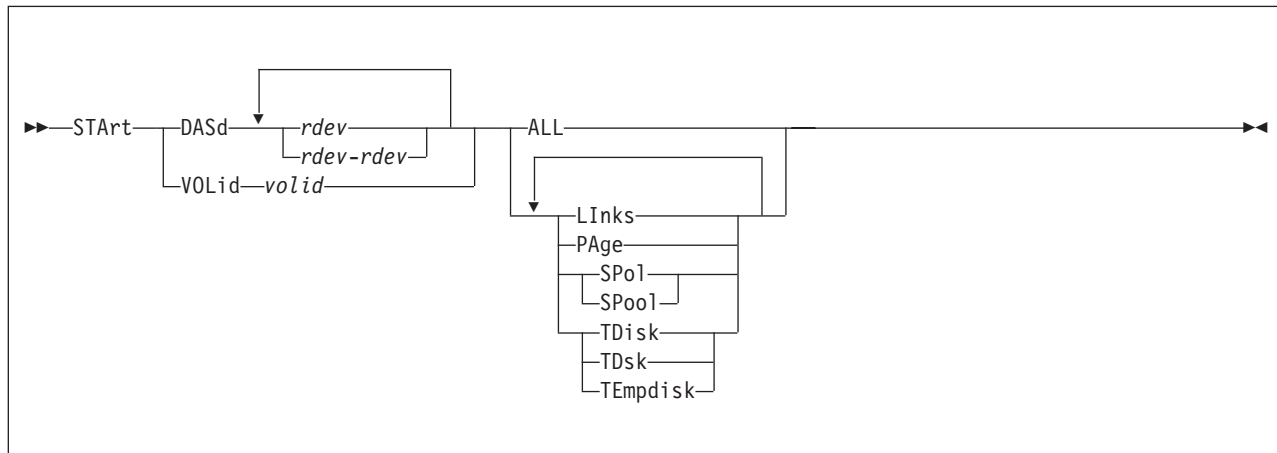
1. Before the first system can join the SSI cluster, you must format the cylinders containing the persistent data record (PDR). You can do this using the FORMSSI utility. For more information on the FORMSSI utility, see the *z/VM: CP Commands and Utilities Reference*.
2. The PDR volume must be an ECKD device and either a CP-owned DASD or in the user volume list.
3. When an SSI statement is specified, ACTIVATE ISLINK statements must also be specified to define direct ISFC connections to each of the other members of the SSI cluster. If other member(s) are joined to the cluster during IPL of an SSI member, ISFC connections to the joined members must be established before the system operator is logged on and IPL completes.
 - If there is not an ISFC connection to every joined member, message HCP1669I is displayed and the system waits until there are connections to all joined members.
 - If there are not enough ACTIVATE ISLINK statements to define direct connections to every joined member, message HCP1670E is displayed, followed by disabled wait state 1670.
4. If an error related to an SSI statement is found, a wait state 1682 occurs. Allowing the system to continue initialization as if it were not a member of an SSI cluster could result in loss of data. The wait state enables you to fix the problem without risking the loss of data.
5. If an SSI statement is found in the system configuration file, the system is defined as a member of an SSI cluster. Because of this membership, any system configuration file statements that define non-SSI cross-system linking are not allowed and result in a disabled wait state during IPL. The following is a list of configuration statements that conflict with an SSI statement:
 - XLINK_DEVICE_DEFAULTS
 - XLINK_SYSTEM_EXCLUDE
 - XLINK_SYSTEM_INCLUDE
 - XLINK_VOLUME_EXCLUDE
 - XLINK_VOLUME_INCLUDE
6. If you want to add a new system to the SSI cluster, add the new system in an available slot in the SSI member list by using the CP SET SSI command and then promptly update the SSI statement. For more information about the CP SET SSI command, see *z/VM: CP Commands and Utilities Reference*.
7. If you change the order of the members in the SSI member list, a cold start is required on all systems in the SSI cluster. A cold start deletes spool files. Files that are to be preserved during such a change should be dumped to tape using the CP SPXTAPE DUMP command. After the cold start, use SPXTAPE LOAD to restore the spool files.

Examples

1. To define an SSI cluster that contains three systems and one available slot, use the following SSI statement:

```
SSI clustera PDR_VOL pdrvool ,
    SLOT 1 Member1 ,
    SLOT 2 Member2 ,
    SLOT 3 Member3
```

START (Disk) Statement



Purpose

Use the START statement to restart devices after they have been drained. You can also use them to change the processing options currently in effect for the devices.

How to Specify

Include as many statements as needed; they are optional. You can place START statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

DASd *rdev*

is the real device number of the DASD you want started. The variable *rdev* is a hexadecimal number between X'0000' and X'FFFF'.

DASd *rdev-rdev*

is a range of real device numbers specifying the DASD you want started. Each *rdev* is a hexadecimal number between X'0000' and X'FFFF'.

VOLid *valid*

is the volume serial number of the volume you want started.

ALL

tells CP to allow new operations on this device, including:

- Writing pages during page-out
- Allowing minidisk linking
- Allocating space for new spool records.
- Allocating temporary disk space.

LInks

tells CP to start allowing users to link to minidisks on this device.

PAge

tells CP to start writing pages to this device during page-out operations.

SPo1

SPool

tells CP to allocate space on this device for new spool records.

TDisk**TDsk****TEmpdisk**

tells CP to allocate temporary disk space on this device.

Usage Notes

1. CP processes the system configuration file during an IPL, which means CP has not attached any volumes to the system when processing your START statements. Therefore, when you specify a START VOLID statement, you can only use volumes that were previously specified in the system configuration file using CP_OWNED statements (see “CP_OWNED Statement” on page 74).

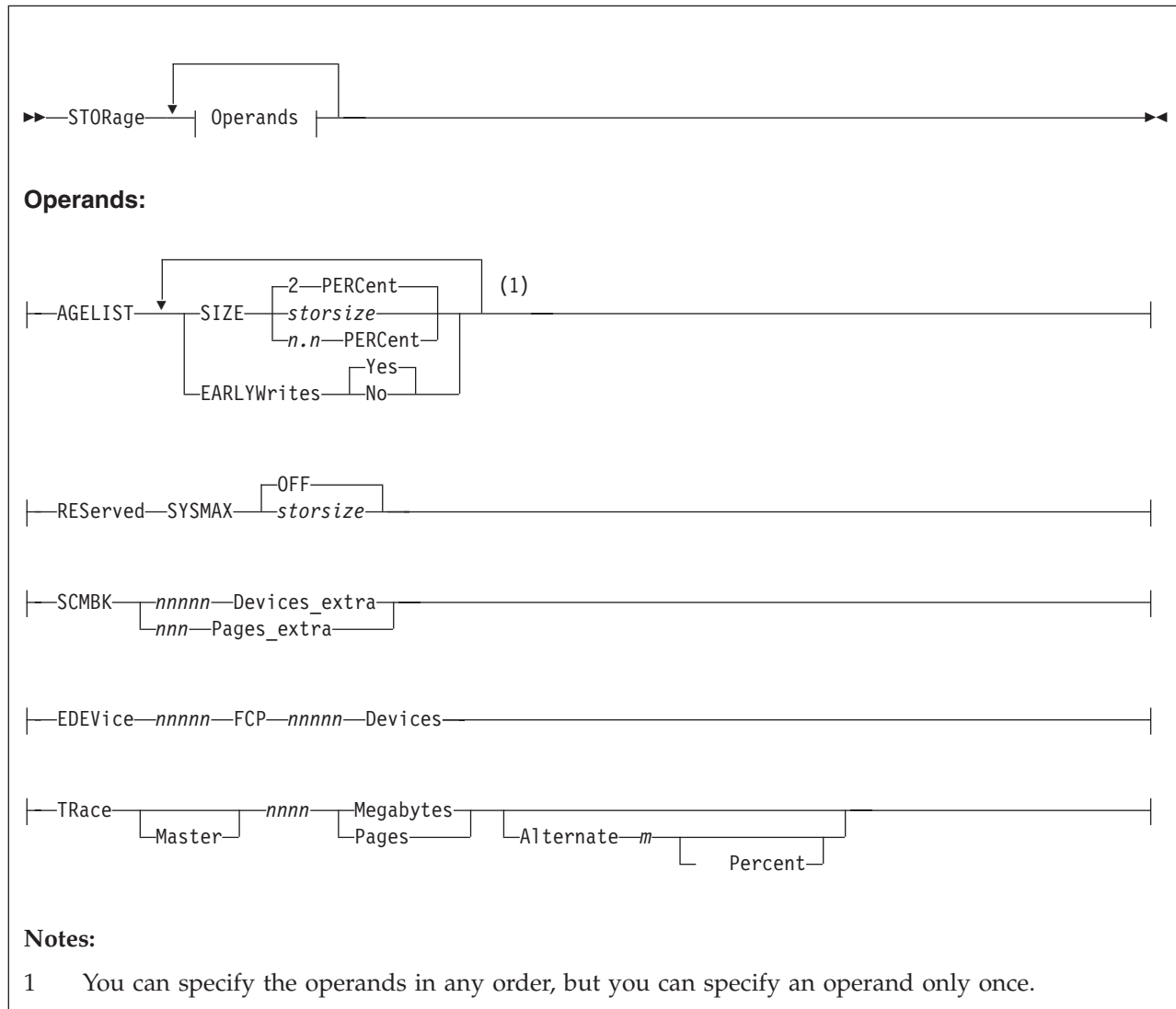
Examples

1. To have CP start allowing:
 - All new operations on all DASD at real devices numbers X'0700' through X'07FF'
 - Spooling on DASD at real device number X'0800'
 - Paging on volume SYSPG1 (which was, of course, previously defined on a CP_OWNED statement)

use the following START statements:

```
Start  DASD   0700-07ff  All      /* Allow all activity on these DASD */
Start  DASD   0800      Spool     /* Allow spooling only on DASD 800 */
Start  VolID   syspg1    Page     /* Allow CP to allocate page space */
                                   /*   on volume SYSPG1           */
```

STORAGE Statement



Purpose

Use the **STORAGE** statement to allocate real storage for system usage, such as for subchannel measurement blocks (SCMBKs).

How to Specify

Include as many statements as needed; they are optional. You can place **STORAGE** statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

AGELIST SIZE *storsize*

is the target size of the global aging list used by the frame replenishment algorithm, specified as an amount of storage.

The format of the storage size is *nu* where *n* is a 7-digit decimal number greater than 0 and *u* is the 1-character storage unit suffix (M,G,T,P,E).

The specified storage size must not exceed 5% of the current size of the Dynamic Paging Area (DPA). The size of the DPA varies over time and it includes available frames and those that contain pageable content.

AGELIST SIZE *n.n* PERCENT

is the target size of the global aging list used by the frame replenishment algorithm, specified as a percentage of the current size of the Dynamic Paging Area (DPA). The size of the DPA varies over time and it includes available frames and those that contain pageable content. When a percent value is specified, the system recalculates the target storage size periodically to adjust to the changing size of the DPA.

The decimal percentage can have at most one decimal place, and be in the range of .1 through the maximum allowed percentage of 5%. Regardless of the size of the configuration, CP never sets a target size smaller than 1M.

The default value is 2%.

Note: The target size of the aging list is a guideline to CP. The actual amount of storage in the global aging list at any point in time may differ significantly below the target amount, and at times may rise above the value. The size of the aging list can be changed after IPL using the SET AGELIST command. See *z/VM: CP Commands and Utilities Reference* for more information.

EARLYWrites

when Yes, the frame replenishment algorithm backs up page content to auxiliary storage in advance of frame reclaim to maintain a pool of readily reclaimable frames. When No is specified, pages are backed up only when the system is in need of frames.

The default is Yes.

RESERVED SYSMAX OFF

(the default) indicates there is no explicit system maximum on the total amount of storage that can be reserved using the SET RESERVED command for users, NSSs, and DCSSs. In this case the total amount of reserved storage is capped only by the size of the Dynamic Paging Area (DPA) at the time the command is issued.

RESERVED SYSMAX *storsize*

indicates the maximum amount of storage that can be reserved for all users, NSSs, and DCSSs using the SET RESERVED command. The maximum is specified as a storage size in format *nu* where *n* is a 1-7 digit decimal number and *u* is the 1-character storage unit suffix (M,G,T,P, or E).

SCMBK *nnnn* Devices_extra

SCMBK *nnn* Pages_extra

tells CP how much additional storage to allocate for SCMBKs. CP allocates the SCMBK space in contiguous pages of storage. During initialization, CP allocates one SCMBK for every subchannel on the system and rounds the amount of storage up to the nearest page. Thus, you have enough SCMBK space for every real device on your system plus some free SCMBK space. How much free SCMBK space you have will vary, depending upon how many real devices you have on your system.

When you specify the SCMBK operand, CP calculates the amount of SCMBK storage exactly as if you had not specified the SCMBK operand, and then CP adds on the extra storage you want.

STORAGE

When you specify the `DEVICES_EXTRA` operand, CP takes the number of extra devices you specified, calculates the number of pages of storage that it needs to reserve for those extra devices, and then adds the extra pages to the number of pages of SCMBK space that it originally calculated for the existing subchannels on your system. The variable *nnnnn* must be a 1-digit to 5-digit decimal number between 0 and 65535.

When you specify the `PAGES_EXTRA` operand, CP takes the number of pages that it originally calculated for the existing subchannels on your system and adds to that the number of extra pages you specified. The variable *nnn* must be a 1-digit to 3-digit decimal number between 0 and 511.

EDEVICE *nnnnn* FCP *nnnnn* Devices

specifies the number of expected emulated devices that will be defined within the z/VM LPAR, and the number of unique FCP subchannels that will be used for this configuration. This information will be used to set the size of the reserved pool for memory allocations during device configuration.

Emulated devices can range from 0 to 65,535, and each one will occupy roughly 17,000 bytes of pool storage. FCP devices can also range from 0 to 65,535, and each will occupy about 113,000 bytes of pool storage. There cannot be more than 65,535 combined EDEVs and FCPs. If this statement is not specified, a default pool for 100 EDEVs and 10 FCP subchannels will be allocated.

TRace

tells CP how many 4 KB pages to allocate to the internal trace table for the master processor and alternate processors in the configuration. For example, if you run z/VM on a uniprocessor and you specify:

```
Storage Trace 100 Pages
```

CP allocates 100 pages for the internal trace table. If you run z/VM on a dyadic processor and you specify:

```
Storage Trace Master 100 Pages Alternate 90 Percent
```

CP allocates 100 pages for the internal trace table of the master processor, and 90 percent of the 100 pages (that is, 90 pages) as the internal trace table for each of the other processors in the complex.

If you omit the `TRACE` operand, CP calculates the internal trace table storage size by allocating 1 page of storage for every 64 pages (256 KB) of real storage or 100 pages, whichever is smaller.

You can specify *nnnn* as any decimal number between 3 pages and less than one fourth of real storage.

Usage Notes

1. The `STORAGE` statement does not define the size of real storage. When IPLed, CP will use all of the real storage defined as `INITIAL` for the logical partition unless you specifically configure CP to use less storage. You can do this by using the `IPL PARAMETERS` field on the Stand Alone Program Loader (SAPL) screen to specify the `STORE` parameter with the amount of storage you want CP to use. For more information, see “Passing IPL Parameters” on page 36. After you IPL CP, you can use the `SET STORAGE` command to dynamically change the size of real storage. For more information, see *z/VM: CP Commands and Utilities Reference*.
2. In storage configurations that have a large area of non-addressable storage (a hole) near the top of the storage address range, and with only a small amount

of storage addressable above the hole, you may want to limit CP's use of storage to the large contiguous area below the hole. This will have two effects:

- a. The response from the QUERY STORAGE command will be closer to the actual usable real storage.
- b. The system will not map the non-addressable area of storage with control blocks which may use more storage than would be gained by the small amount of usable storage that is available above the hole.

One example of this type of storage configuration is a physically partitioned processor. The processor controller makes some of the storage available to one partition, but it may not make contiguous address ranges available to one side or the other.

Note: Many processors do provide only contiguous storage ranges to each partition.

3. The SCMBK operand will be ignored when format-1 measurement blocks are being used.
4. The EDEVICE operand is compared with any EDEVICE statements in the system configuration file. The larger of the two will be used to determine the pool sizes.

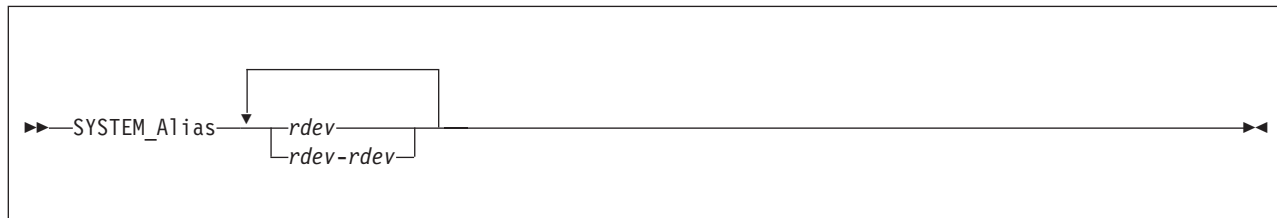
Examples

1. The following STORAGE statement allocates 1 megabyte of storage for the internal trace table:

```
Storage,                               /* Configure Use of Real Storage */

Trace Master 1 M Alternate 90 Percent,
/* Allocate 1 Megabyte of space */
/* Master Processors trace table */
/* and 90% of that amount for */
/* each of the other processors */
/* in the complex */
```

SYSTEM_ALIAS Statement



Purpose

Use the SYSTEM_ALIAS statement to specify HyperPAV alias devices to be automatically attached to the system during system initialization.

Operands

rdev

rdev-rdev

is the real device number of a HyperPAV alias device to be attached to the system during system initialization. The variable *rdev* must be a hexadecimal number between X'0000' and X'FFFF'. You can specify a single real device, a list, a range, or any combination thereof.

Usage Notes

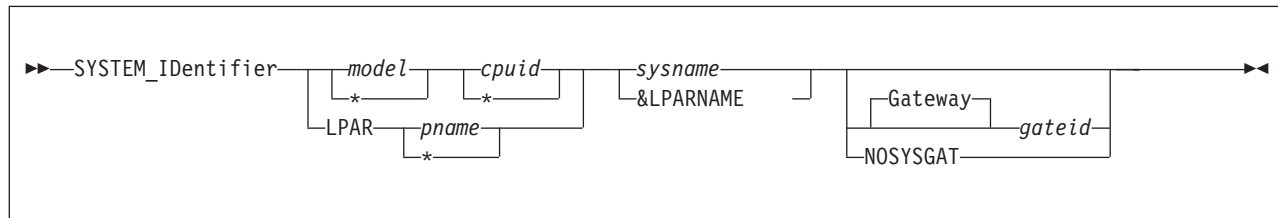
1. Devices specified that are not HyperPAV alias devices are ignored.

Examples

1. To have HyperPAV alias devices 5C44-5C47 attached to the system during system initialization, use the following SYSTEM_ALIAS statement:
SYSTEM_ALIAS 5C44-5C47



SYSTEM_IDENTIFIER Statement



Purpose

Use the SYSTEM_IDENTIFIER statement to define the system name (system ID) for the z/VM system to be run in a specified logical partition (LPAR) or on a specified processor. If your installation has several processors, you can specify a SYSTEM_IDENTIFIER statement for each one. At initialization, CP matches either the real LPAR name or the processor model and CPU identification numbers with those specified in the SYSTEM_IDENTIFIER statements to determine the system name to be used. The selected system name appears on printed output separator pages and in the status area of 3270 display screens.

The SYSTEM_IDENTIFIER statement also identifies the system gateway name for a system. The system gateway is identified automatically when CP initializes on the system. A system gateway provides a way to access private or global resources on a specific system within a CS or TSAF collection. It also provides access to private or global resources in a CS collection from an adjacent TSAF collection. Similarly, resources in a TSAF collection can be accessed from an adjacent CS collection.

By default, the system gateway name is the same as the system name for the system; this is the recommended naming convention. However, if this default conflicts with another gateway name, you can use the SYSTEM_IDENTIFIER statement to specify a unique system gateway name for the system.

How to Specify

Include as many statements as needed; they are optional. You can place SYSTEM_IDENTIFIER statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications. If one or more statements match the system being IPLed, the last matching statement overrides any previous matching statements.

Operands

model

is a 1- to 4-character string that specifies the processor unit model number. CP evaluates the string using pattern matching rules that are described below in Usage Note 2 on page 269. An asterisk (*) tells CP to match any processor unit model number.

cpuid

is a 1- to 6-character string that specifies the processor identification number of a CPU in the processor complex. CP evaluates the string using pattern matching rules that are described below in Usage Note 2 on page 269. An asterisk (*) tells CP to match any processor identification number.

LPAR *pname*

specifies the logical partition name. *pname* is a 1- to 8-character string that can consist of only letters A to Z and numbers 0 to 9. During statement processing, any lowercase letters are translated to uppercase. CP evaluates the string using pattern matching rules that are described below in usage note 2. An asterisk (*) tells CP to match any logical partition name.

sysname

is the 1- to 8-character system name (system ID).

If the system is a member of an SSI cluster, *sysname* must be alphanumeric (no special characters).

If the system is not a member of an SSI cluster, it is best (but not required) that you do not use the characters @, #, €, and " in the *sysname* because the system, by default, assigns these characters as logical line editing symbols. For a discussion of the system defaults settings for logical line editing symbols, refer to Appendix B in *z/VM: CP Commands and Utilities Reference*.

&LPARNAME

tells CP to use the LPAR name as the system name. If CP is executing in a virtual machine, the user ID is used as the system name.

Gateway *gateid*

is the 1- to 8-character name of the system gateway that will be identified when this system initializes. The *gateid* name is optional; if not specified, the system gateway name defaults to the system name. If this system is a member of an SSI cluster, the system gateway name must match the system name. ISFC will then use this value as the system's node name within a CS collection.

NOSYSGAT

If you specify NOSYSGAT as the *gateid* value, a system gateway name is not identified for the system. Also, the specified system cannot join a CS collection or an SSI cluster.

Usage Notes

1. You can use the *sysname* defined on this statement as a record qualifier on other statements to be processed for the same z/VM system.
2. You can include the *sysname* in a nickname group defined on an EQUATE statement (see "EQUATE Statement" on page 147).
3. Pattern matching generally follows the rules used by the CMS LISTFILE command. Use an asterisk (*) to match any number of characters; use a percent sign (%) to match any single character.
4. If the system is a member of an SSI cluster, the system name is the member name. Because each member of an SSI cluster must have a unique system name and IBM recommends using a common system configuration file, each member should have its own SYSTEM_IDENTIFIER statement in the system configuration file.

Examples

1. Set BOSTON3 as the system name for any processor in the complex. In addition, this method tells CP to match any processor model and any processor in that complex.

```
System_Identifier * %20721 Boston3      /* Set Boston3 as our    */
                                         /* system name          */
                                         /* for any processor    */
                                         /* in the complex       */
```

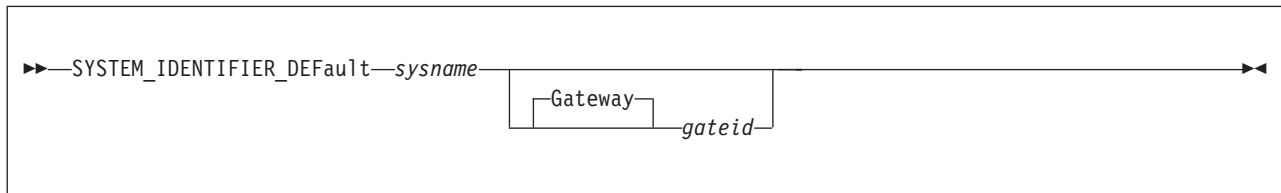
SYSTEM_IDENTIFIER

2. To make the system name be the same as the LPAR name, use the following SYSTEM_IDENTIFIER statement:

```
System_Identifier * * &LPARNAME          /* Use LPAR name as the sysname */
```
3. When the system runs in the LPAR named LP1, use the following statement to make the system name "YANKEE1":

```
System_Identifier LPAR LP1 YANKEE1      /* If in LPAR LP1, use YANKEE1 */
```

SYSTEM_IDENTIFIER_DEFAULT Statement



Purpose

Use the SYSTEM_IDENTIFIER_DEFAULT statement to provide CP with a default system name. CP uses the SYSTEM_IDENTIFIER_DEFAULT statement when z/VM is loaded on a system whose model and CPU identification numbers do not correspond with any of those specified on SYSTEM_IDENTIFIER statements.

The default system name then appears on printed output separator pages and in the status area of 3270 display screens.

The SYSTEM_IDENTIFIER_DEFAULT statement also identifies the system gateway name for a system. The system gateway is identified automatically when CP initializes on the system. A system gateway provides a way to access private or global resources on a specific system within a CS or TSAF collection. It also provides access to private or global resources in a CS collection from an adjacent TSAF collection. Similarly, resources in a TSAF collection can be accessed from an adjacent CS collection.

By default, the system gateway name is the same as the system name for the system; this is the recommended naming convention. However, if this default conflicts with another gateway name, you can use the SYSTEM_IDENTIFIER_DEFAULT statement to specify a unique system gateway name for the system.

Because each system in an SSI cluster must have a unique system name and IBM recommends using a common system configuration file, IBM recommends you not include a SYSTEM_IDENTIFIER_DEFAULT statement in the system configuration file for an SSI member.

How to Specify

Include as many statements as needed; they are optional. You can place SYSTEM_IDENTIFIER_DEFAULT statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

sysname

is the 1- to 8-character system name.

Gateway *gateid*

is the 1- to 8-character name of the system gateway that will be identified when this system initializes. The *gateid* name is optional; if not specified, the system gateway name defaults to the *sysname* for the system. If this system is a

SYSTEM_IDENTIFIER_DEFAULT

member of the SSI cluster, the system gateway name must match the system name. ISFC will then use this value as its node name within a CS collection.

If you specify NOSYSGAT as the *gateid* value, a system gateway name is not identified for the system. Also, the specified system cannot join a CS collection or an SSI cluster.

Usage Notes

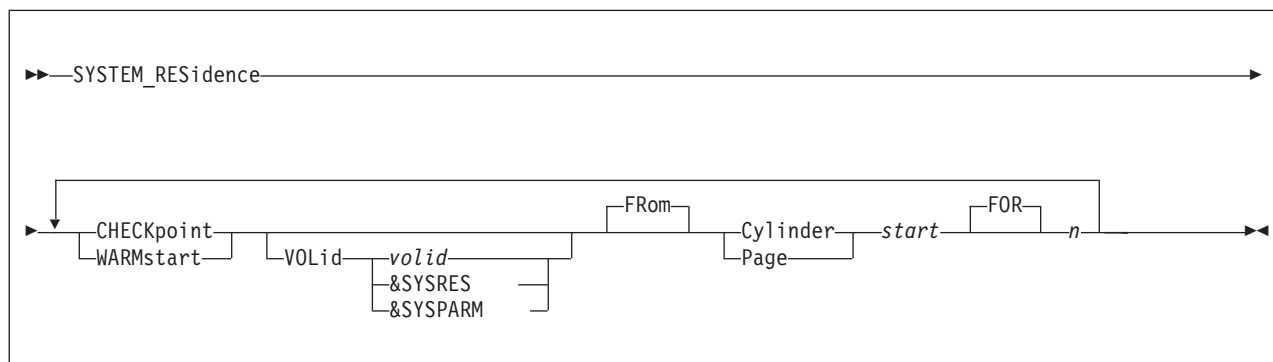
1. It is recommended that the characters @, #, ¢, and " not be used in the *sysname* because the system, by default, assigns these characters as logical line editing symbols. Refer to Appendix B in the *z/VM: CP Commands and Utilities Reference* for a discussion of the system defaults settings for logical line editing symbols.

Examples

1. To define a default system name of BOSTON3 for your system, use the following SYSTEM_IDENTIFIER_DEFAULT statement:

```
System_Identifier_Default  Boston3          /* No matter what machine */
                                          /* CP is IPLed on, let us */
                                          /* be known as BOSTON3    */
```

SYSTEM_RESIDENCE Statement



Purpose

Use the SYSTEM_RESIDENCE statement to describe the layout of the CP system residence disk.

How to Specify

Include as many statements as needed; they are optional. You can place SYSTEM_RESIDENCE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

CHECKpoint

tells CP that you are defining the real starting location and the maximum number of pages or cylinders that the checkpoint process will use to preserve system restart data.

WARMstart

tells CP that you are defining the real starting location and the maximum number of pages or cylinders that will be used for saving warm start data.

VOLid *valid*

tells CP the volume label of the device to use as the checkpoint or warm start device. If omitted, it defaults to the system residence volume.

VOLid &SYSRES

tells CP that the system residence device is to be used as the checkpoint or warm start device.

VOLid &SYSPARM

tells CP that the volume containing the active PARM disk is to be used as the checkpoint or warm start device.

FFrom Cylinder *start*

FFrom Page *start*

tells CP the real starting location (in cylinders or pages) where the checkpoint or warm start information is saved. For CKD device types, *start* is a nonzero decimal number from 1 to 65511. For FBA devices, *start* is a 1-to-6 digit 4 KB page number that is greater than 3 (pages 0 through 3 are reserved).

SYSTEM_RESIDENCE

FOR *n*

defines the maximum number of cylinders or pages that CP should use for the checkpoint or warm start area. For CKD device types, *n* is a 1-digit decimal number from 1 to 9 that represents cylinders. For FBA device types, *n* is a decimal number from 1 to 2000 that represents 4 KB pages.

Usage Notes

1. The checkpoint and warm start areas must not overlap.
2. The system residence volume is the volume on which the CP module resides. This is usually the IPL volume, but may be another volume selected through the full screen loader.
3. The checkpoint and warm start areas must be on a CP_OWNED volume.
4. Once you have IPLed the system with Checkpoint and warm start areas defined, you cannot move them without doing a CLEAN START, therefore you should allocate enough space to allow for expected growth.
5. The checkpoint and warm start areas can be extended (in the same place) if there is room without doing a CLEAN START. For example, if your current specification is:

```
SYSTEM_RESIDENCE CHECKpoint valid ESARES from Cyl 100 for 5
```

you could change it to:

```
SYSTEM_RESIDENCE CHECKpoint valid ESARES from Cyl 100 for 9
```

if cylinders 105 – 108 are not in use for other purposes.

Examples

1. To define the system residence volume with the:
 - Checkpoint area starting at cylinder 101 and occupying 2 cylinders on DASD SYS002 and
 - Warm start area starting at cylinder 204 and occupying 1 cylinder on DASD SYS001,

specify the following SYSTEM_RESIDENCE statement:

```
System_Residence,  
  CheckPoint VolID sys002  from Cylinder 101  for 2,  
  WarmStart  VolID sys001  from Cylinder 204  for 1
```

2. To define the system residence volume with the:
 - Checkpoint area starting at cylinder 568 and occupying 9 cylinders on DASD ESARES and
 - Warm start area starting at cylinder 784 and occupying 9 cylinders on DASD ESARES,

specify the following SYSTEM_RESIDENCE statement:

```
System_Residence,  
  WarmStart  VolID esares  from Cylinder 568  for 9,  
  CheckPoint VolID esares  from Cylinder 784  for 9
```

SYSTEM_USERIDS Statement

»»SYSTEM_USERids

(1)

ACCount1—OPERACCT—AUTOlog

ACCount1—userid—AUTOlog

ACCount1—userid—NOAUTOlog

ACCOUNT2—userid—AUTOlog

ACCOUNT2—userid—NOAUTOlog

DUMP—OPERATNS

DUMP—userid

EREp1—OPEREREp—AUTOlog

EREp1—userid—AUTOlog

EREp1—userid—NOAUTOlog

EREp2—userid—AUTOlog

EREp2—userid—NOAUTOlog

OPERator—OPERATOR—DISConnect

OPERator—userid—DISConnect

OPERator—userid—NODISConnect

STARTup—AUTOLOG1—AUTOlog

STARTup—userid—AUTOlog

STARTup—userid—NOAUTOlog

SYMPTom1—OPERSYMP—AUTOlog

SYMPTom1—userid—AUTOlog

SYMPTom1—userid—NOAUTOlog

SYMPTOM2—userid—AUTOlog

SYMPTOM2—userid—NOAUTOlog

Notes:

1 You must specify at least one of the following operands.

Purpose

Use the SYSTEM_USERIDS statement to specify user IDs that will perform special functions during and after IPL. These functions include accumulating accounting records, system dump files, EREP records, and symptom records, and specifying the primary system operator's user ID and disconnect status.

How to Specify

Include as many statements as needed; they are optional. You can place SYSTEM_USERIDS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ACCount1 *userid*

ACCOUNT2 *userid*

specifies the user IDs of the virtual machines for which the *ACCOUNT system service is to accumulate and checkpoint accounting records. You can specify one or two user IDs. One or both of these virtual machines are automatically logged on during CP initialization. The user IDs are alphanumeric character strings of up to eight characters. OPERACCT is the default for ACCOUNT1.

AUTOlog

NOAUTOlog

specify whether CP should log on the indicated user ID at IPL.

DUMP *userid*

is the user ID of the virtual machine that receives spooled system dumps. The variable *userid* must be an alphanumeric character string of as many as eight characters. OPERATNS is the default.

EREP1 *userid*

EREP2 *userid*

are the user IDs of the virtual machines for which the *LOGREC system service is to accumulate and checkpoint error records. You can specify one or two user IDs. EREP1 can be shortened to EREP. The variable *userid* must be an alphanumeric string 1- to 8-characters long. These virtual machines are automatically logged on during CP initialization. OPEREREP is the default for EREP1.

OPERator *userid*

is the primary system operator's user ID. The variable *userid* is an alphanumeric character string of as many as eight characters. The default is OPERATOR.

DISConnect

NODISConnect

indicates whether CP should disconnect the primary system operator when a software-initiated IPL occurs and the primary system operator is not logged onto the primary system console.

If you specify DISCONNECT, and the primary system operator is not logged onto the primary system console when a software-initiated IPL occurs, CP disconnects the primary system operator. If you specify NODISCONNECT, CP does not force the primary system operator to be disconnected. If you do not code this operand, DISCONNECT is assumed.

Specifying NODISCONNECT may affect system security. For more information, see usage note 5 on page 277.

STARTup *userid*

specifies the user ID that is to be logged on automatically at IPL to perform functions you select. AUTOLOG1 is the default.

SYMptom1 *userid*

SYMPTOM2 *userid*

specifies the user IDs of virtual machines for which the CP *SYMPTOM system service is to accumulate and checkpoint symptom records. One or two user IDs can be specified. The user IDs are alphanumeric strings of as many as eight characters each. OPERSYMP is the default for SYMPTOM and SYMPTOM1.

Usage Notes

1. If the user ID specified on the SYSTEM_USERIDS ACCOUNT statement has a virtual machine definition in the user directory, that user ID is logged on at system initialization.
2. CP creates system dump files as a result of system abends and system restarts. You can also use the VMDUMP command to send virtual machine dumps to the virtual machine you specify in the SYSTEM_USERIDS statement.
3. If the user ID specified on the SYSTEM_USERIDS EREP statement has a virtual machine definition in the user directory at system initialization, the associated virtual machine is logged on to the system.
4. CP logs on a system operator with the user ID you specify on the OPERATOR operand, regardless of whether that user ID has a virtual machine definition in the user directory.
5. If you specify NODISCONNECT, CP allows the primary system operator to remain logged onto the primary system console after all software-initiated IPLs. This makes the primary system operator's user ID available to any user with access to the primary system console, which could lead to a system-wide compromise of security. If you specify NODISCONNECT, make sure that the primary system console and all alternate system consoles are in a secure environment and are continuously monitored by authorized personnel.
6. When the primary system operator logs off, the next user that logs on with at least one of the privilege classes required for the system operator will become the primary system operator. However, this can be overridden by either:
 - Specifying alternate operators using the ALTERNATE_OPERATORS statement in the system configuration file
 - Selecting a new operator using the SET SYSOPER command.

For more information about the ALTERNATE_OPERATORS statement, see “ALTERNATE_OPERATORS Statement” on page 57. For more information on defining operator privilege class, see “PRIV_CLASSES Statement” on page 212.

7. If the user ID specified on the SYSSYMP macroinstruction has a virtual machine definition in the user directory at system initialization, the virtual machine designated by that user ID is logged on to the system.
8. If you are changing records relating to ACCOUNT, EREP or SYMPTOM, refer to the following sections: “Disassociating a User ID from the Retrieval of Accounting Records” on page 337, “Disassociating a User ID from the Retrieval of EREP Records” on page 356, and “Disassociating a User ID from the Retrieval of Symptom Records” on page 360.

Examples

1. The following SYSTEM_USERIDS statement specifies:
 - The system operator as user ID OPERATOR and to specify that CP should disconnect the system operator when a software re-IPL occurs and the system operator is not logged on to the system console
 - Dumps should go to the OPERATNS user ID
 - CP should automatically log the AUTOLOG1 user ID at IPL
 - One EREP user ID called EREP and to have CP automatically log on that user ID at IPL
 - One accounting user ID called DISKACNT
 - One symptom records user ID called OPERSYMP

SYSTEM_USERIDS

```
System_UserIDs,
  Operator  operator,      /* use OPERATOR ID as operator      */
             Disconnect, /* If bounce, disconnect oper      */
  Dump      operatns,     /* use OPERATNS ID for dump collection */
  StartUp   autolog1,     /* CP will XAUTOLOG this ID during init */
  Erep      erep Autolog, /* Collect I/O error & Send to EREP ID */
  Account   diskacnt,     /* Send Accting Records to Diskacnt ID */
  Symptom   opersymp      /* Send Symptom Records to Opersymp ID */
```

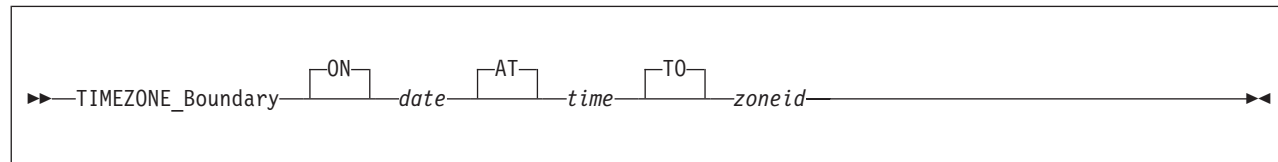


THROTTLE

During initialization, CP responds:

```
Device 1C10 added to throttle set. Rate = 1.
```

TIMEZONE_BOUNDARY Statement



Purpose

Use the TIMEZONE_BOUNDARY statement to tell CP what time zone to choose at IPL so that it can determine the local time.

How to Specify

Include as many statements as needed; they are optional. You can place TIMEZONE_BOUNDARY statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

ON *date*

is the date, in the format *yyyy-mm-dd*, on which CP should begin using a given time zone.

AT *time*

is the time, in the format *hh:mm:ss*, when CP should begin using a given time zone.

TO *zoneid*

is a 3-character time zone definition established by an earlier TIMEZONE_DEFINITION statement.

Usage Notes

1. Before you can use this statement, you must already have defined the timezone to which you are changing. You can do so with TIMEZONE_DEFINITION statements in the system configuration file. For more information about the TIMEZONE_DEFINITION statement, see "TIMEZONE_DEFINITION Statement" on page 283.
2. As its name suggests, this statement establishes the boundaries for the time zones that CP can use. You must specify at least one boundary that has occurred before the current date; otherwise, CP will use Coordinated Universal Time (UTC) to determine the new time. For example, if you include the following statements in your system configuration file:

```

TimeZone_Boundary on 2007-03-11 at 02:00:00 to EDT
TimeZone_Boundary on 2007-11-04 at 02:00:00 to EST
TimeZone_Boundary on 2008-03-09 at 02:00:00 to EDT
  
```

CP determines the local time according to where the time of the system's clock fits in to the boundaries. If you IPL the system before 02:00:00 UTC on March 11, 2007, CP assumes that the local time is UTC, because nothing has told it otherwise. If you IPL between 02:00:00 UTC on March 11, 2007, and 02:00:00 EDT on November 04, 2007, CP assumes that EDT is the local time. If you IPL after 02:00:00 EDT on November 04, 2007, but before 02:00:00 EST March 09,

TIMEZONE_BOUNDARY

2008, CP takes EST as the local time; if you IPL any time after 02:00:00 EST on March 09, 2008, CP assumes that the local time is EDT. CP determines which time zone 02:00:00 is in from the preceding TIMEZONE_BOUNDARY statement. If there is no preceding statement, CP assumes that 02:00:00 is in UTC.

3. After the system is up and running, you can issue the CP SET TIMEZONE command to change the time zone of the running system. If you do so, you may only choose a time zone that has already been defined with either a TIMEZONE_DEFINITION statement or the CP DEFINE TIMEZONE command. For more information about the TIMEZONE_DEFINITION statement, see “TIMEZONE_DEFINITION Statement” on page 283. For more information about the CP SET TIMEZONE command, see the *z/VM: CP Commands and Utilities Reference*.

Examples

1. To define eastern daylight time (EDT) and eastern standard time (EST) through the year 2009, use the following TIMEZONE_BOUNDARY statements:

```
/*----- Timezone Boundary Condition Definitions -----*/
```

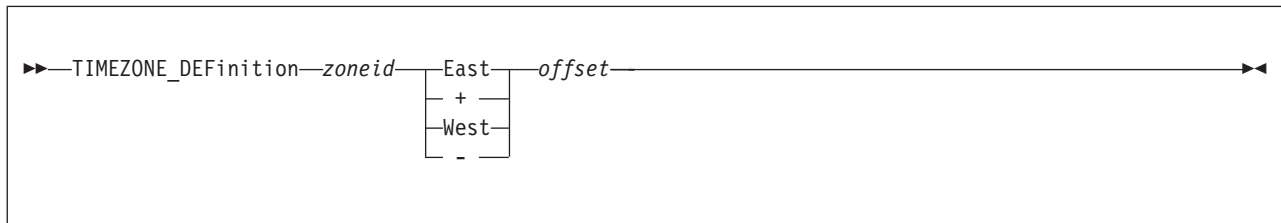
```
TimeZone_Boundary on 2006-04-02 at 02:00:00 to EDT  
TimeZone_Boundary on 2006-10-29 at 02:00:00 to EST
```

```
TimeZone_Boundary on 2007-03-11 at 02:00:00 to EDT  
TimeZone_Boundary on 2007-11-04 at 02:00:00 to EST
```

```
TimeZone_Boundary on 2008-03-09 at 02:00:00 to EDT  
TimeZone_Boundary on 2008-11-02 at 02:00:00 to EST
```

```
TimeZone_Boundary on 2009-03-08 at 02:00:00 to EDT  
TimeZone_Boundary on 2009-11-01 at 02:00:00 to EST
```

TIMEZONE_DEFINITION Statement



Purpose

Use the TIMEZONE_DEFINITION statement to define system time zones according to their difference from Coordinated Universal Time (UTC).

How to Specify

Include as many statements as needed; they are optional. You can place TIMEZONE_DEFINITION statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

zoneid

is the 3-letter time zone ID that you are defining. The variable *zoneid* must be a 1- to 3-character identifier.

Important Note

The zone IDs UTC and GMT are predefined. You cannot specify UTC or GMT as a *zoneid*.

East

+ tells CP to add the value specified by *offset* to Coordinated Universal Time (UTC) to define this time zone ID. EAST is the same as +.

West

- tells CP to subtract the value specified by *offset* from the Coordinated Universal Time (UTC) to define the time zone ID. WEST is the same as -.

offset

is the difference between UTC and *zoneid*. You can enter *offset* as *hh:mm:ss* or *hh.mm.ss*, where *hh* is required and *mm* and *ss* are optional. You can specify *ss* only if you have specified *mm*.

Usage Notes

1. This statement defines the time zones that will always be available after an IPL. You can use the CP DEFINE TIMEZONE command to define additional time zones after the system is up and running. For more information about the CP DEFINE TIMEZONE command, see the *z/VM: CP Commands and Utilities Reference*.

Examples

1. To define time zone:
 - EDT as 4 hours west of UTC

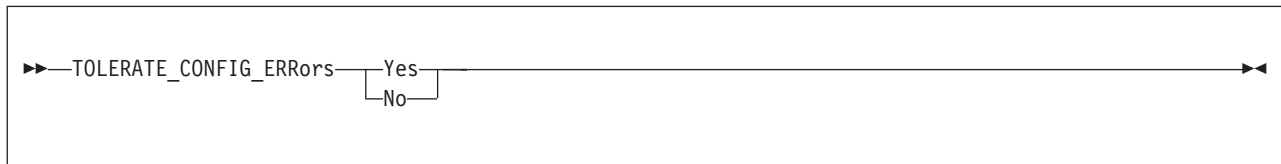
TIMEZONE_DEFINITION

- EST as 5 hours west of UTC
- DRB as 5 ½ hours west of UTC
- RFC as 4 ½ hours west of UTC
- IKA as 3 ½ hours west of UTC
- DAC as 4 ½ hours east of UTC
- PDT as 7 hours west of UTC
- PST as 8 hours west of UTC

use the following TIMEZONE_DEFINITION statements:

```
TimeZone_Definition  edt  West  4.00.00  /* EDT is West 4 from UTC */
TimeZone_Definition  est  West  5.00.00  /* EST is West 5 from UTC */
TimeZone_Definition  drb  West  5.30.00  /* DRB is West 5 hrs, 30
/*      minutes from UTC    */
TimeZone_Definition  rfc  West  4.30.00  /* RFC is West 4 hrs, 30
/*      minutes from UTC    */
TimeZone_Definition  ika  West  3.30.00  /* IKA is West 3 hrs, 30
/*      minutes from UTC    */
TimeZone_Definition  dac  East  4.30.00  /* DAC is East 4 hrs, 30
/*      minutes from UTC    */
TimeZone_Definition  pdt  West  7.00.00  /* PDT is 7 West of UTC */
TimeZone_Definition  pst  West  8.00.00  /* PST is 8 West of UTC */
```


TOLERATE_CONFIG_ERRORS Statement



Purpose

Use the TOLERATE_CONFIG_ERRORS statement to mark sections of the system configuration file that must be without errors when CP processes them.

How to Specify

Include as many statements as needed; they are optional. You can place TOLERATE_CONFIG_ERRORS statements anywhere in the system configuration file.

If you do not specify any TOLERATE_CONFIG_ERRORS statements, CP will tolerate errors in your system configuration file.

The first statement you specify must be TOLERATE_CONFIG_ERRORS NO. All subsequent statements must alternate between YES and NO. You cannot have two TOLERATE_CONFIG_ERRORS statements in a row with the same operand. That is, you cannot tell CP to tolerate errors, process a few more statements, and then tolerate errors again.

Operands

Yes

tells CP to begin tolerating errors in the system configuration file.

No tells CP not to tolerating any errors in the system configuration file until encountering a TOLERATE_CONFIG_ERRORS YES statement.

Usage Notes

1. When CP finds an error in a system configuration file statement that follows a TOLERATE_CONFIG_ERRORS NO statement, it remembers the error occurrence and, after displaying all the errors encountered, prompts the operator with a question. The operator can respond to the question in one of the following ways:
 - Stopping the IPL process
 - Continuing with the normal IPL process
 - Continuing with the normal IPL process but not automatically logging on any virtual machines.
2. If CP does not find any errors while processing the system configuration file or if all errors found are in sections of the system configuration file where TOLERATE_CONFIG_ERRORS YES is in effect, the normal IPL process continues.
3. If you are using the IMBED and the TOLERATE_CONFIG_ERRORS statements, remember that CP processes the statements in an imbed file as if those statements were included in the master system configuration file. If you are not

TOLERATE_CONFIG_ERRORS

tolerating errors in the master file and then repeat the statement in the imbedded file, CP will flag the duplicate statement in the imbedded file as an error.

4. If you change a system configuration file, you should run the CPSYNTAX exec to make sure there are no syntax errors in the system configuration file.

Examples

1. To tell CP not to ignore any syntax problems found in the processing of the CP_OWNED statements, use the following TOLERATE_CONFIG_ERRORS statements:

```
Tolerate_Config_Errors  no      /* Don't ignore errors here */

CP_Owned  Slot 1 ESARES
CP_Owned  Slot 2 ESAP01
CP_Owned  Slot 3 ESAP02
CP_Owned  Slot 4 ESAP03
CP_Owned  Slot 5 ESAP04
CP_Owned  Slot 6 ESAP05
```

```
Tolerate_Config_Errors  yes      /* Back to normal mode      */
```

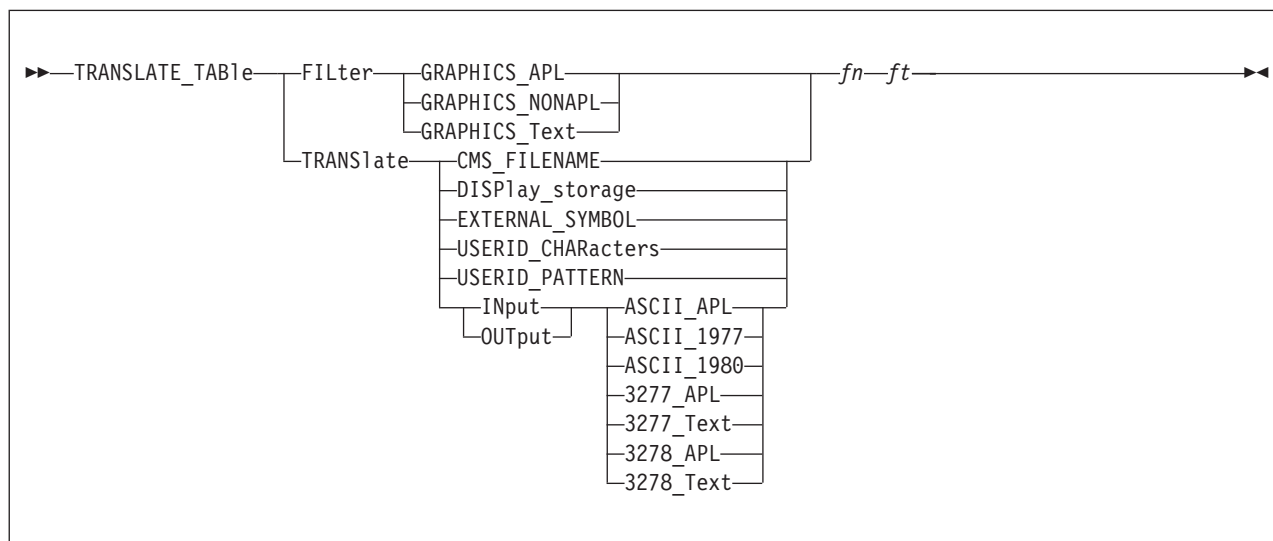
2. To make sure CP does not ignore any errors when defining your checkpoint and warm start areas, use the following TOLERATE_CONFIG_ERRORS statements:

```
Tolerate_Config_Errors  no          /* Don't Ignore Any Errors in */
                                   /* the System Residence Stmt */
System_Residence,

    CheckPoint  VolID  esares  From  Cylinder  784  For  9,
    WarmStart   VolID  esares  From  Cylinder  568  For  9

Tolerate_Config_Errors  yes          /* From here on, errors are OK */
```

TRANSLATE_TABLE Statement



Purpose

Use TRANSLATE_TABLE statements to specify replacements for the standard translation tables that CP uses to accomplish certain tasks.

How to Specify

Include as many statements as needed; they are optional. You can place TRANSLATE_TABLE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

FILter

tells CP to use the specified file to filter out invalid characters.

GRAPHICS_APL

tells CP to use this translation table to filter out invalid characters and 3270 orders out of a 3270 data stream destined for an APL display.

GRAPHICS_NONAPL

tells CP to use this translation table to filter invalid characters out of a 3270 data stream destined for an EBCDIC (non-APL) display.

GRAPHICS_Text

tells CP to use this translation table to filter out invalid characters and 3270 orders out of a 3270 data stream destined for an 3270 text display.

TRANSLate

tells CP to use the specified file to translate input or output characters.

CMS_FILENAME

defines which characters are acceptable to use when defining CMS file names and file types.

DISPlay_storage

tells CP to use the hexadecimal-to-EBCDIC translation table when issuing

TRANSLATE_TABLE

the CP DISPLAY command with the T option or the CPTYPE command. For more information about the CP DISPLAY and CPTYPE commands, see the *z/VM: CP Commands and Utilities Reference*.

EXTERNAL_SYMBOL

defines which characters are acceptable to use when defining entry point names.

USERID_CHARACTERS

defines the translation test table used to validate user IDs in the system configuration file. This statement overrides the table in HCPTBL. Indicate valid characters by setting their positions in the translation test table to X'00'. A non-zero value means that the character is not valid in a user ID.

If you change the USERID_CHARACTERS table, make corresponding changes to the USERID_PATTERN table. See “USER Directory Statement” on page 609 or “IDENTITY Directory Statement” on page 502 for points to consider in selecting valid characters for user IDs.

If the translation test table you define invalidates any characters from the default acceptable set:

- Uppercase letters (A through Z)
- Numbers (0 through 9)
- Other (# \$ @ _ -)

then results are unpredictable.

USERID_PATTERN

defines the translation test table used to validate user ID patterns in the system configuration file. This statement overrides the table in HCPTBL. Indicate valid characters by setting their positions in the translation test table to X'00'. Any non-zero value means that the character is not valid in a user ID pattern.

If you change the USERID_PATTERN table, make corresponding changes to the USERID_CHARACTERS table. Make sure the USERID_PATTERN table includes the pattern-matching characters asterisk (*) and percent (%) as valid characters.

INput

OUTput

tells CP to use the specified file to translate input or output characters.

ASCII_1977

defines the translation table used to translate input characters coming from a TTY UASCII-1977 level display to EBCDIC, or output EBCDIC characters to those going to a TTY UASCII-1977 terminal.

ASCII_1980

defines the translation table used to translate input characters coming from a TTY UASCII-1980 level display to EBCDIC, or output EBCDIC characters to those going to a TTY UASCII-1980 terminal.

ASCII_APL

defines the translation table used to translate ASCII APL input characters coming from an ASCII APL-capable display to EBCDIC APL characters, or to translate EBCDIC APL characters to those going to an ASCII APL-capable display.

3277_APL

defines the translation table used to translate input characters coming from a 3277 APL display, or output characters going to such a display.

3278_APL

defines the translation table used to translate input characters coming from a 3278 APL display, or output characters going to such a display.

3277_Text

defines the translation table used to translate input characters coming from a text-only 3277 display, or output characters coming from such a display.

3278_Text

defines the translation table used to translate input characters coming from a text-only 3278 display, or output characters going to such a display.

fn is the file name of the translation table file.

ft is the file type of the translation table file.

Usage Notes

1. The specified file must reside on the same minidisk as the system configuration file so that CP can find the file during IPL processing.
2. As with the system configuration file, comments in the file containing the translation table must be delimited with a beginning `/*` and an ending `*/`. A single comment may span multiple lines in the file.
3. Data found outside the aforementioned comment delimiters must be EBCDIC hexadecimal. Because each byte in the translation table is represented by 2 hexadecimal digits, no token in the file can consist of an odd number of characters. Translated characters may be grouped in clusters to improve the readability of the table.
4. Exactly 256 translated characters (512 data bytes) must exist in the file. If the number of characters specified does not equal 256, CP will generate an error and otherwise ignore the statement.

Examples

1. To display the underscore character (X'6D') as an underscore character rather than the period (X'4B') defined in the default translation table used by the DISPLAY command, use the following:

```
/* Use the following translate table located in file,      */
/*   DISPLAY STORAGE, as the hexadecimal to EBCDIC      */
/*   translate table.                                     */
```

```
Translate_Table Translate Display_Storage display storage
```

On the same minidisk as the system configuration file, you would put a file called DISPLAY STORAGE containing the following information:

```
/*-----*
 * Translate table for display of storage *
 *-----*/

4B4B4B4B 4B4B4B4B 4B4B4B4B 4B4B4B4B /* .... .... .... ....
*/
4B4B4B4B 4B4B4B4B 4B4B4B4B 4B4B4B4B /* .... .... .... ....
*/
4B4B4B4B 4B4B4B4B 4B4B4B4B 4B4B4B4B /* .... .... .... ....
*/
```

TRANSLATE_TABLE

```

    4B4B4B4B 4B4B4B4B 4B4B4B4B 4B4B4B4B /* .... .... .... ....
*/
    404B4B4B 4B4B4B4B 4B4B4B4B 4C4D4E4F /* .... .... .... <(+|
*/
    504B4B4B 4B4B4B4B 4B4B4B5B 5C5D5E5F /* &;... .... ...$
*);* */
    60614B4B 4B4B4B4B 4B4B4B6B 6C6D6E6F /* -/.. .... ...., %_>?
*/
    4B4B4B4B 4B4B4B4B 4B4B7A7B 7C7D7E7F /* .... .... ..
# @'=" */
    4B818283 84858687 88894B4B 4B4B4B4B /* .abc defg hi.. ....
*/
    4B919293 94959697 98994B4B 4B4B4B4B /* .jkl mnop qr.. ....
*/
    4B4BA2A3 A4A5A6A7 A8A94B4B 4B4B4B4B /* ..st uvwx yz.. ....
*/
    4B4B4B4B 4B4B4B4B 4B4B4B4B 4B4B4B4B /* .... .... .... ....
*/
    4BC1C2C3 C4C5C6C7 C8C94B4B 4B4B4B4B /* .ABC DEFG HI.. ....
*/
    4BD1D2D3 D4D5D6D7 D8D94B4B 4B4B4B4B /* .JKL MNOP QR.. ....
*/
    4B4BE2E3 E4E5E6E7 E8E94B4B 4B4B4B4B /* ..ST UVWX YZ.. ....
*/
    F0F1F2F3 F4F5F6F7 F8F94B4B 4B4B4B4B /* 0123 4567 89.. ....
*/

```

CP reads the DISPLAY STORAGE file at IPL time and would replace the default table used with the CP DISPLAY or CPTYPE commands with the table specified in the file.

USERFORM Statement

```

▶▶—USERForm—userform—operform—┐
                                └NARrow┘

```

Purpose

Use the USERFORM statement to create a list of user form names and their corresponding operator form numbers, and to specify forms as NARROW so that a narrow separator page is printed.

How to Specify

Include as many statements as needed; they are optional. You can place USERFORM statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

userform

is a 1- to 8-character alphanumeric name of a user form.

operform

is a 1- to 8-character alphanumeric operator form number.

NARrow

tells CP that the form is no more than 86 columns wide. If you specify NARROW, separator information does not print beyond column 86.

Usage Notes

1. The *userform* and *operform* operands establish the correspondence between the user form and operator form. If you do not specify any user form and operator form pairs, CP does not generate a form list and does not distinguish between user and operator forms.

Examples

1. To define three user form and operator form pairs with the following characteristics:
 - User form DOCUMENT paired with operator form G1PN which are at most 86 characters wide
 - User form LISTING paired with operator form G1PW
 - User form PLAIN paired with operator form G1PN which are at most 86 characters wide

use the following USERFORM statements:

```

Userform  document  g1pn  Narrow
Userform  listing   g1pw
Userform  plain     g1pn  Narrow

```

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output include the PRINT, ASSEMBLE, UPDATE, GENMSG, TAPE, FILEPOOL FORMAT AUDIT, and SET DOSLNCNT commands.

LPP OFF

indicates that internal defaults will be used as the global value for lines per page. The defaults are the same as those which have been used on prior releases of VM for virtual printers and consoles.

LPP *nnn*

sets the default global lines per page value to *nnn*. *nnn* must be a decimal number with a range of 30 to 255.

POSIXOPT

defines the default POSIX authorizations to permit or prohibit all users on the system from querying other users' POSIX information or having their POSIX security values changed.

These authorizations can be overridden for a specific user by adding the POSIXOPT directory statement ("POSIXOPT Directory Statement" on page 578) to that users' virtual machine definition.

QUERYDB ALLOW

(the default) specifies by default, users are permitted to query other users' POSIX database information.

QUERYDB DISALLOW

specifies that by default, users are not permitted to query other users' POSIX database information.

EXEC_SETIDS DISALLOW

(the default) specifies by default, users are not permitted to have their POSIX security values changed on behalf of a POSIX *exec()* function call designating a file with the *setuid* or *setgid* attributes.

EXEC_SETIDS ALLOW

specifies that by default, users are permitted to have their POSIX security values changed on behalf of a CP *exec()* processing. The server requesting the change must be authorized to do so by the SETIDS option of the POSIXOPT directory statement.

MESSAGE_LEVEL

sets the default message level for a user who accesses the system, overriding the default of WNG ON, MSG ON, and IMMSG ON. At least one of the following message levels must be specified:

WNG

enables the user to receive messages from other users issued by the WARNING or WNG command.

MSG

enables the user to receive messages from other users issued by the MESSAGE, MSG, or MSGNOH command.

EMSG_CODE

enables the user to receive the message code portion of error messages.

EMSG_TEXT

enables the user to receive the text portion of error messages.

IMMSG

enables the user to receive informational messages

USER_DEFAULTS

OFF

prevents the user from receiving any messages, warnings, error messages, or informational messages.

CPLANGUAGE *langid*

langid is the system default language. *langid* must be 1 to 5 characters and must consist of CMS file system characters only. If the CPLANGUAGE operand is not specified on any USER_DEFAULTS statement, CP uses the language that was built into the CP nucleus as the system default language.

Usage Notes

1. If the USER_DEFAULTS statement is not specified, or the POSIXOPT operand is not specified, the defaults are to permit all users to query other users' POSIX database information, and prohibit all users from having their POSIX security values changed on behalf of CP *exec()* processing. ESM (External Security Manager) may override each user's settings.
2. If the USER_DEFAULTS statement is not specified, or the LPP operand is not specified, the default global value for lines per page is 'OFF'.
3. The LPP option of the SPOOL command may be used to change the LPP value for individual virtual printers and consoles.

Examples

1. The following example shows how to specify the USER_DEFAULTS statement. Note that you can specify more than one operand on a single USER_DEFAULTS statement.

To specify that:

- All users in the system can not query other users' POSIX database information.
- All users in the system are prohibited from having their POSIX security values changed by other (authorized) users.

use the following USER_DEFAULTS statement:

```
User_Default posixopt Querydb disallow Exec_Setids disallow
```

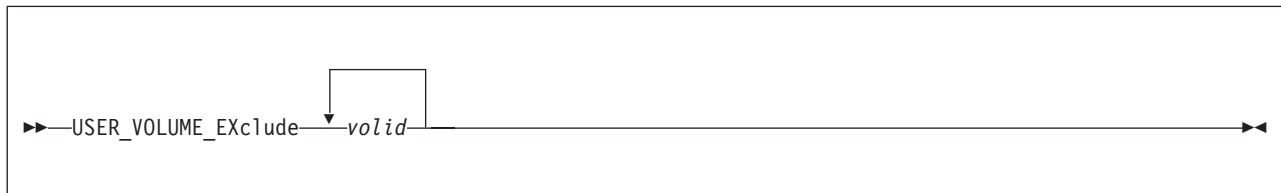
2. To specify that the default lines per page value for all virtual printers and virtual consoles is 56, use the following USER_DEFAULTS statement:

```
User_Defaults lpp 56
```

3. To specify that internal defaults should be used (as in prior releases of VM) as the lines per page value for all virtual printers and virtual consoles, use the following USER_DEFAULTS statement:

```
User_Defaults lpp OFF
```

USER_VOLUME_EXCLUDE Statement



Purpose

Use the `USER_VOLUME_EXCLUDE` statement to define volumes that are to be excluded from the user volume list. (User volumes are those volumes that you use to contain minidisks.) During system IPL, CP attaches to the system any volumes whose volume identifiers match a generic volume identifier specified in a `USER_VOLUME_INCLUDE` statement unless the volume is also specified in a `USER_VOLUME_EXCLUDE` statement.

How to Specify

The `USER_VOLUME_EXCLUDE` statement is optional; if specified, you can include as many statements as you need as long as the total number of volumes specified on a single statement does not exceed 500. If you specify a generic volume identifier, CP counts each volume that matches the pattern as one.

You can place `USER_VOLUME_EXCLUDE` statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

valid

is a volume serial number or a generic volume serial number for a specific subset of volumes. The variable *valid* is a 1- to 6-character alphanumeric string with no imbedded blanks. A generic volume serial number is a 1- to 6-character string with asterisks (*) in place of one or more arbitrary characters and percent signs (%) in place of exactly one arbitrary character. For example:

```
User_Volume_ExcLude  es%vm*
```

creates a list that includes all volumes whose volume serial number start with ES and have VM as their fourth and fifth characters.

A single asterisk (*) prevents CP from attaching all user volumes from the system that are also specified on any `USER_VOLUME_EXCLUDE` statements.

Usage Notes

1. If a volume identifier matches a *valid* pattern specified both in `USER_VOLUME_EXCLUDE` and `USER_VOLUME_INCLUDE` statements, CP does not attach the volume to the system during initialization. A duplicate *valid* causes the entire statement to be rejected. A volume is automatically attached to the system if:

It is explicitly listed in the `USER_VOLUME_LIST` statement

It is explicitly listed in the `USER_VOLUME_INCLUDE` statement

USER_VOLUME_EXCLUDE

It satisfies a USER_VOLUME_INCLUDE pattern and does not satisfy a USER_VOLUME_EXCLUDE statement.

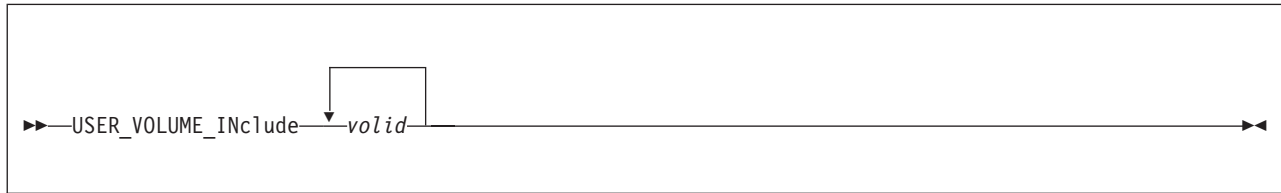
2. Dedicated devices are not user volumes. They must be attached to the user to which they are dedicated and not to the system. Therefore, if you specify USER_VOLUME_INCLUDE statements, you may want to specify dedicated devices in USER_VOLUME_EXCLUDE statements.

Examples

1. To exclude volume XAUSRF from the user volume list, use the following USER_VOLUME_EXCLUDE statement:

```
User_Volume_Exclude  xausrf  /* Exclude the following User Volume  */
                        /* from the System User Volume List.  */
                        /* NOTE: a previous USER_VOLUME_INCLUDE */
                        /* XAUSR* would have caused this volume */
                        /* to be mounted.  */
```

USER_VOLUME_INCLUDE Statement



Purpose

Use the USER_VOLUME_INCLUDE statement to define user volumes by a generic volume identifier and to include those volumes in the user volume list. (User volumes are those volumes that you use to contain minidisks.) During system IPL, CP attaches to the system any volumes whose volume identifiers match a generic volume identifier specified in a USER_VOLUME_INCLUDE statement. A volume must be attached to the system before users can link to minidisks it contains.

How to Specify

The USER_VOLUME_INCLUDE statement is optional; if specified, you can include as many statements as you need as long as the total number of volumes specified on a single statement does not exceed 500. If you specify a generic volume identifier, CP counts each volume that matches the pattern as one.

You can place USER_VOLUME_INCLUDE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

valid

is a volume serial number or a generic volume serial number for a specific subset of volumes. The variable *valid* is a 1- to 6-character alphanumeric string with no imbedded blanks. A generic volume serial number is a 1- to 6-character string with asterisks (*) in place of one or more arbitrary characters and percent signs (%) in place of exactly one arbitrary character. For example:

```
User_Volume_Include es%vm*
```

creates a list that includes all volumes whose volume serial number start with ES and have VM as their fourth and fifth characters.

A single asterisk (*) attaches all volumes to the system.

Usage Notes

1. You can specify volumes that you do not want defined as user volumes by specifying them on USER_VOLUME_EXCLUDE statements (“USER_VOLUME_EXCLUDE Statement” on page 295).
2. If a volume identifier matches a generic volume identifier specified in both USER_VOLUME_INCLUDE and USER_VOLUME_EXCLUDE statements, CP does not attach the volume to the system during initialization. A duplicate *valid* causes the entire statement to be rejected. A volume is automatically attached to the system if:

It is explicitly listed in the USER_VOLUME_LIST statement

USER_VOLUME_INCLUDE

It is explicitly listed in the USER_VOLUME_INCLUDE statement

It satisfies a USER_VOLUME_INCLUDE pattern and does not satisfy a USER_VOLUME_EXCLUDE statement.

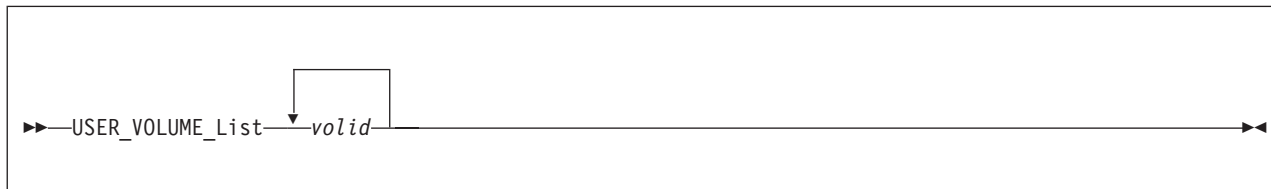
3. If a volume is normally attached to the system using a USER_VOLUME_INCLUDE statement, CP does not notify the operator if the volume is not mounted. If a user volume is necessary for normal system operation, specify it with a USER_VOLUME_LIST statement (see "USER_VOLUME_LIST Statement" on page 299) so that the operator is notified during system initialization that the volume is not mounted.

Examples

1. To include all volumes whose first 5 characters are XAUSR in the user volume list, use the following USER_VOLUME_INCLUDE statement:

```
User_Volume_Include  xausr*      /* Include the following User Volumes */
                                /* on the System User Volume List.. */
                                /* So, any volume starting with      */
                                /* XAUSR* will be mounted.             */
```

USER_VOLUME_LIST Statement



Purpose

Use the USER_VOLUME_LIST statement to generate a list of user DASD volumes. (User volumes are those volumes you use to contain minidisks.) At system IPL, CP attaches the specified user volumes to the system. A volume must be attached to the system before users can link to minidisks it contains.

How to Specify

The USER_VOLUME_LIST statement is optional; if specified, you can include as many statements as you need as long as the total number of volumes specified on a single statement does not exceed 500.

You can place USER_VOLUME_LIST statements anywhere in the system configuration file.

Operands

valid

is the volume serial number of the DASD that you want included in the user volume list. The variable *valid* is a 1- to 6-character string where each character can be a letter, number, or hyphen.

Usage Notes

1. If you do not specify user volumes in any USER_VOLUME_LIST statements, you can still attach a volume to a virtual machine or system using the CP ATTACH command. For more information about the CP ATTACH command, see the *z/VM: CP Commands and Utilities Reference*.
2. If you specify a volume on a USER_VOLUME_LIST statement that is not mounted when you load CP, CP considers that volume unavailable. CP notifies the operator that the volume is not mounted and continues processing, if possible. The system operator can mount and attach the volume to the system when it is needed using the CP ATTACH command. This provision leaves space for future growth.
3. You can also define user volumes by specifying a generic volume identifier. To do this, use the USER_VOLUME_INCLUDE statement (see “USER_VOLUME_INCLUDE Statement” on page 297).
4. At system initialization (IPL), if more than one DASD volume has the same serial number (*valid*), and that *valid* is in the CP-owned or user volume list, and no *rdev* has been specified for that *valid*, the volume with the lowest device number is attached to the system. This rule does not apply to duplicates of the system residence volume (the volume containing the minidisk from which the CP nucleus module was read).

USER_VOLUME_LIST

5. Specifying a *valid* that has been specified previously on a USER_VOLUME_RDEV or USER_VOLUME_LIST statement causes this statement to be rejected.
6. A volume is automatically attached to the system if:
 - It is explicitly listed in a USER_VOLUME_RDEV statement
 - It is explicitly listed in a USER_VOLUME_LIST statement
 - It is explicitly listed in a USER_VOLUME_INCLUDE statement
 - It satisfies a USER_VOLUME_INCLUDE pattern and does not satisfy a USER_VOLUME_EXCLUDE statement.

Examples

1. To add volumes USPK1, USPK2, USPK3, USPK4, and USPK5 to the user DASD volume list, use the following USER_VOLUME_LIST statements:

```
User_Volume_List  uspk1      /* Attach the following disks to the */
User_Volume_List  uspk2      /* system at IPL time. These disks */
User_Volume_List  uspk3      /* contain user minidisks. They    */
User_Volume_List  uspk4      /* will be attached to the system */
User_Volume_List  uspk5      /* IPL time.                      */
```


USER_VOLUME_RDEV Statement

```
►►—USER_VOLUME_Rdev—valid—RDEV—rdev—◄◄
```

Purpose

Use the USER_VOLUME_RDEV statement to specify a user DASD volume at a specific real device number. (User DASD volumes are those volumes you use to contain minidisks.) At system IPL, if the device at the specified RDEV address is labeled with the specified volume ID, CP attaches the volume to the system. A volume must be attached to the system before users can link to minidisks it contains.

How to Specify

The USER_VOLUME_RDEV statement is optional; if specified, you can include as many statements as you need. Each statement may specify only one volume.

You can place USER_VOLUME_RDEV statements anywhere in the system configuration file.

Operands

valid

is the volume serial number of the DASD that you want included in the user volume list. The variable *valid* is a 1- to 6-character string where each character can be a letter, number, or hyphen.

RDEV *rdev*

specifies the real device address of the DASD volume you want included in the user volume list. The variable *rdev* is a 1- to 4-character hexadecimal device address.

Usage Notes

1. If you do not specify user volumes in any USER_VOLUME_RDEV statements, you can still attach a volume to a virtual machine or system using the CP ATTACH command. For more information about the CP ATTACH command, see the *z/VM: CP Commands and Utilities Reference*.
2. If you specify a volume on a USER_VOLUME_RDEV statement that is not mounted when you load CP, CP considers that volume unavailable. CP notifies the operator that the volume is not mounted and continues processing, if possible. The system operator can mount and attach the volume to the system when it is needed using the CP ATTACH command. This provision leaves space for future growth.
3. You can also define user volumes by specifying a generic volume identifier. To do this, use the USER_VOLUME_INCLUDE statement (see “USER_VOLUME_INCLUDE Statement” on page 297).
4. If the DASD volume at the specified RDEV address has a different volume ID than specified on the USER_VOLUME_RDEV statement, or if no DASD volume exists at the specified RDEV address, no volume with the specified volume ID is attached.

USER_VOLUME_RDEV

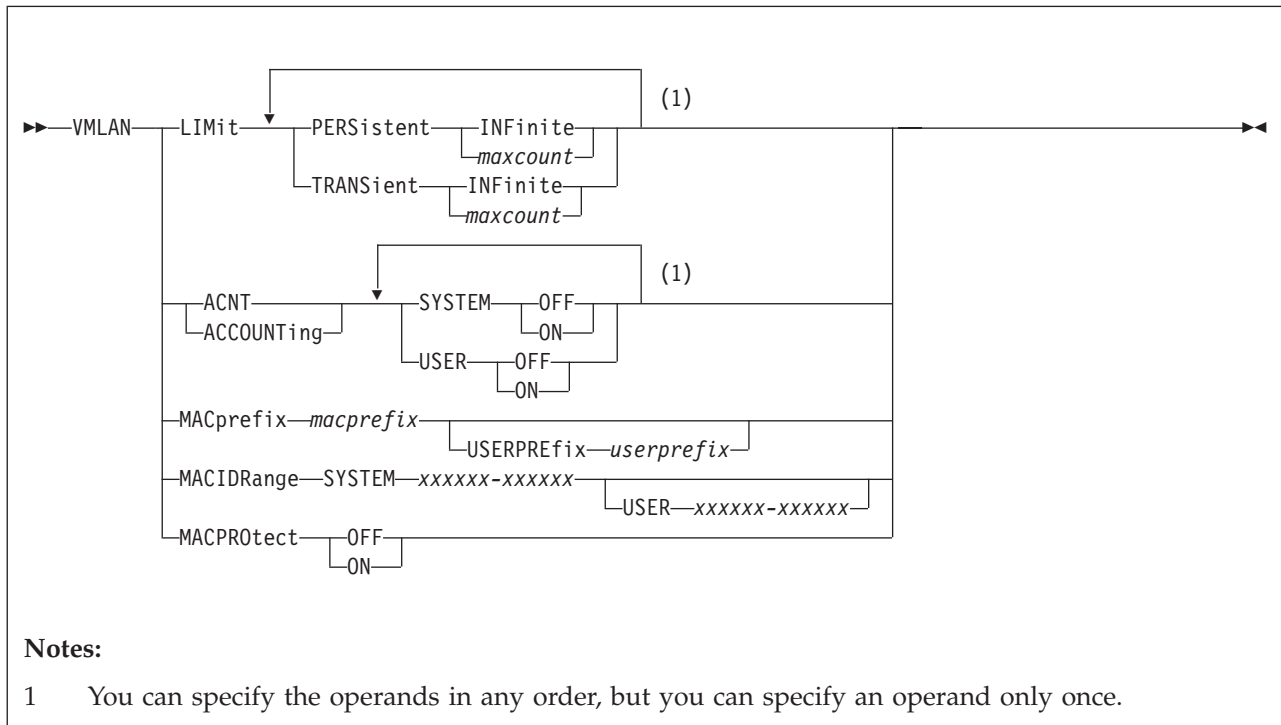
5. At system initialization (IPL), if more than one DASD volume has the same serial number (*valid*), and that *valid* is in the CP-owned or user volume list, and no *rdev* has been specified for that *valid*, the volume with the lowest device number is attached to the system. This rule does not apply to duplicates of the system residence volume (the volume containing the minidisk from which the CP nucleus module was read).
6. Specifying a *valid* that has been specified previously on a USER_VOLUME_RDEV or USER_VOLUME_LIST statement causes this statement to be rejected.
7. Using the USER_VOLUME_RDEV statement instead of the USER_VOLUME_LIST statement provides a convenient method for managing a case where there might be multiple DASD defined to the system that have the same volume ID, and the device with the higher device number is the one that should be attached. This eliminates the need to set the devices OFFLINE_AT_IPL and then attach the devices after the IPL process has completed.
8. A volume is automatically attached to the system if:
 - It is explicitly listed in a USER_VOLUME_RDEV statement
 - It is explicitly listed in a USER_VOLUME_LIST statement
 - It is explicitly listed in a USER_VOLUME_INCLUDE statement
 - It satisfies a USER_VOLUME_INCLUDE pattern and does not satisfy a USER_VOLUME_EXCLUDE statement.

Examples

1. To add volumes USPK7 and USPK8, at device addresses 0554 and 0F23 respectively, to the user DASD volume list, use the following USER_VOLUME_RDEV statements:

```
User_Volume_Rdev  uspk7 RDEV 0554  /* Attach the following disks to the */
User_Volume_Rdev  uspk8 RDEV 0F23  /*  system at IPL time.          */
```

VMLAN Statement



Purpose

Use the VMLAN statement to control global attributes for virtual and real networking support.

How to Specify

Include as many statements as needed; they are optional. You can place VMLAN statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

PERSistent INFinite

indicates the number of PERSISTENT guest LANs and virtual switches allowed on the CP Host system as infinite. This is the default.

PERSistent maxcount

is the maximum number of PERSISTENT guest LANs and virtual switches allowed on the CP Host system at one time. The value *maxcount* must be a decimal number in the range 0 - 1024. If PERSistent *maxcount* is not specified, the system default is INFinite.

A persistent LAN is created when the DEFINE LAN statement is used to create a LAN during system initialization, or when a Class B user issues the DEFINE LAN command to define a SYSTEM owned LAN. A persistent virtual switch is created when the DEFINE VSWITCH statement is used to create the switch during system initialization, or when a Class B user issues the DEFINE VSWITCH command to define a virtual switch.

TRANSient INFinite

indicates the number of TRANSIENT guest LANs allowed on the CP Host system as infinite. This is the default.

TRANSient *maxcount*

is the maximum number of TRANSIENT guest LANs allowed on the CP Host system at one time. The value *maxcount* must be a decimal number in the range 0 - 1024. If TRANSient *maxcount* is not specified, the system default is INFinite.

A transient LAN is created when the DEFINE LAN command is used to define a general user LAN.

ACNT|ACCOUNTing SYSTEM ON|OFF

sets the default accounting state for guest LANs owned by the SYSTEM user ID. The default state of this attribute is **OFF**. Class B users are authorized to override this setting on the **DEFINE LAN** and **SET LAN** commands.

ACNT|ACCOUNTing USER ON|OFF

sets the default accounting state for guest LANs owned by individual users. The default state of this attribute is **OFF**. Class B users are authorized to override this setting on the **DEFINE LAN** and **SET LAN** commands.

MACprefix *macprefix*

specifies the 3-byte prefix (manufacturer ID) used when CP automatically generates locally administered MAC addresses on the system. It must be 6 hexadecimal digits in the range 020000 - 02FFFF. In combination with the MAC ID automatically assigned by CP, the MACPREFIX allows unique identification of virtual adapters within a network. If MACPREFIX is not specified, the default is 020000 (02-00-00).

In an SSI cluster, the MACPREFIX value must be different for each member system and cannot be the same as the USERPREFIX value for the cluster. The default MACPREFIX for a cluster member is 02xxxx (02-xx-xx), where xxxx is the slot number assigned to the system in the SSI member list on the SSI configuration statement.

USERPREFIX *userprefix*

specifies the 3-byte prefix used when user-defined locally administered MAC addresses are generated. It must be 6 hexadecimal digits in the range 020000 - 02FFFF.

A user-defined MAC address is an explicit MAC assignment made from the user directory for a network device. When a persistent MAC address is required, the last 6 hexadecimal digits of the address are specified on the MACID operand of the NICDEF directory statement. The USERPREFIX and MACID values are concatenated to make up the 12 hexadecimal digits of the MAC address assigned to the network device. If USERPREFIX is not specified, the default is set to the MACPREFIX value.

In an SSI cluster, the USERPREFIX value must be identical for all member systems and cannot be the same as the MACPREFIX value for any member. The default is 020000 (02-00-00).

MACIDRange SYSTEM *xxxxxx-xxxxxx* USER *xxxxxx-xxxxxx*

is the range of identifiers (up to 6 hexadecimal digits each) to be used by CP when generating the unique identifier part (last 6 hexadecimal digits) of a virtual adapter MAC address. If a MACIDRANGE SYSTEM range is not specified, CP creates unique identifiers in the entire range (000001 - FFFFFFFF).

USER *xxxxxx-xxxxxx* is the subset of the **SYSTEM** range of identifiers that is reserved for explicit user definition of MACIDs. The MACIDs within this range are reserved for the **SET NIC MACID** command, or for virtual adapters defined with the **MACID** operand on the **NICDEF** directory statement.

MACPROtect

turns MAC address protection on or off for virtual network devices on the system. Turning MAC address protection on prevents a guest from using a MAC address that is not assigned to the user's network device. **MACPROTECT** is valid only for **ETHERNET** virtual switches and guest LANs.

Three levels of inheritance are used when determining the MAC address protection level for a MAC address assigned to a network device. The highest is the system level, followed by the virtual switch or guest LAN level. The lowest level is the protection set for a specific network data device.

The MAC address protection level assigned is determined first at the device, then virtual switch or guest LAN and lastly the system level. If MAC address protection is set at the device level using the **SET NIC CP** command, then its current setting is used. When the device is set to **UNSPECIFIED**, it will inherit the **MACPROTECT** setting of the virtual switch. When the virtual switch **MACPROTECT** setting is set to **UNSPECIFIED**, the MAC address specified by this configuration statement will be used.

OFF set the MAC address protection level to off for all virtual switches, guest LANs and network devices whose MAC address protection setting are not specified (set to **UNSPECIFIED**). Off is the default setting.

If MAC address protection is set to **UNSPECIFIED** by the **SET NIC CP** command for a specific device or the **SET VSWITCH** command for virtual switch coupled devices or the **SET LAN** command for LAN coupled devices, then the device's MAC address protection will be set off.

ON set the MAC address protection level on for coupled devices defined with a MAC address protection set to **UNSPECIFIED**. Set the MAC address protection level to on for all virtual switches, guest LANs and network devices whose MAC address protection setting are not specified (set to **UNSPECIFIED**).

If MAC address protection is set to **UNSPECIFIED** by the **SET NIC CP** command for a specific device or the **SET VSWITCH** command for virtual switch coupled devices or the **SET LAN** command for LAN coupled devices, then the device's MAC address protection will be set on.

Usage Notes

1. Use the **QUERY VMLAN** command to find out the limits that have been established for a running CP system.
2. The limits established by the **VMLAN** statement only apply **AFTER** system initialization. The **DEFINE LAN** and **DEFINE VSWITCH** statements in **SYSTEM CONFIG** are not affected by these limits. Therefore, it is possible to find (using **QUERY VMLAN**) that the current number of guest LANs is higher than the limit.
3. To prohibit users from defining any guest LANs on a given system, set the limit to zero (0). For example, "**VMLAN LIMIT TRANSIENT 0**" would prevent general users from creating guest LANs.

4. Use the MACPREFIX and MACIDRANGE parameters, or the USERPREFIX parameter, if you require a predictable MAC address assignment for virtual NICs on your system. When you combine systems using a virtual switch, each host should define a unique MACPREFIX in the SYSTEM CONFIG file to ensure that each host will generate unique MAC addresses.
5. When MACPREFIX and USERPREFIX are set to the identical value (explicitly or by default), and a virtual adapter is defined with the DEFINE NIC command or with the NICDEF or SPECIAL directory statement, a MAC address is assigned by concatenating the MACPREFIX value with the MACID value found first in the following priority list:
 - a. The MACID from a SET NIC MACID command issued for the device
 - b. The MACID specified on a NICDEF directory statement defining the device, which must be in the USER subset of the MACIDRANGE SYSTEM range
 - c. An available MACID from the MACIDRANGE SYSTEM range
6. When MACPREFIX and USERPREFIX are set to different values, the MACIDRANGE option is ignored and the entire MACID range (000001 - FFFFFFFF) is used for both automatic and user-defined locally administered MAC addresses on the system. When a virtual adapter is defined with the DEFINE NIC command or with the NICDEF or SPECIAL directory statement, a MAC address is assigned by concatenating the USERPREFIX value with the MACID value found first in the following priority list:
 - a. The MACID from a SET NIC MACID command issued for the device
 - b. The MACID specified on a NICDEF directory statement defining the deviceIf a user-defined MACID cannot be found, the USERPREFIX is ignored. CP selects the next available MACID value and appends it to the MACPREFIX to create the MAC address.

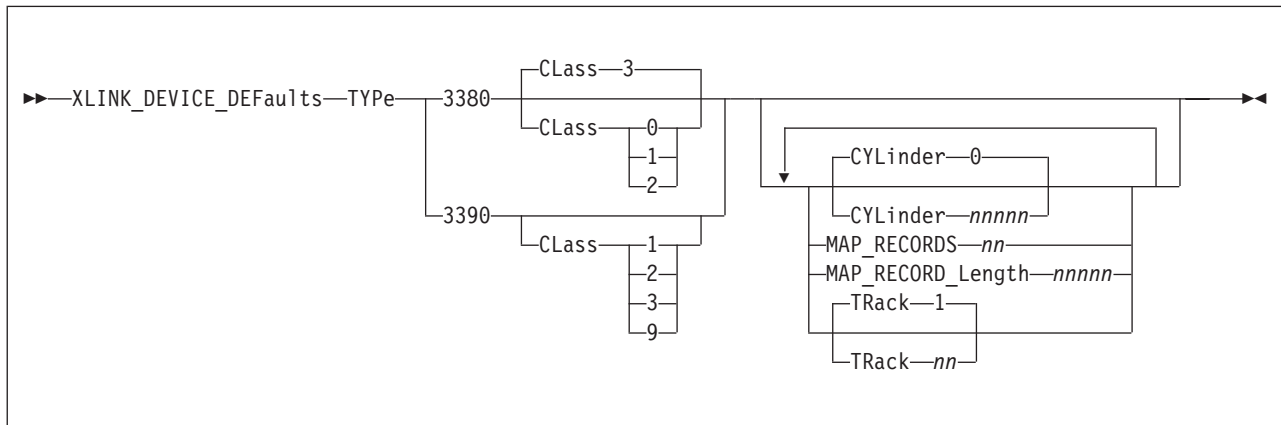
Examples

1. To allow any number of PERSISTENT guest LANs, but set a limit of 20 guest LANs for use on a transient basis, specify the following:

```
vmlan limit persistent infinite transient 20
```
2. To enable accounting for every user-owned guest LAN, specify the following:

```
vmlan accounting user on
```

XLINK_DEVICE_DEFAULTS Statement



Purpose

Use the XLINK_DEVICE_DEFAULTS statement to change the defaults for the cross-system link (XLINK) CSE area location and format for specific types of DASD.

Note: Although this statement allows you to change the definitions of cylinder, track, map records, and record length for the CSE area, it is not recommended. This statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

Attention: Current upper limits may exceed capacities of present devices and cause errors when attempting to access beyond a particular device limit. Therefore, any change of defaults should be done with caution.

You cannot specify the XLINK_DEVICE_DEFAULTS statement with the SSI statement.

How to Specify

Include as many statements as needed; they are optional. You can place XLINK_DEVICE_DEFAULTS statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

Operands

TYPe 3380

tells CP that you want to change the defaults for a 3380 DASD. Optionally, you can specify:

CLass 0, 1, or 2

tells CP that this 3380 DASD belongs in the 1770 cylinder size group.

CLass 3

(the default) tells CP that this 3380 DASD belongs in the 2655 cylinder size group.

XLINK_DEVICE_DEFAULTS

If you are not sure which class to specify, we recommend that you choose a cylinder size group which is larger than the actual number of cylinders on the device or choose the default.

If you omit the CLASS operand for 3380 devices, XLINK uses a value of 2655 cylinders for all 3380 type K devices and 1770 for all 3380 non-type K devices.

TYPE 3390

tells CP that you want to change the defaults for a 3390 DASD. Optionally, you can specify:

Class 1

tells CP that this 3390 DASD belongs in the 1113 cylinder size group.

Class 2

tells CP that this 3390 DASD belongs in the 2226 cylinder size group.

Class 3

tells CP that this 3390 DASD belongs in the 3339 cylinder size group.

Class 9

tells CP that this 3390 DASD belongs in the 10017 or greater, cylinder size group. This class supports the maximum number of cylinders on the 3390.

If you are not sure which class to specify, we recommend that you choose a cylinder size class larger than the actual number of cylinders on the device.

CYLINDER *nnnnn*

tells CP the number of the cylinder where the CSE area is located for the specified DASD type. The variable *nnnnn* is a decimal number from 0 to one less than the maximum number of cylinders on the DASD. If omitted, the default is 0.

Note: Although this statement allows you to change the cylinder definition for the CSE area, it is not recommended. The statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

Attention: Current upper limits may exceed capacities of present devices and cause errors when attempting to access beyond a particular device limit. Therefore, any change of defaults should be done with caution.

MAP_RECORD *nn*

defines the number of map records on the CSE area. The variable *nn* is a decimal number from 2 to 56. Specify as many records as will fit on one track. Table 11 shows the map record defaults for each device type.

Table 11. Map Record Defaults for Each DASD Type

Device Type	Number of Map Records	Map Record Length
3380 non-type K	11	1770
3380 type K	8	2655
3390-1 (native)	12	1113
3390-1 (emulated)	12	1113
3390-2 (native)	8	2226
3390-2 (emulated)	8	2226
3390-3 (native)	8	3339
3390-3 (emulated)	8	3339

Table 11. Map Record Defaults for Each DASD Type (continued)

Device Type	Number of Map Records	Map Record Length
3390-9 (native)	56	65520
OTHER	8	1024

Note: Although this statement allows you to change the definition of map records for the CSE area, it is not recommended. The statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

Attention: Current upper limits may exceed capacities of present devices and cause errors when attempting to access beyond a particular device limit. Therefore, any change of defaults should be done with caution.

MAP_RECORD_Length *nnnnn*

defines the number of cylinders CP should make available for XLINK to use. This value should be at least equal to the number of cylinders on the volume. If *nnnnn* is smaller than the number of cylinders on the volume, CP denies links to minidisks on cylinders with a number higher than *nnnnn*. The variable *nnnnn* is a decimal number from 203 to the maximum number of cylinders on the DASD. The maximum number that can be specified is 65520. Table 11 on page 308 shows the map record defaults for each device type.

For CKD devices *nnnnn* also defines the record length of the map records. On these devices 1 byte in the map record corresponds to 1 cylinder. All cylinders are mapped in 1 physical record per system. On ECKD capable CKD devices there may be several physical records per system. One byte in the map record corresponds to 2 cylinders. Each physical record is 256 bytes and maps 512 cylinders. The number of physical records needed depends on the number of cylinders made available to XLINK.

Note: Although this statement allows you to change the definitions of record length for the CSE area, it is not recommended. The statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

Attention: Current upper limits may exceed capacities of present devices and cause errors when attempting to access beyond a particular device limit. Therefore, any change of defaults should be done with caution.

TRack *nn*

tells CP on which track of the specified CKD DASD to place the CSE area. The variable *nn* is a decimal number from 0 to 64, but you cannot specify TRACK 0 if you also specified CYLINDER 0. If omitted, the default is TRACK 1.

CP uses multiple tracks for ECKD capable CKD devices. The number of tracks used for ECKD capable CKD devices depends on the number of cylinders on the volume. Thus, CP does not use the value specified in TRACK *nn* for an ECKD capable CKD device.

Note: Although this statement allows you to change the definition of track for the CSE area, it is not recommended. The statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

XLINK_DEVICE_DEFAULTS

Attention: Current upper limits may exceed capacities of present devices and cause errors when attempting to access beyond a particular device limit. Therefore, any change of defaults should be done with caution.

Usage Notes

1. Support for the cross system extensions (CSE) environment has been removed. However, the cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems, and “CSE” is still used in some function and object names, command responses, and messages related to XLINK.
2. The CYLINDER, MAP_RECORD, MAP_RECORD_LENGTH, and TRACK operands let you specify CSE area values that are different from the default values associated with the device type. This is not recommended unless there is a valid reason for doing so.
3. The default parameters for model K devices are those associated with 3380 CLASS=3, which are 2655 cylinders and 12 map records. If you want to make all 3380s use the same parameters as model Ks, add the three following statements to each system configuration file:

```
Xlink_Device_Defaults  Type 3380  Class 0,
                        MAP_Record 8,
                        MAP_Record_Length 2655
Xlink_Device_Defaults  Type 3380  Class 1,
                        MAP_Record 8,
                        MAP_Record_Length 2655
Xlink_Device_Defaults  Type 3380  Class 2,
                        MAP_Record 8,
                        MAP_Record_Length 2655
```

Examples

1. The default placement of the XLINK map is on cylinder 0 track 1. If this default is inappropriate for your installation, you may specify a different DASD location on every XLINK_VOLUME_INCLUDE statement, or use the XLINK_DEVICE_DEFAULTS statement.

For example, suppose that all of your 3390 devices, regardless of capacity, must reserve all tracks on cylinder 0 for other uses. Because of this, you decide to place the XLINK map on cylinder 5 track 0. Therefore, use the following XLINK_DEVICE_DEFAULTS statement:

```
Xlink_Device_Defaults  Type 3390  Cylinder 5  Track 0
```

Any individual volumes on 3390 devices could have their XLINK map placed elsewhere on the device by use of the XLINK_VOLUME_INCLUDE statement.

XLINK_SYSTEM_EXCLUDE Statement



Purpose

| Use the XLINK_SYSTEM_EXCLUDE statement to specify a system that CP is to
| exclude from the cross-system link (XLINK) function.

You cannot specify the XLINK_SYSTEM_EXCLUDE statement with the SSI
statement.

How to Specify

Include as many statements as needed; they are optional. You can place
XLINK_SYSTEM_EXCLUDE statements anywhere in the system configuration file.
If you specify more than one statement with the same operands, the last operand
definition overrides any previous specifications.

Operands

sysname
| is the 1- to 8-character name of a system to be excluded from cross-system link.

Usage Notes

- | 1. Support for the cross system extensions (CSE) environment has been removed.
| However, the cross-system link (XLINK) function that was included in CSE is
| still supported for non-SSI systems, and “CSE” is still used in some function
| and object names, command responses, and messages related to XLINK.
- | 2. If a system name is specified on both an XLINK_SYSTEM_EXCLUDE statement
and an XLINK_SYSTEM_INCLUDE statement, CP will ignore the
XLINK_SYSTEM_EXCLUDE statement.
- | 3. The XLINK function is not supported for FBA devices.

Examples

1. To exclude systems VM1, VM2, VM3, and VM4 from XLINK, use the following
XLINK_SYSTEM_EXCLUDE statements:
- ```
Xlink_System_Exclude vm1 /* Exclude the following systems from */
Xlink_System_Exclude vm2 /* cross-system links so that no one */
Xlink_System_Exclude vm3 /* on the other systems will have */
Xlink_System_Exclude vm4 /* access to them. */
```

## XLINK\_SYSTEM\_INCLUDE Statement

```
►►—XLINK_SYSTEM_INclude—Slot—n—sysname—◄◄
```

### Purpose

Use the XLINK\_SYSTEM\_INCLUDE statement to specify a system that CP is to include in the cross-system link (XLINK) function.

You cannot specify the XLINK\_SYSTEM\_INCLUDE statement with the SSI statement.

### How to Specify

Include as many statements as needed; they are optional. You can place XLINK\_SYSTEM\_INCLUDE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

### Operands

#### Slot *n*

tells CP what position this system will hold in the list of systems participating in cross-system link. The maximum value of *n* depends on the type of DASD under cross-system link protection.

#### *sysname*

is the 1- to 8-character name of a system to be included in cross-system link.

### Usage Notes

1. Support for the cross system extensions (CSE) environment has been removed. However, the cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems, and "CSE" is still used in some function and object names, command responses, and messages related to XLINK.
2. If a system name is specified on both an XLINK\_SYSTEM\_EXCLUDE statement and an XLINK\_SYSTEM\_INCLUDE statement, CP ignores the XLINK\_SYSTEM\_EXCLUDE statement.
3. If you specify any systems on the XLINK\_SYSTEM\_INCLUDE or XLINK\_SYSTEM\_EXCLUDE statements and the system that you IPL is in neither list, CP prompts the operator with a warning that this omission may cause the loss of data integrity. The operator can choose to stop the system initialization process, continue as normal, or allow system initialization to continue but have CP skip the normal process of autologging users.
4. The order of system names in XLINK\_SYSTEM\_INCLUDE statements for all systems participating in cross-system link must be identical. That is, the system name for all XLINK\_SYSTEM\_INCLUDE SLOT 1 statements must be the same for all systems.

## Examples

1. To include systems BOSTON3, NEWYORK, and BOSTON4 in cross-system link in slots 1, 2, and 3 (respectively), use the following XLINK\_SYSTEM\_INCLUDE statements:

```
/*-----*/
/* Include the BOSTON3, NEWYORK, and BOSTON4 systems */
/* in cross-system linking. */
/*-----*/
Xlink_System_Include Slot 1 boston3
Xlink_System_Include Slot 2 newyork
Xlink_System_Include Slot 3 boston4
```

## XLINK\_VOLUME\_EXCLUDE Statement

►►XLINK\_VOLUME\_Exclude—*valid*◄◄

### Purpose

Use the XLINK\_VOLUME\_EXCLUDE statement to specify a DASD volume that CP is to exclude from the cross-system link (XLINK) function. The specified volume is not to be shared through cross-system link. If mounted and shared among systems, this volume has no extended link protection.

You cannot specify the XLINK\_VOLUME\_EXCLUDE statement with the SSI statement.

### How to Specify

Include as many statements as needed; they are optional. You can place XLINK\_VOLUME\_EXCLUDE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

### Operands

*valid*

is a volume serial number or a generic volume serial number for a specific subset of volumes to be excluded from cross-system link. The variable *valid* is a 1- to 6-character alphanumeric string with no imbedded blanks. A generic volume serial number is a 1- to 6-character string with asterisks (\*) in place of one or more arbitrary characters and percent signs (%) in place of exactly one arbitrary character. For example:

```
Xlink_Volume_Exclude es%vm*
```

excludes all volumes whose volume serial number start with ES and have VM as their fourth and fifth characters.

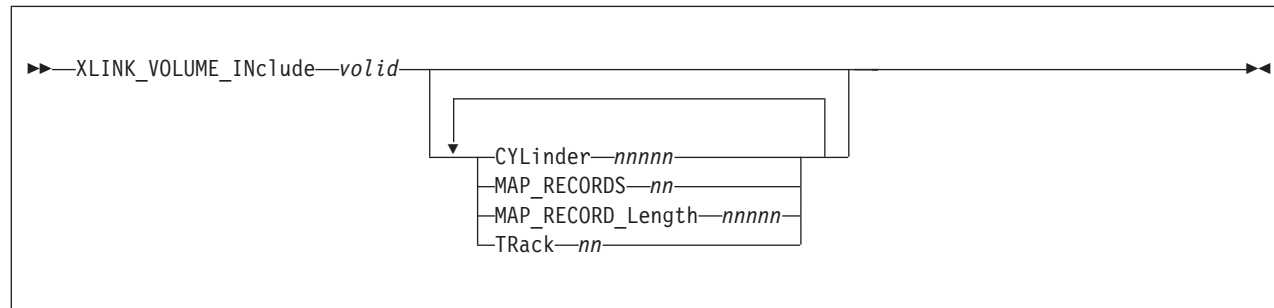
### Usage Notes

1. Support for the cross system extensions (CSE) environment has been removed. However, the cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems, and "CSE" is still used in some function and object names, command responses, and messages related to XLINK.
2. If you do not specify XLINK\_VOLUME\_EXCLUDE or XLINK\_VOLUME\_INCLUDE statements, and the system that you are IPLing is specified on an XLINK\_SYSTEM\_INCLUDE statement, all DASD volumes are included in cross-system link protection.
3. A volume is included in cross-system link protection if it is:
  - Explicitly listed on an XLINK\_VOLUME\_INCLUDE statement, or
  - Matched by a generic volume identifier on an XLINK\_VOLUME\_INCLUDE statement and not found (either explicitly or generically) on an XLINK\_VOLUME\_EXCLUDE statement.

## Examples

1. To exclude volumes VMUSR4, VMUSR7, and VMUSR9 from cross-system linking, use the following XLINK\_VOLUME\_EXCLUDE statements:

```
Xlink_Volume_Exclude vmusr4 /* Exclude VMUSR4, VMUSR7, and */
Xlink_Volume_Exclude vmusr7 /* VMUSR9 from cross-system */
Xlink_Volume_Exclude vmusr9 /* link operations ... */
```



Use the `XLINK_VOLUME_INCLUDE` statement to specify a DASD volume that CP is to include in the cross-system link (XLINK) function.

You cannot specify the `XLINK_VOLUME_INCLUDE` statement with the `SSI` statement.

Include as many statements as needed; they are optional. You can place XLINK\_VOLUME\_INCLUDE statements anywhere in the system configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

*valid*

is a volume serial number or a generic volume serial number for a specific subset of volumes to be included in cross-system link. The variable *valid* is a 1- to 6-character alphanumeric string with no imbedded blanks. A generic volume serial number is a 1- to 6-character string with asterisks (\*) in place of one or more arbitrary characters and percent signs (%) in place of exactly one arbitrary character. For example:

Xlink Volume Include es%vm\*

includes all volumes whose volume serial number start with ES and have VM as their fourth and fifth characters.

**CYLinder** *nnnnnn*

defines the cylinder where the CSE area is located for every *valid*. The variable *nnnnn* is a decimal number from 0 to one less than the maximum number of cylinders on the DASD. If omitted, the default is 0.

MAP RECORDS *nn*

defines the number of map records on the CSE area. The variable  $nm$  should not be smaller than the number of systems that share the volume. If it is, then



all links to minidisks on this volume are denied. We recommend that you use as many records as can fit on one track. See Table 12 on page 318 for the default values.

#### MAP\_RECORD\_Length *nnnnn*

defines the number of cylinders made available for XLINK use. This value should not be smaller than the number of cylinders on the volume. If it is, links to minidisks starting on a cylinder with a number higher than *nnnnn* are denied. The variable *nnnnn* is a decimal number from 203 to the maximum number of cylinders on the DASD. The maximum number that can be specified is 65520. See Table 12 on page 318 for the default values.

For CKD devices, *nnnnn* also defines the record length of the map records. On these devices, one byte in the map record corresponds to one cylinder. All cylinders are mapped in one physical record per system. On ECKD-capable CKD devices, there may be several physical records per system, as one byte in the map record corresponds to two cylinders. Each physical record is 256 bytes and maps 512 cylinders. The number of physical records needed depends on the number of cylinders made available to XLINK.

#### TRack *nn*

defines the track number on which the CSE area is located for every CKD DASD volume matching *validn*. The variable *nn* is a decimal number from 0 to 64, but it cannot be 0 if the value of CYLINDER is 0. If omitted, the default is 1.

For ECKD-capable CKD devices, multiple tracks are used. The number of tracks used for ECKD-capable CKD devices depends on the number of cylinders on the volume. The value specified in TRACK *nn* is not used for an ECKD-capable CKD device matching *validn*.

### Usage Notes

1. Support for the cross system extensions (CSE) environment has been removed. However, the cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems, and "CSE" is still used in some function and object names, command responses, and messages related to XLINK.
2. If you do not specify XLINK\_VOLUME\_INCLUDE or XLINK\_VOLUME\_EXCLUDE statements, and the system that you are IPLing is specified on an XLINK\_SYSTEM\_INCLUDE statement, all DASD volumes are included in cross-system link protection.
3. A volume is included in cross-system link protection if it is:
  - Explicitly listed on an XLINK\_VOLUME\_INCLUDE statement, or
  - Matched by a generic volume identifier on an XLINK\_VOLUME\_INCLUDE statement and not found (either explicitly or generically) on an XLINK\_VOLUME\_EXCLUDE statement.
4. The values you choose for CYLINDER and TRACK must be valid for the device type or types on which the specified volumes reside. This statement does not make sure that your values are valid, because when it is processed, the device types are not yet known.
5. Although the XLINK\_VOLUME\_INCLUDE enables you to change the definitions of cylinder, track, record length, and map records for the CSE area, we do not recommend that you do so. This capability is included to provide link support for new devices with new geometries, should that support become necessary in the future. Table 12 on page 318 shows the map record defaults for each device type.

## XLINK\_VOLUME\_INCLUDE

Table 12. Map Record Defaults for Each Device Type

| Device Type       | Number of Map Records | Map Record Length |
|-------------------|-----------------------|-------------------|
| 3380 non-type K   | 11                    | 1770              |
| 3380 type K       | 8                     | 2655              |
| 3390-1 (native)   | 12                    | 1113              |
| 3390-1 (emulated) | 12                    | 1113              |
| 3390-2 (native)   | 8                     | 2226              |
| 3390-2 (emulated) | 8                     | 2226              |
| 3390-3 (native)   | 8                     | 3339              |
| 3390-3 (emulated) | 8                     | 3339              |
| 3390-9 (native)   | 56                    | 65520             |
| OTHER             | 8                     | 1024              |

6. These defaults support the current CKD and ECKD-capable CKD DASD. The length of each map record is the maximum number of cylinders on any currently existing model of that device type. The number of records defined for other devices is 8, but the actual number of records used is limited to the number that fits on a track of such “*other*” device.

### Examples

1. To include DASD volumes USRPK1, USRPK2, and USRPK3 in cross-system linking, use the following XLINK\_VOLUME\_INCLUDE statements:

```
Xlink_Volume_Include usrpk1 /* Include USERPK1, USERPK2 and */
Xlink_Volume_Include usrpk2 /* USERPK3 in cross-system link */
Xlink_Volume_Include usrpk3 /* operations ... */
```

---

## Chapter 7. The Logo Configuration File

This chapter:

- Provides a summary of logo configuration file statements
- Provides general rules for coding the logo configuration file
- Describes each logo configuration file statement in detail

---

### Using a Logo Configuration File

Creating a logo configuration file allows you to change features of logos that appear on the screen or on separator pages of printed output. The logo configuration file overrides the default logo information, which is defined in the HCPBOX ASSEMBLE file included in the CP module. For example, you can:

- Have certain logo picture files appear on certain terminals
- Include your own information in status and online fields
- Place often-used command text in the command input field on the logo screen

The name of the logo configuration file defaults to LOGO CONFIG unless you specify a different name on the LOGO\_CONFIG statement in the system configuration file. You must place the logo configuration file and the files to which it refers on the parm disk, the CMS minidisk that CP will access at IPL time.

---

### Summary of Logo Configuration File Statements

Table 13 lists all the logo configuration file statements, gives you a brief description of each statement, and points you to where you can get more information about each statement.

*Table 13. Logo Configuration File Statements (LOGO CONFIG)*

| Statement      | Description                                                                                                    | Location                               |
|----------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------|
| CHOOSE_Logo    | Defines the logo picture files that CP uses for specified terminals and for separator pages of printed output. | "CHOOSE_LOGO Statement" on page 325    |
| INPUT_AREA     | Defines which file CP uses when displaying the input area of the logo.                                         | "INPUT_AREA Statement" on page 331     |
| ONLINE_MESSAge | Specifies the file whose text CP should use for the online message area of the logo.                           | "ONLINE_MESSAGE Statement" on page 332 |
| STATUS         | Defines the text of the status fields displayed in the bottom right corner of the screen.                      | "STATUS Statement" on page 333         |

---

### General Rules for Coding a Logo Configuration File

When creating or updating a logo configuration file, you must follow some general syntax rules.

#### Format

The logo configuration file can be a fixed or variable length record file. No individual record in the file should be longer than 4000 characters. No individual statement in the file should be longer than 4000 characters after all continuations of the statement have been resolved.

### Comments

You can add comments to the file by delimiting them with `/*` and `*/`. A single comment may span multiple records in the file. Thus,

```
/*-----*
 * The following section defines the status areas *
 -----/
```

is valid. As many comments as necessary may be entered on a single record in the file. For example,

```
Choose_logo default /* fn ft */ LOGO DEFAULT /* Default cmd */ 'DIAL PVM'
```

is allowed.

### Continuations

To put a statement in more than one record of the configuration file, place a comma at the ends of all but the last line of the statement. For example, you can code the `CHOOSE_LOGO` statement as follows:

```
Choose_logo Local ,
 Address 100-200 ,
 Screen_size 27x132 ,
 MODEL5 LOGO ,
 'DIAL VTAM'
```

A comma at the end of a line indicates that the statement is not yet complete. You should not code a comma if the statement information is complete but a comment continues to the next record.

```
Choose_logo Local ,
 Address 100-200 ,
 Screen_size 27x132 ,
 MODEL5 LOGO ,
 'DIAL VTAM' /* Go to VTAM if user enters
 nothing for user or password */
```

is valid, but a comma after `'DIAL VTAM'` would make the statement invalid, as you have specified no subsequent options. The comma can be placed directly after the last entry on the line. Thus, the example above would also be valid if specified as

```
Choose_logo Local,
 Address 100-200,
 Screen_size 27x132,
 MODEL5 LOGO,
 'DIAL VTAM' /* Go to VTAM if user enters
 nothing for user or password */
```

Finally, a blank line does not cause a continuation to be terminated. You could specify

```
Choose_logo Local,
 Address 100-200,

 Screen_size 27x132,
 MODEL5 LOGO,
 'DIAL VTAM' /* Go to VTAM if user enters
 nothing for user or password */
```

because CP ignores any blank lines in the configuration file.

## Case

In general, it does not matter whether information in the logo configuration file is entered in upper case or mixed case. Most entries in the configuration file are converted to upper case before they are processed. Thus,

```
Status Running Running
```

and

```
Status Running RUNNING
```

would have the same results. An exception to this rule occurs when CP encounters a quoted string in the file. A quoted string is any string enclosed within single quotation marks; the string may contain blanks and special character sequences such as `/*` and `*/` that are not usually permitted in a single token. Where quoted strings are allowed and a quoted string is specified in the configuration file, the text inside the quotation marks is not converted to upper case. In the following example, the specified status area would remain in mixed case:

```
Status Running 'Running'
```

## Categories

Each of the four statements in a logo configuration file modifies a different part of the screen.

- `CHOOSE_LOGO` defines the logo picture that occupies the center of a screen.
- `INPUT_AREA` defines the input area that contains the user ID, password, and command areas.
- `ONLINE_MESSAGE` defines the online message that appears at the top of the screen.
- `STATUS` defines the status area in the lower right hand portion of the screen.

## Precedence

You can include more than one `INPUT_AREA` or `ONLINE_MESSAGE` statement in the configuration file, but CP will use only the last occurrence of a given statement during logo processing. For example,

```
Input_Area INPUT FILE
```

followed by

```
Input_Area INPUT AREA
```

would cause CP to use the file `INPUT AREA` instead of `INPUT FILE`.

You can code a `STATUS` statement for each of the different operands. You can code multiple `STATUS` statements with the same operand, but CP will use only the last one with a given operand. For example,

```
Status Running 'Going'
```

followed by

```
Status Running 'Gone'
```

would cause CP to use `Gone` instead of `Going`.

You should code `CHOOSE_LOGO` statements in three separate groups, one for each of the following categories:

- Locally attached terminals

## Logo Configuration File

- Terminals logging on through logical devices
- Terminals managed by a VSM.

Within these groups, you should code statements in the order of least specific to most specific. Statements that choose logo picture files for certain terminals within a group should occur after statements that choose files for all the terminals in that group.

CP puts the information specified on each group of CHOOSE\_LOGO statements into separate search chains, which it searches from the bottom up. When CP encounters a terminal, it goes through the search chain established for similar terminals until it finds a statement that applies to the specific terminal. Thus, for a given terminal, CP uses the last statement in the logo configuration file that applies.

## Selection

The type of terminal determines the process that CP uses to select a logo picture file. CP supports three types of terminals:

- Terminals directly managed by CP
- Terminals logging on through logical devices
- Terminals managed by a VTAM service machine (VSM)

For each type, CP looks at a series of CHOOSE\_LOGO statements to find out which logo picture file to use for a terminal.

- For terminals that CP manages directly, CP searches through CHOOSE\_LOGO statements with the LOCAL operand.
- For terminals represented by logical devices, it searches through CHOOSE\_LOGO statements with the LDEV operand.
- For terminals managed by a VSM, it searches through CHOOSE\_LOGO statements with the VSM operand.

In all three cases, if CP cannot find a statement that applies to a given terminal, it will use the file specified on the CHOOSE\_LOGO DEFAULT statement, if there is one.

If CP finds a statement that applies to a terminal, but the logo picture file it specifies is too large for the screen, CP will skip the statement and try the next one in the search order.

When CP gets to the end of the search order, the last file it will try to use is either the one specified on a CHOOSE\_LOGO DEFAULT statement, or, if there is no such statement, the default logo in HCPBOX ASSEMBLE. If the default logo picture file (from either source) is too large, CP will use the file specified on the CHOOSE\_LOGO MINIMUM statement, if there is such a statement.

If all else fails, CP will use the logos defined in HCPBOX.

---

## Creating Logo Screens

You can use the DRAWLOGO sample utility program to create logo screens for your system. DRAWLOGO invokes the X\$DRWL\$X sample XEDIT macro. With this utility, you can edit the text of the logo file and modify the 3270 screen attributes of the logo components in a logo file:

- The online message
- The picture
- The input area

DRAWLOGO creates these logo files on the first CMS minidisk accessed in R/W mode. By default, the file type is LOGO. For example, assuming file mode A is accessed in read/write mode, to create LOCOTERM LOGO A, enter:

```
drawlogo locoterm
```

In addition to using XEDIT commands, you can use special functions that are defined for the PF keys:

- Insert 3270 attributes (for colors, highlighting, and so on) When you insert an attribute into your logo, a special symbol appears on your screen to mark the position of the attribute. This symbol does not appear when the logo is put into production and displayed by CP.
- Change attributes
- Insert input field markers.
- Display your logo as you are creating it.

For the complete description of DRAWLOGO, see “DRAWLOGO” on page 840.

DRAWLOGO creates a new logo configuration file, but it does not put it into production. To replace the current system logo configuration file with LOCOTERM LOGO, use the CP REFRESH command:

1. Put LOCOTERM LOGO on a CMS-formatted minidisk accessed by CP.
2. Enter:  
refresh logoinfo locoterm logo

For information about the REFRESH command, see the *z/VM: CP Commands and Utilities Reference*.

## Special Considerations When Creating Logos

You can use certain special characters to add color anywhere in the ONLINE\_MESSAGE and CHOOSE\_LOGO files. If you do so, be careful when you use the INPUT\_AREA file, as the screen cursor will be tabbed to the strings defining the beginning of the color fields as well as to the various INPUT\_AREA fields.

Other special characters are defined for use in building an INPUT\_AREA file. The input area consists of the user ID, password, and command areas.

The use of four colors is supported. PF (program function) keys are defined to allow the insertion of the correct hexadecimal values. The colors defined are as follows:

Table 14. Colors for the CHOOSE\_LOGO and ONLINE\_MESSAGE Files

| Color               | Hexadecimal Representation |
|---------------------|----------------------------|
| Blue                | 1DF0                       |
| Green               | 1D40                       |
| Red                 | 1DC8                       |
| White, highlighting | 1DF8                       |

## Logo Configuration File

Table 14. Colors for the CHOOSE\_LOGO and ONLINE\_MESSAGE Files (continued)

| Color           | Hexadecimal Representation |
|-----------------|----------------------------|
| Protected field | 1D70                       |

The input area comprises three input fields, user ID, password, and command areas. Customarily they appear in this order; the user ID area must precede the password area. The fields may all appear on the same line or on different lines.

PF (program function) keys are also defined to assist in their use. A table of the different fields and their values follows.

Table 15. Input Area Fields

| Field ID | Hexadecimal Representation |
|----------|----------------------------|
| User ID  | 1D4013                     |
| Password | 1D4C                       |
| Command  | 1D40                       |

The above values are the same as in HCPBOX. Logo processing scans the input area for these values in order to determine where to read from the screen. For the logon process to operate correctly, these values must be used.





## CHOOSE\_LOGO

CHOOSE\_LOGO statement that applies. Therefore, when specifying multiple CHOOSE\_LOGO statements, put the generic ones at the top of the file and put the specific ones at the bottom.

### Operands

#### DEFAuLt

tells CP which logo picture file to use when no other CHOOSE\_LOGO statements apply to a specific terminal.

#### LDEV

tells CP which logo picture file to use for terminals logging on to the system through a logical device. You can choose to have one logo picture file for all terminals or you can choose a specific model number, screen size, or user ID:

#### MODe1

tells CP the model number of the terminal. The table below shows the screen size associated with each model:

##### Model Equivalent Screen Size

|   |           |
|---|-----------|
| 2 | 24 by 80  |
| 3 | 32 by 80  |
| 4 | 43 by 80  |
| 5 | 27 by 132 |

**Note:** MODEL operands only apply to terminals with at least as many rows and columns as the screen size that the model number implies. For example, if you had the following statements in your LOGO CONFIG file:

```
Choose_Logo Default File DEFAULT LOGO
Choose_Logo Ldev Model 3 File PVM LOGO
```

and a user with a 24 by 80 terminal used the PVM logical device to get to your system, that user would be looking at the DEFAULT LOGO, not the PVM LOGO. The user needs at least a 32 by 80 terminal to see the PVM LOGO..

#### SCReen\_size rowsXcolumns

tells CP the screen size of the terminal. SCREEN\_SIZE operands only apply to terminals with at least as many rows and columns as the user's actual screen size.

#### USERid *userid*

tells CP to use a specific logo picture file for a specific user ID that creates the logical device (for example, PVM or TCP/IP). You can use this operand to tell CP to use a certain logo picture file for terminals logging on through certain types of logical devices.

#### LOCa1

tells CP which logo picture file to use for devices attached directly to the system. You can choose to have one logo picture file for all locally-attached devices, or you can choose a specific address, a specific address range, the model number, or the screen size:

#### ADDReSS *rdev*

#### ADDReSS *rdev-rdev*

tells CP which logo picture file to use for a specific device address (or range of device addresses) for terminals that CP manages directly. *rdev* must be a hexadecimal number between X'0000' and X'FFFF'.

**Model**

tells CP the model number of the terminal. The table below shows the screen size associated with each model:

**Model    Equivalent Screen Size**

2   24 by 80

3   32 by 80

4   43 by 80

5   27 by 132

**Note:** MODEL operands only apply to terminals with at least as many rows and columns as the screen size that the model number implies. For example, if you had the following statements in your LOGO CONFIG file:

```
Choose_Logo Default File DEFAULT LOGO
Choose_Logo Local Model 4 File LOCAL LOGO
```

and someone used a locally-attached terminal with 32 rows and 80 columns, that user would be looking at the DEFAULT LOGO, not the LOCAL LOGO. The user needs at least a 43 by 80 terminal to see the LOCAL LOGO.

**Screen\_size rowsXcolumns**

tells CP the screen size of the terminal. SCREEN\_SIZE operands only apply to terminals with at least as many rows and columns as the user's actual screen size.

**Minimum**

tells CP which logo picture file to use when the file specified on another CHOOSE\_LOGO statement is too large to fit on that terminal's screen.

**PRINT\_Separator**

tells CP which logo picture file to use on separator pages of output printed on spooling printers.

**VSM**

tells CP which logo picture file to use for people logging on through VTAM service machines (VSMs). You can choose to have one logo picture file for all VSMs, or you can choose a specific user ID:

**USERid user id**

tells CP the user ID of the VSM through which the user is logging on. You can use this operand to tell CP to use a specific logo picture file for terminals logging on through a specific VSM.

**fn ft****File fn ft**

tells CP the file name and file type of the logo picture file. The FILE keyword is optional, unless you gave the logo picture file a name that CP might mistake for a different operand. For example, use FILE if the logo picture file's name is MOD LOGO, because CP interprets the file name MOD as an abbreviation of the MODEL keyword.

**'text'**

tells CP what text to display in the command area of the logo's area. Enclose the text in single or double quotation marks, so that CP does not mistake an imbedded blank as the end of the text. If the text is longer than the input area, CP truncates the text.

If you need to include a single quotation mark in the title, enclose the whole string with double quotation marks. If you need to include a double quotation mark in the title, enclose the whole string with single quotation marks. Also, you may use two consecutive double quotation marks ("" ) to represent a " character within a string delimited by double quotation marks. Similarly, you may use two consecutive single quotation marks (') to represent a ' character within a string delimited by single quotation marks.

### Usage Notes

Notes for Logo Picture Selection on Terminals:

For terminal picture selection, CP determines the amount of space that remains on the screen after accommodating the online message (at the top of the screen), the input area (at the bottom of the screen) and leaving one reserved line. For example, if the screen on which a logo is to be displayed measures 32 rows by 80 columns and the input area contains 6 records, the picture must fit in the remaining space:

```
remaining rows = 32 (rows in screen)
 - 6 (rows in input area)
 - 1 (rows in online message)
 - 1 (reserved row)
 = 24
```

Thus, the picture file selected for this screen can measure no more than 24 rows by 80 columns.

#### A Note About Picture Widths

For VSM logos, the screen is assumed to be 24 rows by 78 columns and the input area need not be accommodated within the 24 rows. Thus, a VSM logo picture file can never contain more than 22 rows or be wider than 78 characters.

No matter how large a screen is on which CP is to display a logo, the number of rows in the logo picture file multiplied by the logical record length of the picture file cannot exceed 3000 characters.

The type of terminal on which the logo is to be displayed determines the process that CP uses to select a logo picture file. For each type of terminal, CP looks at a series of CHOOSE\_LOGO statements to find out which logo picture file to use for the terminal:

- For terminals that CP manages directly, CP searches through CHOOSE\_LOGO statements with the LOCAL operand.
- For terminals represented by logical devices, it searches through CHOOSE\_LOGO statements with the LDEV operand.
- For terminals managed by a VSM, it searches through CHOOSE\_LOGO statements with the VSM operand.

In all three cases, CP attempts to find a CHOOSE\_LOGO statement that applies to the screen and for which the picture file exists on a CP-accessed disk and fits in the space remaining on the screen. The CHOOSE\_LOGO statements are scanned in reverse order of their specification in the logo configuration file.

If no CHOOSE\_LOGO statement meets the aforementioned criteria, the next step taken by CP will depend on whether or not a CHOOSE\_LOGO DEFAULT statement was specified in the logo configuration file.

- If CHOOSE\_LOGO DEFAULT was specified, CP will attempt to read the file specified on the statement and will check if the picture in the file fits in the space remaining on the screen. The maximum width (logical record length) of a default logo file is 78 characters. If the file does not exist on a CP-accessed minidisk or the file is too large to fit on the screen, CP will move on to minimum logo processing.
- If CHOOSE\_LOGO DEFAULT was not specified, CP will check to see if the logo picture specified at HCPBOXNS in HCPBOX fits on the space remaining on the screen. If the picture at HCPBOXNS is too large to fit on the screen, CP will move on to minimum logo processing.

As the minimum logo screen does not include an input area, CP determines the amount of rows remaining for a logo picture as:

(number of rows in screen) - 1 (for online message) - 2 (reserved lines)

Thus, our example above would now read:

```
remaining rows = 32 (rows in screen)
 - 1 (rows in online message)
 - 2 (reserved rows)
 = 29
```

Thus, the minimum logo picture used for this screen can measure no more than 29 rows by 78 columns. Minimum logo processing proceeds as follows:

- If CHOOSE\_LOGO MINIMUM was specified, CP will attempt to read the file specified on the statement and will check if the picture in the file fits in the space remaining on the screen. The maximum width (logical record length) of a minimum logo file is 78 characters. If the file does not exist on a CP-accessed minidisk or the file is too large to fit on the screen, CP will move on to basic logo processing.
- If CHOOSE\_LOGO MINIMUM was not specified, CP will check to see if the logo picture specified at HCPBOXMS in HCPBOX fits on the space remaining on the screen. If the picture at HCPBOXMS is too large to fit on the screen, CP will move on to basic logo processing.

Finally, if no suitable logo picture has been found for the screen, CP will use the basic logo picture defined at HCPBOXBS in HCPBOX. This logo contains no picture; only an online message will be displayed at the top of the screen and a status area at the bottom of the screen. This logo is guaranteed to fit on all screens.

Notes for Separator Pages of Printed Output:

1. Files containing logo pictures for separator pages should have no more than 16 records, each of which should not be longer than 49 characters.
2. If you do not code a CHOOSE\_LOGO PRINT\_SEPARATOR statement, or if the file specified is too large to fit on a separator page, then CP will use the spooling logo defined at HCPBOXBX or, failing that, HCPBLKDB. If you change the logo picture file for the separator pages, enter the CPACCESS command to have CP re-access the minidisk where the separator logo is stored. Use the REFRESH command to activate the changes.

## Examples

Defaults:

```
Choose_Logo Default CAMBVM3 DEFAULT
```

specifies that CP should use the file CAMBVM3 DEFAULT to create default logos.

## CHOOSE\_LOGO

`Choose_Logo Minimum CAMBVM3 MINIMUM`

specifies that CP should use the file CAMBVM3 MINIMUM as the logo picture file when no other picture file can be found to fit on the terminal screen.

Logical Devices:

`Choose_Logo LDEV LDEVS LOGO`

specifies that CP should use the logo picture file LDEVS LOGO for all terminals logging on through logical devices.

`Choose_Logo LDEV Model 3 CAMBVM3 MOD3LOGO`

specifies that CP should use the logo picture file CAMBVM3 MOD3LOGO for all the Model 3 terminals that log on through logical devices. Model 3 terminals have 32 rows and 80 columns.

`Choose_Logo LDEV Model 3 Userid PVM PVM LOGO`

specifies that CP should use the logo picture file PVM LOGO for all terminals that have at least 32 rows and 80 columns and that log in through PVM.

Locally Attached Terminals:

`Choose_Logo Local CAMBVM3 LOCAL`

specifies that CP should display the file CAMBVM3 LOCAL on all locally attached terminals.

`Choose_Logo Local Address 0010-001F CAMBVM3 LOCAL2 'DIAL VTAM'`

specifies that for terminals attached locally between the addresses X'0010' and X'001F', CP should use the logo picture file CAMBVM3 LOCAL2, and place the command DIAL VTAM on the command line.

`Choose_Logo Local Address 0200-02FF Screen_size 27X132 CAMBVM3 LOCMOD5`

specifies that CP should display the file CAMBVM3 LOCMOD5 on all the Model 5 terminals (terminals that have 27 rows and 132 columns) between addresses X'0200' and X'02FF'.

Separator Pages:

`Choose_Logo Print_separator PRINTSEP LOGO`

specifies that CP should use the logo picture file PRINTSEP LOGO on separator pages of printed output.

Terminals Logging on through a VSM:

`Choose_Logo VSM Userid VTAM CAMBVM3 VTAM`

specifies that CP should use the logo picture file CAMBVM3 VTAM on all screens managed by the VSM named VTAM.

## INPUT\_AREA Statement

```
►►—INPUT_AREA—fn—ft—◄◄
```

### Purpose

Use the INPUT\_AREA statement to define a file whose contents will be used in place of the input area provided in HCPBOX ASSEMBLE. This input area contains the input fields for a user ID, password, and command text.

### How to Specify

You can place INPUT\_AREA statements anywhere in the logo configuration file. If you specify more than one INPUT\_AREA statement, the last overrides any previous specifications.

### Operands

*fn* tells CP the file name of the file containing the input area text.

*ft* tells CP the file type of the file containing the input area text.

### Usage Notes

1. If the input area file contains more than 6 records or is wider than 80 characters, CP will use the input area in HCPBOX instead of the one specified in the file.
2. If more than one version of the file exists on the disks accessed by CP, CP will use the file on the lowest accessed minidisk.
3. Although you can use different logo pictures for different terminals, you can define only one input area, which will be displayed on all terminals.
4. CP is shipped with a sample utility program, DRAWLOGO, and a sample XEDIT macro, X\$DRWL\$X, to help you construct the input area file. Refer to Appendix A, "Sample Utility Programs," on page 839 for more information on DRAWLOGO and X\$DRWL\$X.
5. Within the file, you can choose to place more than one input field on one line.

### Examples

1. To use the VM1 INPUT file to define the input area, use the following INPUT\_AREA statement:

```
Input_Area VM1 INPUT /* Use the Input Area defined in */
 /* file, "VM1 INPUT" */
```

## ONLINE\_MESSAGE Statement

```
►►—ONLINE_MESSAge—fn—ft—◄◄
```

### Purpose

Use the ONLINE\_MESSAGE statement to change what appears in the online message section, which always appears at the top of the logo screen. If you omit this statement, CP uses the default online message defined in HCPBOX ASSEMBLE.

### How to Specify

You can place ONLINE\_MESSAGE statements anywhere in the logo configuration file. If you specify more than one ONLINE\_MESSAGE statement, the last overrides any previous specifications.

### Operands

*fn* tells CP the file name of the file containing the online message text.

*ft* tells CP the file type of the file containing the online message text.

### Usage Notes

1. If the online message file contains more than one record or is wider than 78 characters, CP will use the online message defined in HCPBOX instead of the one defined in the file.
2. If the online message text is wider than the screen on which it will be displayed, CP truncates it.

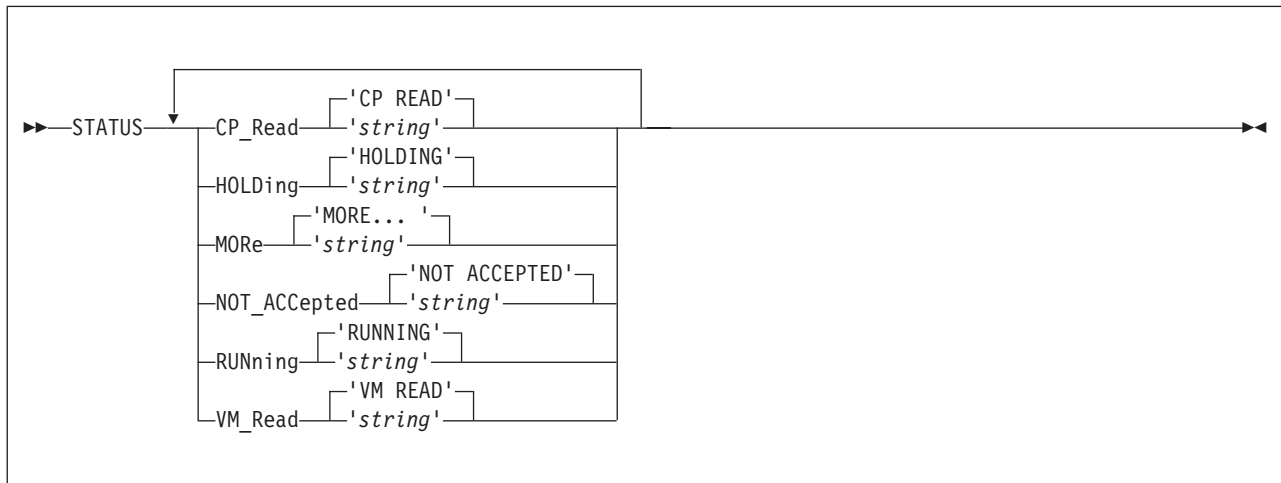
### Examples

1. To use the TOP MESSAGE file to define the online message section, use the following ONLINE\_MESSAGE statement:
 

```
Online_Message Top Message /* The Online Message Can be found */
 /* in file "TOP MESSAGE" */
```



## STATUS Statement



### Purpose

Use the STATUS statement to redefine the default text of the status fields displayed in the bottom right corner of the screen.

### How to Specify

Include as many statements as needed; they are optional. You can place STATUS statements anywhere in the logo configuration file. If you specify more than one statement with the same operands, the last operand definition overrides any previous specifications.

### Operands

#### **CP\_Read** *string*

identifies the string to be displayed in the status area when a virtual machine has issued a CP read. The string can be as long as eight characters. The default string is 'CP READ'.

#### **HOLDing** *string*

identifies the string to be displayed in the status area when there is more information to be displayed and the current screen cannot be cleared because highlighted output appears on it, or when the user presses ENTER when the screen is in MORE... status. The string can be as long as eight characters. The default string is 'HOLDING'.

#### **MORE** *string*

identifies the string to be displayed in the status area when there is more information to be displayed and there is no highlighted text on the current screen. The string can be as long as eight characters. The default string is 'MORE... '.

#### **NOT\_ACCEpted** *string*

identifies the string to be displayed in the status area when CP is executing a command that prevents it from accepting any more input from the command line. The string can be as long as 12 characters. The default string is 'NOT ACCEPTED'.

## STATUS

### **RUNning** *string*

identifies the string to be displayed in the status area when none of the other status conditions exists. The string can be as long as eight characters. The default string is 'RUNNING'.

### **VM\_Read** *string*

identifies the string to be displayed in the status area when a virtual machine has issued a VM read. The string can be as long as eight characters. The default string is 'VM READ'.

## Usage Notes

1. You may have applications that depend on the default status fields. Changing the values of the fields may cause these applications to fail.
2. If you want to include imbedded blanks or preserve mixed case in your character strings, enclose the strings in single quotation marks.
3. The string may be enclosed in single or double quotation marks unless it is a single word entered with no imbedded blanks, in which case the entire word will be capitalized.

If you need to include a single quotation mark in the string, enclose the whole string with double quotation marks. If you need to include a double quotation mark in the string, enclose the whole string with single quotation marks. Also, you may use two consecutive double quotation marks ("" ) to represent a " character within a string delimited by double quotation marks. Similarly, you may use two consecutive single quotation marks (') to represent a ' character within a string delimited by single quotation marks.

## Examples

1. You can code the following STATUS statement to change all of the status fields to mixed case:

```
Status CP_Read 'CP Read',
 Holding 'Holding',
 More 'More... ',
 Not_Accepted 'Not accepted',
 Running 'Running',
 VM_Read 'VM Read'
```

---

## Chapter 8. Setting Up Service Virtual Machines

This chapter describes how to set up virtual machines for:

- Accounting, error recording, and symptom record recording
- Communication controller support
- Service pool virtual machines
- Print Services Facility/VM
- Data storage management.

### Notes:

1. All virtual machines that contain data retrieval applications and use the IUCV facility to connect to the CP accounting, error recording, or symptom record recording system services must include an IUCV directory statement that identifies the appropriate CP recording system service. In addition, when the virtual machine user ID is identified to CP in the appropriate SYSTEM\_USERIDS system configuration file statement (ACCOUNT1, ACCOUNT2, EREP1, EREP2, SYMPTOM1, or SYMPTOM2), data is queued for the application even when the virtual machine is not logged on and CP is started with the COLD option. CP logs on these virtual machines as part of its initialization.
2. Consider adding a LOGONBY statement to the virtual machine definition for service machines. It lets the system administrators and system programmers log on to the service machine using their own log on password rather than that of the service virtual machine. This eliminates the need for many users to know the service virtual machine's log on password.
3. Consider adding the STGEXEMPT operand to the OPTION directory statement for service virtual machines. This operand ensures that the user ID is not subject to being stopped or forced due to the amount of free storage it causes CP to consume. STGEXEMPT is recommended to protect special purpose user IDs which are vital to the installation, user IDs running trusted code, and user IDs which should never be forced off the system.

---

### Setting Up Virtual Machines for Accounting

The z/VM System DDR tapes or DVD include:

- A sample virtual machine definition for an accounting virtual machine. This definition contains the required IUCV authorization for connecting to the CP accounting system service. The user ID for the virtual machine is DISKACNT.

**Note:** One or two virtual machines can be set up as accounting virtual machines.

- A sample system configuration file that defines the user ID for the accounting virtual machine as DISKACNT. The user ID for the accounting virtual machine is defined as part of the SYSTEM\_USERIDS statement in the system configuration file so that it is automatically logged on by CP.
- A sample PROFILE EXEC for the accounting virtual machine. The PROFILE EXEC is supplied on user ID DISKACNT's 191 A-disk.

## Setting Up SVMs

If the accounting virtual machine is not logged on, use the XAUTOLOG command to log on the accounting virtual machine automatically. To do this for the *diskacnt* user ID, enter:

```
xautolog diskacnt
```

---

## Setting Up Virtual Machines to Collect Accounting Records

Your installation can set up multiple virtual machines to collect the accounting records. There are two methods that you can use to specify to CP which virtual machines will be used to retrieve accounting data. These are as follows:

- At CP generation time in the system configuration file, code the SYSTEM\_USERIDS statement to specify the virtual machine IDs (up to two) for which the CP accounting system service (\*ACCOUNT) is to accumulate records. If these users have a virtual machine definition in the user directory, they will be logged on as part of CP initialization. See “SYSTEM\_USERIDS Statement” on page 275 for information about the SYSTEM\_USERIDS statement.
- Additional virtual machines can also collect accounting records by following the instructions in sections:
  - See “Specifying a New Accounting Virtual Machine.”
  - See “Starting Manual Retrieval of Accounting Records.”

### Specifying a New Accounting Virtual Machine

Normally your installation sets up particular virtual machines to be the accounting virtual machines. If you want to have additional virtual machines collect accounting records, do the following:

- Make sure the new accounting virtual machine has an A-disk available to receive the accounting records.
- Make sure the system programmer authorizes the new virtual machine to receive the records in the IUCV directory statement.

The user entering the RETRIEVE utility must have a virtual machine definition containing an IUCV directory statement authorizing the virtual machine to connect to the CP system service which supports the type of record being collected. \*ACCOUNT must be specified for ACCOUNT records.

- Follow the steps outlined in “Starting Manual Retrieval of Accounting Records.”

### Starting Manual Retrieval of Accounting Records

Ordinarily, the accounting virtual machine starts retrieving automatically when you bring up z/VM. But there may be times when you need to start retrieval manually. For example, you may find out through error messages or by entering the QUERY RECORDING command that the accounting virtual machine has stopped retrieving. Or your installation may not set up the accounting virtual machine to start retrieval automatically. In either case, you may start retrieval manually, as follows:

1. If necessary, disconnect from the operator's virtual machine by entering:  

```
disconnect
```
2. Log on the accounting virtual machine.
3. Clear any activity in the virtual machine (including retrieval) by entering:  

```
#cp system reset
```
4. Load CMS into storage by entering:  

```
ipl 190
```

  
or, if your installation has installed CMS in a named saved system,

```
ipl cmsname
```

where *cmsname* is the name of your CMS system.

5. Make sure there is room on the accounting virtual machine's A-disk for more accounting records. To find out how full the A-disk is, enter:

```
query disk a
```

If the A-disk is almost full, process some of the accounting records. Then erase the old files to free space on the A-disk.

6. Start retrieval of accounting records by entering:  

```
retrieve account
```
7. Disconnect the accounting virtual machine by entering:  

```
#cp disconnect
```

You may now use the display for another virtual machine.

8. If necessary, reconnect the operator's virtual machine.

## Disassociating a User ID from the Retrieval of Accounting Records

1. Stop the recording of ACCOUNT records for this user ID. To do this from a user ID authorized for the class **A** or **B** version of the CP RECORDING command, enter:

```
recording account off qid userid
```

Or, the user ID being removed (must be authorized for the class **C**, **E**, or **F** version of the recording command), enter:

```
recording account off
```

2. If there are accounting records queued in host storage for this user ID and you want to save the data, log on the user ID to be deleted and enter:

```
retrieve account
```

This will place the accounting records in the proper file for later processing. Disconnect this user by entering:

```
#cp disconnect
```

Log back on the authorized user ID.

3. If the accounting records queued in host storage for this user ID are not wanted, they may be purged. To do this from a user ID authorized for the class **A** or **B** version of the CP RECORDING command, enter:

```
recording account purge qid userid
```

Or, the user ID being removed (must be authorized for the class **C**, **E**, or **F** version of the recording command), enter:

```
recording account purge
```

This will PURGE all the accounting records queued in host storage for this user ID.

4. Verify the record count is zero and recording is off for this user ID. To do this, enter:

```
query recording
```

**Note:** The deleted user ID remains in the warm start data and in the output of the QUERY RECORDING command until VM is restarted with the COLD option.

5. If the user ID is specified on the SYSTEM\_USERIDS statement in the system configuration file, remove that user ID.

**Note:** The user ID OPERACCT is the default if the SYSACNT macroinstruction is omitted and no user ID for accounting is specified in the system configuration file.

## Accounting Record Formats

### PI

CP produces the following types of accounting records:

- Virtual machine user records (record type 1).
- Records for devices dedicated to a virtual machine user (record type 2).
- Records for temporary disk space dedicated to a virtual machine user (record type 3).
- Records that are written when CP detects that a user has entered enough LOGON, AUTOLOG, XAUTOLOG, or APPCVM CONNECT invocations with an invalid password to reach or exceed an installation-defined threshold value (record type 04).
- Records that are written when CP detects that a user has successfully entered a LINK command to a protected minidisk not owned by the user (record type 05).
- Records that are written when CP detects that a user has entered enough LINK commands with an invalid password to reach or exceed an installation-defined threshold value (record type 06).
- Records generated whenever a user logs off or disconnects from a device controlled by the VCNA or VSCS (record type 07).
- Records that are written when CP detects that a user has successfully entered a LINK command to a protected minidisk not owned by that user's virtual machine (record type 08). Record type 08 is also generated when the user logs off or disconnects or when a SHUTDOWN or FORCE command causes a logged-on virtual machine to be forced off the system. Disconnected virtual machines do not have another 08 record generated for them if they are forced off.
- Records generated about ISFC (record type 09).
- Records logging changes to a user's privilege class (record type 0A)
- Records for virtual disk in storage space (record type B)
- Records for Network Data Transmissions (record type C)
- Records generated as a result of a user-initiated DIAGNOSE X'4C' instruction (record type C0)
- Records for CPU capability (record type D).

**Note:** Record types 04, 05, 06, and 08 are generated only when LOGON, AUTOLOG, XAUTOLOG, LINK, and CONNECT journaling is on.

These records are all 80-character card images.

The size of the fields in the accounting records restricts the data limit that each field can contain. To find the available field size, refer to each record type. Since the fields are limited in their capacity, it is recommended that you cut accounting records at least once a day.

### Accounting Records for Virtual Machine Resource Usage (Record Type 1)

Type 1 accounting records are produced whenever a user logs off or the ACNT command is entered. These records can also be produced when a DEFINE CPU command issued from the command line specifies a change in CPU type. If a DEFINE CPU command is issued through a COMMAND directory statement, no accounting records are produced. The state of CPU affinity during the accounting interval will determine primary and secondary CPU usage. When there is usage on both primary and secondary types, two type 1 accounting records are produced. In this case, only the first record contains data in columns 41 through 64 and 73 through 76. Columns 1 through 28 and 79 and 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable). If the records are produced as a result of the DEFINE CPU command, the records contain usage information for only the CPU being redefined.

#### Column

|       | Contents                                                                                                           |
|-------|--------------------------------------------------------------------------------------------------------------------|
| 1-8   | User ID                                                                                                            |
| 9-16  | Account number                                                                                                     |
| 17-28 | Date and time of accounting ( <i>mmddyyhhmmss</i> )                                                                |
| 29-32 | Number of seconds connected to CP                                                                                  |
| 33-36 | Milliseconds of processor time used, including time for supervisor functions                                       |
| 37-40 | Milliseconds of virtual CPU time used                                                                              |
| 41-44 | Number of page reads                                                                                               |
| 45-48 | Number of page writes                                                                                              |
| 49-52 | Number of requested virtual I/O starts for non-spooled I/O                                                         |
| 53-56 | Number of virtual punch cards sent to a virtual punch                                                              |
| 57-60 | Number of virtual print lines sent to a virtual printer (this includes one line for each carriage control command) |
| 61-64 | Number of virtual punch cards received from a virtual reader                                                       |
| 65    | Virtual CPU type code (see Note 2 )                                                                                |
| 66    | Real CPU type code (see Note 2 )                                                                                   |
| 67-72 | Reserved                                                                                                           |
| 73-76 | Number of completed virtual I/O starts for non-spooled I/O (except DIAGNOSE X'58' and DIAGNOSE X'98')              |
| 77-78 | CPU address (for the SYSTEM VMDBK, this is the real processor address)                                             |
| 79    | Card generator field (C if Diag 4C has been issued, 0 otherwise)                                                   |
| 80    | Accounting record identification code (1)                                                                          |

#### Notes:

1. User virtual machine time may be recorded in more than one record entry. For example:
  - Processor time is accumulated under connect time (bits 29 - 32) and processor time (bits 33 - 40)
2. Virtual and Real CPU Type Codes:
  - X'00' – general purpose Central Processor (CP)
  - X'02' – IBM System z Application Assist Processor (zAAP)
  - X'03' – IBM Integrated Facility for Linux (IFL)
  - X'04' - Internal Coupling Facility (ICF)



- X'05' – IBM System z Integrated Information Processor (zIIP)

### Accounting Records for Dedicated Devices (Record Type 2)

A type 2 accounting record is produced whenever a virtual machine user releases a previously dedicated device. Columns 1 through 28 and 79 and 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable). Translation codes for columns 33 through 36 can be found in Appendix B, “Device Class and Type Codes,” on page 841. See the documentation for each specific device for more complete information on model numbers.

| Column | Contents                                                                                                                                     |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1–8    | User ID                                                                                                                                      |
| 9–16   | Account number                                                                                                                               |
| 17–28  | Date and time of accounting ( <i>mmddyylhmmss</i> )                                                                                          |
| 29–32  | Number of seconds since the virtual disk was created or the number of seconds since the last accounting record was cut for this virtual disk |
| 33     | Device class                                                                                                                                 |
| 34     | Device type                                                                                                                                  |
| 35     | Device model (if any)                                                                                                                        |
| 36     | Device features (if any)                                                                                                                     |
| 37–78  | Reserved                                                                                                                                     |
| 79     | Card generator field (C if Diag 4C has been issued, 0 otherwise)                                                                             |
| 80     | Accounting record identification code (2)                                                                                                    |

### Accounting Records for Temporary Disk Space (Record Type 3)

A type 3 accounting record is produced whenever a virtual machine user releases temporary disk space. Columns 1 through 28 and 79 and 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable). See Appendix B, “Device Class and Type Codes,” on page 841 for information about translation codes for columns 33 through 36. See the documentation for each device for more information on model numbers.

| Column | Contents                                                                                                                          |
|--------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1–8    | User ID                                                                                                                           |
| 9–16   | Account number                                                                                                                    |
| 17–28  | Date and time of accounting ( <i>mmddyylhmmss</i> )                                                                               |
| 29–32  | Number of seconds since the TDISK was created or the number of seconds since the last accounting record was cut for this TDISK    |
| 33     | Device class                                                                                                                      |
| 34     | Device type                                                                                                                       |
| 35     | Device model (if any)                                                                                                             |
| 36     | Device features (if any)                                                                                                          |
| 37–38  | <u>CKD and ECKD Only</u> Number of cylinders of temporary disk space used (only present for CKD or ECKD architected device types) |
| 39–40  | <u>CKD and ECKD Only</u> Reserved                                                                                                 |
| 37–40  | <u>FBA Only</u> Number of FBA blocks used (only present for FBA architected device types)                                         |
| 41–44  | Number of 4-KB pages used (present for all device types)                                                                          |
| 45–78  | Reserved                                                                                                                          |
| 79     | Card generator field (C if Diag 4C has been issued, 0 otherwise)                                                                  |
| 80     | Accounting record identification code (3)                                                                                         |



## Accounting Records for Journaling (Record Types 04, 05, 06, 08, and 0I)

When LOGON, AUTOLOG, XAUTOLOG, LINK, or APPCVM CONNECT journaling is on, CP may create type 04, type 05, type 06, type 08, and type 0I accounting records.

A type 04 accounting record is written whenever CP detects that a user has issued enough LOGON, AUTOLOG, XAUTOLOG, or APPCVM CONNECT invocations with an invalid password to reach or exceed an installation-defined threshold value. This record has the following format:

| <u>Column</u> | <u>Contents</u>                                                                                                       |
|---------------|-----------------------------------------------------------------------------------------------------------------------|
| 1–8           | User ID specified on the command                                                                                      |
| 9–16          | Reserved for IBM use                                                                                                  |
| 17–28         | Date and time of accounting ( <i>mmdyyhhmmss</i> )                                                                    |
| 29–32         | Terminal address (see Note 1 on page 342)                                                                             |
| 33–40         | Invalid password (see Note 2 on page 342)                                                                             |
| 41–48         | User ID that entered AUTOLOG, XAUTOLOG, APPCVM CONNECT, or the BYUSER ID that entered LOGON (see Note 4 on page 343). |
| 49–51         | Reserved for IBM use                                                                                                  |
| 52–53         | Current invalid password count in hexadecimal                                                                         |
| 54–55         | Accounting record limit in hexadecimal                                                                                |
| 56            | Blank                                                                                                                 |
| 57–62         | Reserved                                                                                                              |
| 63–70         | Network qualifier for SNA terminal. Host virtual machine name for TCP/IP terminal.                                    |
| 71–78         | LUNAME for SNA terminal. IP address for TCP/IP terminal (see Note 5 on page 343).                                     |
| 79–80         | Accounting card identification code (04)                                                                              |

A type 05 accounting record is produced whenever CP detects that a user has successfully entered a LINK command to a minidisk protected by a password and not owned by that user. This record is always produced when an external security manager authorizes the link. This record has the following format:

| <u>Column</u> | <u>Contents</u>                                                                    |
|---------------|------------------------------------------------------------------------------------|
| 1–8           | User ID that entered the command                                                   |
| 9–16          | Account number                                                                     |
| 17–28         | Date and time of accounting ( <i>mmdyyhhmmss</i> )                                 |
| 29–32         | Terminal address (see Note 1 on page 342)                                          |
| 33–40         | Reserved for IBM use                                                               |
| 41–48         | User ID of the user that owns the minidisk                                         |
| 49–52         | The minidisk address for which the LINK command was entered                        |
| 53            | Type of minidisk linked (see Note 3 on page 343)                                   |
| 54–55         | Reserved for IBM use                                                               |
| 56–57         | Blank                                                                              |
| 58–62         | Reserved                                                                           |
| 63–70         | Network qualifier for SNA terminal. Host virtual machine name for TCP/IP terminal. |
| 71–78         | LUNAME for SNA terminal. IP address for TCP/IP terminal (see Note 5 on page 343).  |
| 79–80         | Accounting card identification code (05)                                           |

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A type 06 accounting record is produced whenever CP detects that a user has entered enough LINK commands with an invalid password to reach or exceed an installation-defined threshold value. This record has the following format:

| <u>Column</u> | <u>Contents</u>                                                                    |
|---------------|------------------------------------------------------------------------------------|
| 1–8           | User ID that entered the command                                                   |
| 9–16          | Account number                                                                     |
| 17–28         | Date and time of accounting ( <i>mmddyylhmmss</i> )                                |
| 29–32         | Terminal address (see Note 1)                                                      |
| 33–40         | Invalid password (see Note 2)                                                      |
| 41–48         | User ID of the user that owns the minidisk                                         |
| 49–51         | Reserved for IBM use                                                               |
| 52–53         | Invalid password count in hexadecimal                                              |
| 54–55         | Invalid password limit in hexadecimal                                              |
| 56            | Blank                                                                              |
| 57–60         | Minidisk address for which the LINK command was entered                            |
| 61–62         | Reserved                                                                           |
| 63–70         | Network qualifier for SNA terminal. Host virtual machine name for TCP/IP terminal. |
| 71–78         | LUNAME for SNA terminal. IP address for TCP/IP terminal (see Note 5 on page 343).  |
| 79–80         | Accounting card identification code (06)                                           |

A type 08 record is generated when a user logs off or disconnects or when a SHUTDOWN or FORCE command causes that logged-on user to be forced off the system. Disconnected users do not have another 08 record generated for them if they are forced off. This record has the following format:

| <u>Column</u> | <u>Contents</u>                                                                                      |
|---------------|------------------------------------------------------------------------------------------------------|
| 1–8           | User ID                                                                                              |
| 9–16          | Account number                                                                                       |
| 17–28         | Date and time of accounting ( <i>mmddyylhmmss</i> )                                                  |
| 29–48         | Reserved                                                                                             |
| 49–56         | LUNAME for SNA terminal. IP address for TCP/IP terminal (see Note 5 on page 343).                    |
| 57–64         | Network qualifier for SNA terminal. Host virtual machine name for TCP/IP terminal.                   |
| 65–72         | Terminal identification (logical device number, real device number, LUNAME for SNA terminal or NONE) |
| 73–78         | Reserved                                                                                             |
| 79–80         | Accounting record identification code (08)                                                           |

### Notes:

- For the terminal address, columns 29 through 32 may contain one of the following:
  - NONE—if no terminal is found
  - SNA—if terminal is SNA (LUNAME is in columns 71–78)
  - A real or logical device number in the form *Lnnn*, where *nnn* is the logical device number, for all other cases.
- For the invalid password, columns 33 through 40 may contain one of the following:
  - Incorrect password
  - TOO LONG—if entered password is more than 8 characters.

3. For the type of minidisk linked, column 53 may contain one of the following:
  - X'00'—if the link is to a user's minidisk
  - X'10'—if the link is to a full-pack overlay minidisk.
4. A by-user is a user who logs on to a virtual machine using the BY operand of the LOGON command. The by-user's own password is used for LOGON authorization checking for the virtual machine, so the invalid password attempts are counted against the by-user ID, not the user ID of the virtual machine.
5. IP addresses are normally written in dotted-decimal format (for example, 9.130.58.78). In journal records, each segment of the IP address is converted to a two-digit hexadecimal value. For example, 9 is converted to 09, and 130 is converted to 82. The result is an eight-byte string of four two-digit hexadecimal numbers in character form. So, 9.130.58.78 becomes the character string 09823A4E.

A type 0I record is generated when the user is logged on through a logical device with an associated IPv6 address. This record has the following format:

| <u>Column</u> | <u>Contents</u>                                     |
|---------------|-----------------------------------------------------|
| 1–8           | VM user ID                                          |
| 9–16          | Account number                                      |
| 17–28         | Date and time of accounting ( <i>mmddyylhmmss</i> ) |
| 29–36         | Host virtual machine name                           |
| 37–68         | IPv6 address (see note 1)                           |
| 69–78         | Reserved                                            |
| 79–80         | Accounting record identification code (0I)          |

**Note:**

1. IPv6 addresses are normally written in hexadecimal text representation.

**Example:** 0123:4567:89AB:CDEF:FEDC:BA98:7654:3210

In type 0I records, each segment of the IP address is converted from binary to character form. The result is a 32-byte string of 16 two-digit hexadecimal numbers in character form. So, the address shown above becomes 0123456789ABCDEFEDFCBA9876543210.

### Accounting Records for SNA/CCS (Record Type 07)

A type 07 accounting record is produced whenever a user logs off or disconnects from a device controlled by VCNA or VSCS. The record indicates the user's share of the VCNA/VSCS resource used. Columns 1 through 16 and 79 and 80 of this record contain character data. See the *VCNA Installation and Terminal Use Guide* for details of VM/VCNA accounting records and the *ACF/VTAM Planning and Installation* book for details of VSCS accounting records.

| <u>Column</u> | <u>Contents</u>                            |
|---------------|--------------------------------------------|
| 1–8           | User ID                                    |
| 9–16          | Account number                             |
| 17–78         | VSCS/VCNA accounting data                  |
| 79–80         | Accounting record identification code (07) |

### Accounting Records for Inter-System Facility for Communications (Record Type 09)

A type 09 accounting record is produced when the ALL option of the ACNT command is entered. Accounting records are generated for all active conversations and all active links.

There are four different categories of ISFC accounting records:

- Initialization accounting records
- Conversation accounting records
- Link statistics accounting records
- Termination accounting records.

ISFC produces the initialization accounting record during its initialization on the z/VM system. This record, along with the termination accounting record indicates the time frame in which ISFC was active on the z/VM system.

The format of the initialization accounting record is:

| <u>Column</u> | <u>Contents</u>                                                                |
|---------------|--------------------------------------------------------------------------------|
| 1-8           | SYSISFC, indicating that this record was created by the z/VM domain controller |
| 9-12          | Initialization record identifier, ISFI                                         |
| 13-16         | Reserved for IBM use                                                           |
| 17-28         | Date and time the accounting record is generated                               |
| 29-78         | Reserved for IBM use                                                           |
| 79-80         | ISFC accounting record identifier                                              |

The format of the conversation start accounting record is:

| <u>Column</u> | <u>Contents</u>                                                                                                                                                                         |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1-8           | SYSISFC, indicating that this record was created by the z/VM domain controller                                                                                                          |
| 9-12          | Conversation start accounting record identifier, ISFS                                                                                                                                   |
| 13-16         | Conversation ID                                                                                                                                                                         |
| 17-28         | Date and time the accounting record is generated                                                                                                                                        |
| 29-36         | User ID of the user that initiated the conversation                                                                                                                                     |
| 37-59         | Reserved for IBM use                                                                                                                                                                    |
| 60            | Type of name in bytes 61-68. R indicates a global resource. G indicates a gateway name. U indicates a private resource server virtual machine or workstation user ID. I indicates IUCV. |
| 61-68         | Resource name, a gateway name, the user ID of the private resource server virtual machine or workstation, or target userid for an IUCV CONNECT.                                         |
| 69-78         | Reserved for IBM use                                                                                                                                                                    |
| 79-80         | ISFC accounting record identifier                                                                                                                                                       |

The format of the conversation active and conversation end accounting records is:

| <u>Column</u> | <u>Contents</u>                                                                                                                     |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1-8           | SYSISFC, indicating that this record was created by the z/VM domain controller                                                      |
| 9-12          | Conversation record identifier. ISFA indicates a conversation active accounting record; ISFE, a conversation end accounting record. |
| 13-16         | Conversation ID                                                                                                                     |

- 17–28 Date and time the accounting record is generated
- 29–32 Number of bytes received from the remote domain controller since the conversation started or since the last conversation active accounting record was issued.
- 33–36 Number of bytes sent to the remote domain controller since the conversation started or since the last conversation active accounting record was issued.
- 37–78 Reserved for IBM use.
- 79–80 ISFC accounting record identifier

The format of the link statistics accounting records is:

#### Column

#### Contents

- 1–8 SYSISFC, indicating that this record was created by the z/VM domain controller
- 9–12 Link statistics record identifier, ISFL
- 13–16 Reserved for IBM use
- 17–28 Date and time the accounting record is generated
- 29–32 Number of bytes of data received (unsigned binary fullword)
- 33–36 Number of bytes of data sent since the link came up or since the last accounting record was generated for this link (unsigned binary fullword)
- 37–40 Unit address of the link
- 41–44 Number of attention interrupts
- 45–48 Number of write operations that result in collisions
- 49–52 Number of successful write operations
- 53–56 Number of successful read operations
- 57–78 Reserved for IBM use.
- 79–80 ISFC accounting record identifier

The format of the termination accounting record is:

#### Column

#### Contents

- 1–8 SYSISFC, indicating that this record was created by the z/VM domain controller
- 9–12 Termination record identifier, ISFT.
- 13–16 Reserved for IBM use
- 17–28 Date and time the accounting record was generated
- 29–78 Reserved for IBM use
- 79–80 ISFC accounting record identifier

### **Accounting Records for logging changes to a user's privilege (Record Type 0A)**

A type 0A accounting record is produced whenever a SET PRIVCLASS command is successfully issued. The record tracks changes to a user's privilege class and their ability to change their privilege class settings.

There are 4 subtypes of this record.

#### Subtype

#### Description

- L SET PRIVCLASS LOCK has been issued
- U SET PRIVCLASS UNLOCK has been issued
- C The user's privilege class(es) have been changed via the SET PRIVCLASS command.
- R SET PRIVCLASS RESET has been issued

The format for subtypes 'L' (SET PRIVCLASS LOCK) and 'U' (SET PRIVCLASS UNLOCK) appears below. Columns 1 through 36 and 78 through 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable).

### Column

#### Contents

|       |                                                                                |
|-------|--------------------------------------------------------------------------------|
| 1–8   | User ID of the issuer of the SET PRIVCLASS command.                            |
| 9–16  | Account number                                                                 |
| 17–28 | Date and time of accounting ( <i>mmddyymmss</i> )                              |
| 29–36 | Target user ID. User ID that is the target of the SET PRIVCLASS lock or unlock |
| 37–77 | Reserved                                                                       |
| 78    | Subtype                                                                        |

#### Character

#### Subtype Meaning

|       |                                            |
|-------|--------------------------------------------|
| L     | SET PRIVCLASS LOCK has been issued         |
| U     | SET PRIVCLASS UNLOCK has been issued       |
| 79–80 | Accounting record identification code (0A) |

The format for subtypes 'C' (SET PRIVCLASS change) and 'R' (SET PRIVCLASS RESET) appears below. Columns 1 through 36 and 78 through 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable). The privilege class information consists of bits representing privilege classes A-Z, and 1-6 respectively. The bit definitions are defined in HCPCLASS COPY.

### Column

#### Contents

|       |                                                          |
|-------|----------------------------------------------------------|
| 1–8   | User ID of the issuer of the SET PRIVCLASS command       |
| 9–16  | Account number                                           |
| 17–28 | Date and time of accounting ( <i>mmddyymmss</i> )        |
| 29–36 | Target user ID. User ID whose settings are being changed |
| 37–40 | User privilege classes before the change or reset        |
| 41–44 | User privilege classes after the change or reset         |
| 45–48 | User privilege classes as indicated in the directory     |
| 49–77 | Reserved                                                 |
| 78    | Subtype                                                  |

#### Character

#### Subtype Meaning

|       |                                             |
|-------|---------------------------------------------|
| C     | The User's privilege class has been changed |
| R     | The User's privilege class has been reset   |
| 79–80 | Accounting record identification code (0A)  |

## Accounting Records for virtual disk in storage space (Record Type B)

A type B accounting record is produced for a virtual disk in storage. Columns 1 through 28 and 79 and 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable). Translation codes for columns 33 through 36 can be found in Appendix B, "Device Class and Type Codes," on page 841. See the documentation for each specific device for more complete information on model numbers.

### Column

#### Contents

|     |                                              |
|-----|----------------------------------------------|
| 1–8 | User ID. This user ID is defined as follows: |
|-----|----------------------------------------------|

- If the virtual disk in storage is defined in the directory, this is the user ID which contains the MDISK definition for this virtual disk in storage.
- If the virtual disk in storage was defined using the CP DEFINE command, this is the user ID that issued the DEFINE command.

|       |                                                                                                                                               |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 9-16  | Account number                                                                                                                                |
| 17-28 | Date and time of accounting ( <i>mmddyyhhmmss</i> )                                                                                           |
| 29-32 | Number of seconds connected to CP                                                                                                             |
| 33    | Device class                                                                                                                                  |
| 34    | Device type                                                                                                                                   |
| 35    | Device model (if any)                                                                                                                         |
| 36    | Device features (if any)                                                                                                                      |
| 37-40 | Number of FBA blocks used                                                                                                                     |
| 41-44 | Number of 4 KB pages used (present for all device types)                                                                                      |
| 45    | Sub-type of virtual disk accounting record. The only volume defined is zero. If non-zero, the contents of bytes 1-44 and 46-78 are undefined. |
| 46-78 | Reserved                                                                                                                                      |
| 79    | Card generator field (C if Diag 4C has been issued, 0 otherwise)                                                                              |
| 80    | Accounting record identification code (B)                                                                                                     |

### Accounting Records Network Data Transmissions (Record Type C)

Type C accounting records may be produced for any virtual machine user with NETAccounting or NETRouter specified as an option in its user directory. The account records are produced when accounting is performed (CP ACNT command), or when a field in the accounting record is about to overflow, and the user has sent or received data from a Network device. These records are only produced when fields containing byte counters for a device are non-zero.

Network devices to be included in these counts are:

- Virtual network interface cards (NIC)
- Virtual Channel to Channel Adapters
- IUCV and APPC/VM connection paths

The contents of Network Data Transmission accounting records depends on the type of Network device being used. There are 3 different formats, designated by a subtype in byte 78. For subtype 00 (Virtual NIC records), an additional 4 subformats, designated in byte 77, indicate what type of network data is counted in the record.

Type C account record describing data transfer involving routers through a Virtual NIC (Network device type 00). Columns 1 through 28, 35 through 50, and 79 through 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable.)

#### Column

#### Contents

|       |                                                     |
|-------|-----------------------------------------------------|
| 1-8   | VM Userid (Owner of the Virtual NIC)                |
| 9-16  | Account number                                      |
| 17-28 | Date and time of accounting ( <i>mmddyyhhmmss</i> ) |
| 29-30 | Base VDEV address of the Virtual NIC                |
| 31-34 | Default IP Address for this network adapter         |
| 35-42 | LAN or virtual switch owner                         |
| 43-50 | LAN name or virtual switch name                     |
| 51-58 | Bytes Sent (See Data Descriptor)                    |
| 59-66 | Bytes Received (See Data Descriptor)                |
| 67-76 | Reserved                                            |
| 77    | Data Descriptor:                                    |



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|    |                                                                  |
|----|------------------------------------------------------------------|
|    | 00 - Bytes sent to or received from Routers                      |
|    | 01 - Bytes sent to or received from non-Routers                  |
|    | 02 - Bytes sent to or received via Broadcast                     |
|    | 03 - Bytes sent to or received via Multicast                     |
| 78 | Network device type (00) Virtual NIC                             |
| 79 | Card generator field (C if Diag 4C has been issued, 0 otherwise) |
| 80 | Accounting record identification code (C)                        |

### Notes:

1. Hardware headers which appear before the IP Header are not included in the byte counts reported for simulated network adapters.
2. IP addresses are normally written in dotted-decimal format (for example, 9.130.58.78). In journal records, each segment of the IP address is converted to a two-digit hexadecimal value. For example, 9 is converted to 09, and 130 is converted to 82. The result is an 8-byte string of four 2-digit hexadecimal numbers in character form. So, 9.130.58.78 becomes the character string 09823A4E.

TYPE C accounting record for data transfer with a Virtual Channel to Channel Adapter. Columns 1 through 28, 35 through 42, and 79 through 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable.)

### Column

|       | Contents                                                         |
|-------|------------------------------------------------------------------|
| 1-8   | VM Userid (owner of the local CTCA)                              |
| 9-16  | Account number                                                   |
| 17-28 | Date and time of accounting (mmddyyhhmmss)                       |
| 29-30 | VDEV address of the local CTCA                                   |
| 31-34 | Reserved                                                         |
| 35-42 | Userid of the owner of the remote CTCA                           |
| 43-44 | VDEV address of the remote CTCA                                  |
| 45-50 | Reserved                                                         |
| 51-58 | Number of bytes sent to the remote CTCA.                         |
| 59-66 | Number of bytes received from the remote CTCA.                   |
| 67-77 | Reserved                                                         |
| 78    | Network device type (01) virtual CTCA                            |
| 79    | Card generator field (C if Diag 4C has been issued, 0 otherwise) |
| 80    | Accounting record identification code (C)                        |

TYPE C account record for data transfer with an IUCV or APPC/VM connection. Columns 1 through 28, 35 through 42, and 79 through 80 of this record contain character data; all other data is in hexadecimal form (the hexadecimal data is unprintable.)

### Column

|       | Contents                                                         |
|-------|------------------------------------------------------------------|
| 1-8   | VM Userid (Owner of the local connection.)                       |
| 9-16  | Account number                                                   |
| 17-28 | Date and time of accounting (mmddyyhhmmss)                       |
| 29-34 | Reserved                                                         |
| 35-42 | Connected VM Userid (remote)                                     |
| 43-50 | Reserved                                                         |
| 51-58 | Number of bytes sent to the remote user.                         |
| 59-66 | Number of bytes received from the remote user.                   |
| 67-77 | Reserved                                                         |
| 78    | Network device type (02) IUCV or APPC path                       |
| 79    | Card generator field (C if Diag 4C has been issued, 0 otherwise) |



80      Accounting record identification code (C)

**Notes:**

1. Byte count values are reset to zero after an accounting record is created.
2. Byte count values represent data read or written to the device. They will not typically contain bytes transferred as a result of initialization, termination, or error recovery.
3. Accounting for a particular LAN may be controlled by the DEFINE LAN, and SET LAN commands, and default settings may be set by the VMLAN command or VMLAN statement in the system config file.

### Accounting Records for CPU Capability (Record Type D)

A Type D accounting record is produced to record the CPU capability of the processors in the system. A record is generated during VM system initialization and whenever the CPU capability changes.

All fields of the record contain character data.

**Column**

|       | <b>Contents</b>                            |
|-------|--------------------------------------------|
| 1-16  | Reserved                                   |
| 17-28 | Date and time of accounting (mmddyyhhmmss) |
| 29-36 | Primary CPU capability                     |
| 37-44 | Secondary CPU capability                   |
| 45-52 | Nominal CPU capability                     |
| 53-55 | Capacity-Change Reason                     |
| 56-58 | Capacity-Adjustment Indication             |
| 59-78 | Reserved                                   |
| 79    | Card generator field (0)                   |
| 80    | Accounting record identification code (D)  |

## Adding Your Own Accounting Records and Source Code

CP allows you to customize the way it collects accounting records in two ways:

- A virtual machine can use the DIAGNOSE instruction to initiate the generation of a virtual machine accounting record.
- You can add your own source code to the CP accounting exit module.

### User-Initiated Accounting Records (Record Type C0)

A virtual machine user can initiate the creation of an accounting record that contains up to 70 bytes of information of the user's choosing. To do this, the user enters a DIAGNOSE code X'4C' instruction with the following operands (the *z/VM: CP Programming Services* book describes how to enter a DIAGNOSE code):

- The address of a data area in virtual storage that contains the information that the user wants in columns 9 through 78 of the card image record. (This information is placed in the accounting record exactly as it appears in the data area. If more than 70 bytes of data are included, only the first 70 bytes appear in the accounting record.)
- A function code of X'10'.
- The length of the data area in bytes.

The information on this type of accounting record is as follows:

**Column**

|     | <b>Contents</b> |
|-----|-----------------|
| 1-8 | User ID         |

9–78 User-formatted data

79–80 Accounting record identification code (C0)

**PI** end

File spool service virtual machines can generate accounting records in this category. For details, see the *z/VM: CMS File Pool Planning, Administration, and Operation* book.

### CP Accounting Exit (Module HCPACU)

**PI**

You can make system-wide changes to the accounting records that CP collects by adding source code to module HCPACU. HCPACU is an installation-wide exit.

HCPACU supports installation-supplied code for the IBM 3277 Operator Identification Card Reader feature and for examining and modifying CP accounting records. HCPACU is included in the CP nucleus at system generation. Later, during system operation, the CP accounting function calls HCPACU whenever any of the following occurs:

- A virtual machine is started or stopped
- Accounting commands are entered by an operator or a virtual machine
- CP does checkpointing operations.

However, if you do not add any code to HCPACU, the module performs no meaningful function.

HCPACU contains two entry points, HCPACUON and HCPACUOF. Figure 4 on page 351 provides an overview of the IBM-supplied HCPACU module, showing the entry points and the areas where you can add your own source code.

```

 COPY HCOPTNS
HCPACU HCPPROLG ATTR=(RESIDENT),BASE=(R12)
*
 COPY AOFPARM parameter list for HCPACUOF
 COPY AONPARM parameter list for HCPACUON
 COPY HCPEQUAT common system equates
 COPY HCPPFXPG prefix page
 COPY HCPSAVBK savearea block
*
 HCPUSING PFXPG,0
*
HCPACUON HCPENTER CALL,SAVE=DYNAMIC
 HCPUSING AONPARM,R1

*
* Installation-supplied code can be inserted here.
*

 HCPDROP R1
 SLR R15,R15 Set return code of 0
ACUONEXT DS 0H
 ST R15,SAVER15 Store return code
 L R11,SAVER11 Restore register 11
 HCPEXIT EP=HCPACUON
 HCPDROP R13
*
HCPACUOF HCPENTER CALL,SAVE=PFXBALSV
 HCPUSING AOFPARM,R1
 LA R13,PFXBALSV Establish savearea address
 HCPUSING SAVBK,R13

*
* Installation-supplied code can be inserted here.
*

 HCPDROP R1
 SLR R15,R15 Set return code of 0
ACUOFEXT DS 0H
 ST R15,SAVER15 Store return code
* L R11,SAVER11 HCPEXIT does actual load
 HCPEXIT EP=HCPACUOF
 HCPDROP R0,R13
*
 HCPEPILG

```

Figure 4. Module HCPACU Overview

HCPACU has the following requirements and restrictions:

1. HCPACU is written in Assembler H coding language.
2. HCPPROLG, HCPUSING, HCPENTER, HCPDROP, HCPEXIT, and HCPEPILG are IBM-supplied macros (in HCPPSI MACLIB) that must be preserved in HCPACU and used only as shown.
3. The attributes of HCPACU must be REENTRANT and RESIDENT, because HCPACU is called during CP initialization and during CP checkpointing operations.
4. Links and accesses from HCPACU to other modules, data areas, and control blocks are not supported.
5. IBM reserves the right to modify the code associated with this exit. IBM will attempt to make any changes as transparent as possible to the customer.
6. Upon entry to both HCPACUON and HCPACUOF, register 13 points to a save area mapped by HCPSAVBK, shown in Figure 5 on page 352. The caller's

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registers are saved in the save area. A ten-fullword work area, beginning at label SAVEWRK, is available for use by installation-supplied code.

7. Register 11, which points to the address of the dispatched VMDBK, and Register 13, which points to the address of the save area, must not be modified by installation-supplied code.

|          |       |                            |
|----------|-------|----------------------------|
| SAVBK    | DSECT |                            |
|          | DS    | 6F                         |
|          |       | Reserved for IBM use       |
| SAVEREGS | DS    | 0XL64                      |
|          |       | CALLER'S SAVED REGISTER 0  |
| SAVER0   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 1  |
| SAVER1   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 2  |
| SAVER2   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 3  |
| SAVER3   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 4  |
| SAVER4   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 5  |
| SAVER5   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 6  |
| SAVER6   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 7  |
| SAVER7   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 8  |
| SAVER8   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 9  |
| SAVER9   | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 10 |
| SAVER10  | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 11 |
| SAVER11  | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 12 |
| SAVER12  | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 13 |
| SAVER13  | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 14 |
| SAVER14  | DS    | F                          |
|          |       | CALLER'S SAVED REGISTER 15 |
| SAVER15  | DS    | F                          |
| SAVEWRK  | DS    | 0XL40                      |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK0 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK1 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK2 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK3 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK4 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK5 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK6 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK7 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK8 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |
| SAVEWRK9 | DS    | F                          |
|          |       | WORKAREA FOR CALLEE        |

Figure 5. HCPSAVBK Save Area

**Entry Point HCPACUON:** Entry point HCPACUON supports installation-supplied code for the IBM 3277 Operator Identification Card Reader feature. You can add code to examine or validate the data read from an identification card and to accept or reject operator connection to the system.

HCPACUON is called when a LOGON command is entered from a virtual machine, or during autolog processing.

The CP accounting function uses general-purpose register 1 for input to entry point HCPACUON. Register 1 contains the address of a parameter list, called AONPARM, that is described in Figure 6 on page 353. The DSECT for this parameter list must be preserved as shown.

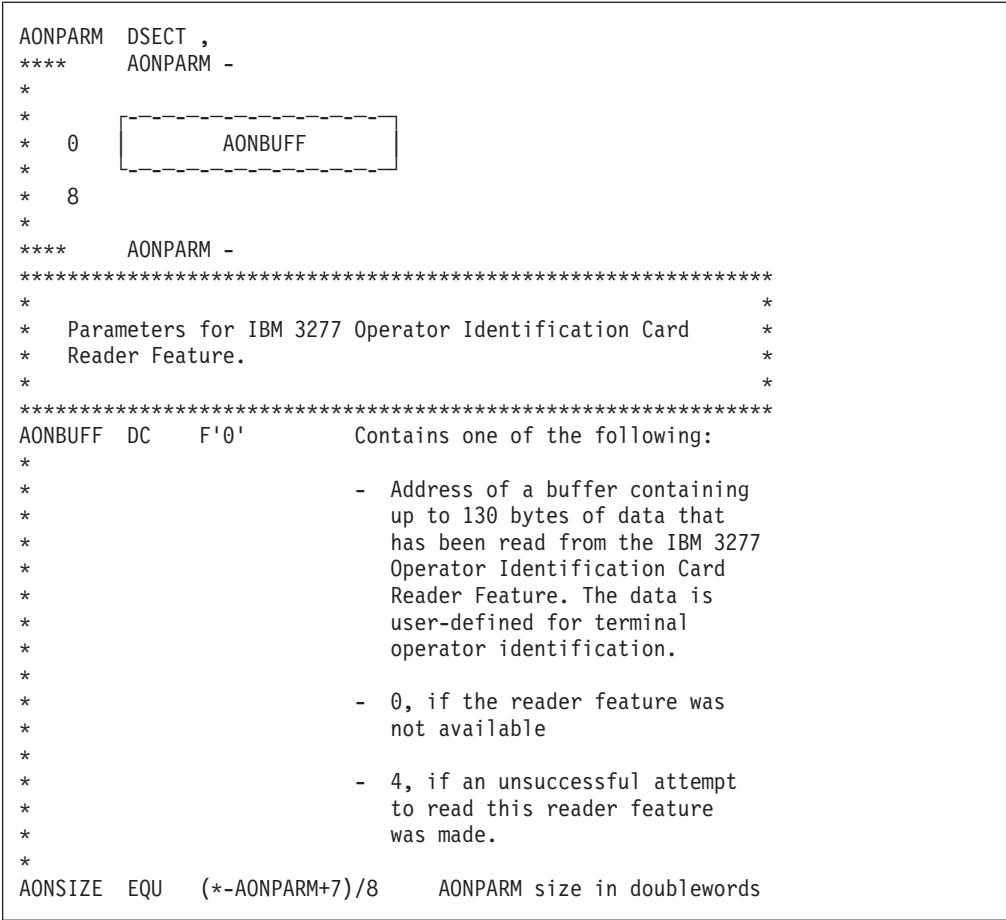


Figure 6. AONPARM Parameter List for Entry Point HCPACUON

Upon return to the CP accounting function from entry point HCPACUON, general-purpose register 15 must contain one of the following return codes:

| Value       | Meaning                                                                                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X'00000000' | Normal processing continues.                                                                                                                                                              |
| X'00000004' | The terminal operator should be forced off the system. However, if the terminal operator was automatically logged on during initialization, you cannot force the operator off the system. |

**Entry Point HCPACUOF:** HCPACUOF supports the addition of installation-supplied code for examining and modifying accounting records. HCPACUOF is called when any of the following occurs:

- A virtual machine operator or system operator enters a LOGOFF or FORCE command
- The system operator enters an ACNT or SET ACCOUNT command
- CP starts the checkpointing function
- A virtual machine issues DIAGNOSE code X'4C' to create a user-initiated accounting record.

For the first three conditions listed above, CP generates accounting record type 1, 2, 3, B, or C. For the last condition, CP generates type C0 accounting records. HCPACUOF is not called during the generation of other types of accounting records.

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The CP accounting function uses general-purpose register 1 for input to entry point HCPACUOF. Register 1 contains the address of a parameter list, called AOFPARM, that is described in Figure 7. The DSECT for this parameter list must be preserved as shown.

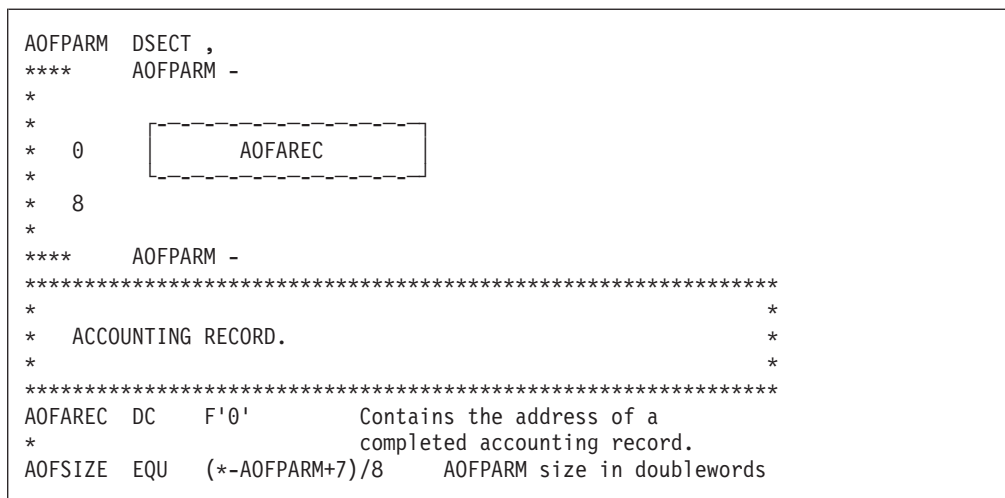


Figure 7. AOFPARM Parameter List for Entry Point HCPACUOF

Upon return to the CP accounting function from entry point HCPACUOF, general-purpose register 15 must contain following return code:

| Value       | Meaning                     |
|-------------|-----------------------------|
| X'00000000' | Normal processing continues |

**PI end**

## Setting Up Virtual Machines for Error Recording

Setting up virtual machines for error recording is similar to setting up virtual machines for accounting. (One or two virtual machines can be used for error recording.) The z/VM System DDR tapes or DVD include:

- A sample virtual machine definition for one error recording virtual machine. The user ID for the virtual machine is EREP.

**Note:** The sample virtual machine definition for the error recording virtual machine (EREP) supplied on the z/VM System DDR tapes or DVD contains the required IUCV authorization to connect to the CP \*LOGREC system service.

- A sample system configuration file that defines the user ID for an error recording virtual machine as EREP. The user ID for an error recording virtual machine is defined as part of the SYSTEM\_USERIDS statement in the system configuration file. This allows the user ID to be automatically logged on by CP initialization and records queued to it.
- A sample PROFILE EXEC for one error recording virtual machine. The PROFILE EXEC is supplied on user ID EREP's 191 A-disk.

If the error recording virtual machine is not logged on, use the XAUTOLOG command to automatically log on the error recording virtual machine. To do this for the EREP user ID, enter:

```
xautolog erep
```

## Setting Up Virtual Machines to Collect EREP Records

Your installation can set up multiple virtual machines to collect the EREP records. There are two methods that you can use to specify to CP which virtual machines will be used to retrieve error recording data. These are as follows:

- At CP generation time in the system configuration file, code the `SYSTEM_USERIDS` statement to specify the virtual machines (up to two) for which the CP Error Logging system service (\*LOGREC) is to accumulate records. If these virtual machines are defined in the user directory, they will be logged on as part of CP initialization. See “`SYSTEM_USERIDS` Statement” on page 275.
- Additional virtual machines can also collect error recording data by following the instructions in sections:
  - See “Specifying a New EREP Virtual Machine.”
  - See “Starting EREP Record Retrieval Manually.”

For information about processing the EREP records, see “Processing EREP Records Collected by the EREP Virtual Machine” on page 357.

### Specifying a New EREP Virtual Machine

Normally, your installation sets up particular virtual machines to be the EREP virtual machines. If you want to have additional virtual machines collect EREP records, then you must do the following:

1. Make sure the new EREP virtual machine has an A-disk available to receive the EREP records.
2. Make sure the system programmer had authorized the new virtual machine to receive the records in the IUCV directory statement.

The virtual machine definition of the user entering the RETRIEVE utility must have an IUCV directory statement authorizing the virtual machine to connect to the CP system service which supports the type of record being collected. \*LOGREC must be specified for EREP records.

3. Follow the steps outlined in the next section, “Starting EREP Record Retrieval Manually.”

### Starting EREP Record Retrieval Manually

Ordinarily, the EREP virtual machine starts retrieving automatically when you bring up z/VM. But there may be times when you need to start retrieval manually. For example, you may find out through error messages or by entering the QUERY RECORDING command that the EREP virtual machine has stopped retrieving. Or your installation may not set up the EREP virtual machine to start retrieval automatically. In either case, you can start retrieval manually, as follows:

1. If necessary, disconnect from the operator's virtual machine by entering:
 

```
disconnect
```
2. Log on the EREP virtual machine.
3. Clear any activity in the virtual machine (including retrieval) by entering:
 

```
#cp system reset
```
4. Load CMS into storage by entering:
 

```
ipl 190
```

or, if your installation has installed CMS in a named saved system:

```
ipl cmsname
```

where *cmsname* is the name of your CMS system.

5. Make sure there is room on the EREP virtual machine A-disk for more EREP records. To find out how full the A-disk is, enter:  
query disk a  
If the A-disk is almost full, process some of the EREP records and erase the old files to free space on the A-disk. See “Processing EREP Records Collected by the EREP Virtual Machine” on page 357.
6. Start EREP record retrieval by entering:  
retrieve erep
7. Disconnect the EREP virtual machine by entering:  
#cp disconnect  
  
You may now use the display for another virtual machine.
8. If necessary, reconnect the operator's virtual machine.

### Disassociating a User ID from the Retrieval of EREP Records

1. Stop the recording of EREP records for this user ID. To do this from a user ID authorized for the class **A** or **B** version of the CP RECORDING command, enter:  
recording erep off qid *userid*  
  
Or, the user ID being removed (must be authorized for the class **C**, **E**, or **F** version of the recording command), enter:  
recording erep off
2. If there are EREP records queued in host storage for this user ID and you want to save the data, log on the user ID to be deleted and enter:  
retrieve erep  
  
This will place the EREP records in the proper file for later processing.  
Disconnect this user by entering:  
#cp disconnect  
  
Log back on the authorized user ID.
3. If the EREP records queued in host storage for this user ID are not wanted, they may be purged. To do this from a user ID authorized for the class **A** or **B** version of the CP RECORDING command, enter:  
recording erep purge qid *userid*  
  
Or, the user ID being removed (must be authorized for the class **C**, **E**, or **F** version of the recording command), enter:  
recording erep purge  
  
This will PURGE all the accounting records queued in host storage for this user ID.
4. Verify the record count is zero and recording is off for this user ID. To do this, enter:  
query recording  
  
**Note:** The deleted user ID remains in the warm start data and in the output of the QUERY RECORDING command until VM is restarted with the COLD option.



5. If the user ID is specified on the SYSTEM\_USERIDS statement in the system configuration file, remove that user ID.

**Note:** The user ID OPEREREP is the default if the SYSEREP macroinstruction is omitted and no user ID for EREP is specified in the system configuration file.

## Processing EREP Records Collected by the EREP Virtual Machine

If you need to process the EREP records that have been collected by the EREP virtual machine, either to clear some space on the EREP A-disk or to format the records for problem determination, you can use the following procedure to process and format the records.

1. Log on the EREP virtual machine.
2. End the retrieval of EREP records in the virtual machine by entering:  
#cp external  
Then enter the following response to the prompt:  
ENTER END OR SUMMARY  
end
3. The EREP virtual machine is now in CMS, and you can check the A-disk for an XAEREPIO RECORD file that has been used by EREP to accumulate records. This is the input file which contains the raw error records to be processed. If another RECORD file exists on the A-disk instead of XAEREPIO RECORD, use its name in place of XAEREPIO in the following steps.
4. Enter the following CMS FILEDEF commands to define the files to be used by the CPEREPIXA utility to process the input file and create a history file:

```
FILEDEF ACCIN DISK XAEREPIO RECORD A (RECFM VB BLKSIZE 20000)
FILEDEF ACCDEV DISK TESTACC RECORD A (RECFM VB BLKSIZE 20000)
FILEDEF TOURIST DISK PRINTAL TOURIST A
FILEDEF EREPPT DISK PRINTAL OUTPUT A
```

ACCIN defines the input file, ACCDEV defines the accumulation file, TOURIST defines the file for messages and diagnostics, and EREPPT defines the file that will contain the report output. Creating the ACCIN, ACCDEV, and EREPPT file definitions before invoking CPEREPIXA allows you to override the CPEREPIXA defaults.

You can place these commands into a REXX exec to be used for processing future records.

To confirm that the file definitions were successfully created, issue the following command:

```
query filedef
```

5. Create a CPEREPIXA control file (PRNTHIST PARM A) containing the following EREP parameters to be used for the first CPEREPIXA invocation.

| <u>Parameter</u> | <u>Meaning</u> |
|------------------|----------------|
|------------------|----------------|

**PRINT=NO**

No reports will be generated.

**ACC=Y**

The selected error records will be accumulated in an output file.

**ZERO=Y**

The error recording files will be cleared after the error records are processed.

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6. If desired, make a copy of the XAEREPIO RECORD file, as it will be deleted as part of the next step.
7. Invoke the CPEREPA utility with the PRNTHIST control file to convert the raw file (XAEREPIO RECORD) to a history file (TESTACC RECORD). This history file will be used as the input file in the second CPEREPA invocation.  
`cperepa prnthist parm a`

Check the A-disk to make sure the TESTACC RECORD file was created if there were raw records to process.

8. Enter the following CMS FILEDEF command to define TESTACC RECORD as the input file for the second CPEREPA invocation:

```
FILEDEF ACCIN DISK TESTACC RECORD A
```

To confirm that the ACCIN file definition was successfully changed, issue the following command:

```
query filedef
```

9. Create a CPEREPA control file (PRINTAL PARM A) containing the following EREP parameters to be used for the second CPEREPA invocation.

| <u>Parameter</u> | <u>Meaning</u> |
|------------------|----------------|
|------------------|----------------|

|                  |                                                                                                                                    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>PRINT=AL</b>  | All of the detail print reports will be generated.                                                                                 |
| <b>HIST=Y</b>    | The error records to be processed are in a history file that was created as an accumulation file in a previous CPEREPA invocation. |
| <b>ACC=N</b>     | The selected error records will not be accumulated in an output file.                                                              |
| <b>LINECT=60</b> | Specifies the maximum line count for each page of the report output.                                                               |

10. Invoke the CPEREPA utility with the PRINTAL control file to process the error records and generate the print reports:

```
cperepa printal parm a
```

11. The PRINTAL OUTPUT A file will now contain all of the formatted records, which can be used as needed.

The PRINTAL OUTPUT, PRINTAL TOURIST, and TESTACC RECORD files should be deleted prior to restarting error record retrieval in the virtual machine. This will ensure that no error records will be combined in successive processing.

12. Run the default PROFILE EXEC on the EREP user ID to restart the EREP record retrieval:

```
profile
```

13. Disconnect the EREP virtual machine by entering:

```
#cp disconnect
```

---

## Setting Up Virtual Machines for Symptom Record Recording

Symptom record recording support allows your installation to record symptom records in CMS files separate from dumps or processor and I/O (LOGREC) errors. CP provides additional information in a symptom record when appropriate. You can use the Dump Viewing Facility VIEWSYM command to view, compare, and select multiple symptom records in CMS files.

A data retrieval application can connect to the CP \*SYMPTOM system service through the IUCV facility to collect symptom records. A virtual machine that contains such an application must have an IUCV directory statement in its virtual machine definition that identifies the CP \*SYMPTOM system service. In addition, when you identify the virtual machine user ID to CP in either the SYSTEM\_USERIDS SYMPTOM1 or SYMPTOM2 statement in the system configuration file, data is queued for the virtual machine even when the virtual machine is not logged on and the z/VM system is started with the COLD option. The virtual machine is also logged on by z/VM as part of initialization.

Setting up virtual machines for symptom record recording is similar to setting up virtual machines for accounting and error recording. (One or two virtual machines can be used for symptom record recording.) The z/VM System DDR tapes or DVD include:

- A sample virtual machine definition for one symptom record recording virtual machine that contains the required IUCV authorization to connect to the CP \*SYMPTOM system service. The user ID for the virtual machine is OPERSYMP.
- A sample system configuration file that *does not* define the user ID for a symptom record recording virtual machine. The user ID for the symptom record recording virtual machine therefore defaults to OPERSYMP.
- A sample PROFILE EXEC for one symptom record recording virtual machine. The PROFILE EXEC is supplied on user ID OPERSYMP's 191 A-disk.

If the symptom record recording virtual machine is not logged on, use the XAUTOLOG command to automatically log on the symptom record recording virtual machine. To do this for the *opersymp* user ID, enter:

```
xautolog opersymp
```

---

## Setting Up Virtual Machines to Collect Symptom Records

Your installation can set up multiple virtual machines to collect the symptom records. There are two methods that you can use to specify to CP which virtual machines will be used to retrieve symptom data. These are as follows:

- At CP generation time in the system configuration file, code the SYSTEM\_USERIDS statement to specify the virtual machine IDs (up to two) for which the CP symptom system service (\*SYMPTOM) is to accumulate records. If these users have a virtual machine definition in the user directory, they will be logged on as part of CP initialization. See “SYSTEM\_USERIDS Statement” on page 275 for information about the SYSTEM\_USERIDS statement.
- Additional virtual machines can also collect symptom records by following the instructions in sections:
  - See “Specifying a New Symptom Record Recording Virtual Machine.”
  - See “Starting Manual Retrieval of Symptom Records” on page 360.

### Specifying a New Symptom Record Recording Virtual Machine

Normally your installation sets up particular virtual machines to be the symptom virtual machines. If you want to have additional virtual machines collect symptom records, do the following:

- Make sure the new symptom virtual machine has an A-disk available to receive the symptom records.
- Make sure the system programmer authorizes the new virtual machine to receive the records in the IUCV directory statement.

The user entering the RETRIEVE utility must have a directory containing an IUCV directory statement authorizing the virtual machine to connect to the CP system service which supports the type of record being collected. \*SYMPTOM must be specified for SYMPTOM records.

- Follow the steps outlined in “Starting Manual Retrieval of Symptom Records.”

### Starting Manual Retrieval of Symptom Records

Ordinarily, the symptom virtual machine starts retrieving automatically when you bring up z/VM. But there may be times when you need to start retrieval manually. For example, you may find out through error messages or by entering the QUERY RECORDING command that the recording virtual machine has stopped retrieving. You may also start retrieval manually, as follows:

1. If necessary, disconnect from the operator's virtual machine by entering:
2. Log on the symptom virtual machine.
3. Clear any activity in the virtual machine (including retrieval) by entering:

```
disconnect
```

```
#cp system reset
```

4. Load CMS into storage by entering:

```
ipl 190
```

or, if your installation has installed CMS in a named saved system,

```
ipl cmsname
```

where *cmsname* is the name of your CMS system.

5. Make sure there is room on the symptom virtual machine's A-disk for more symptom records. To find out how full the A-disk is, enter:

```
query disk a
```

If the A-disk is almost full, process some of the symptom records. Then erase the old files to free space on the A-disk.

6. Start retrieval of symptom records by entering:
7. Disconnect the symptom virtual machine by entering:

```
retrieve symptom
```

```
#cp disconnect
```

You may now use the display for another virtual machine.

8. If necessary, reconnect the operator's virtual machine.

### Disassociating a User ID from the Retrieval of Symptom Records

1. Stop the recording of SYMPTOM records for this user ID. To do this from a user ID authorized for the class A or B version of the CP RECORDING command, enter:

```
recording symptom off qid userid
```

Or, the user ID being removed (must be authorized for the class C, E, or F version of the recording command), enter:

```
recording symptom off
```

2. If there are symptom records queued in host storage for this user ID and you want to save the data, log on the user ID to be deleted and enter:

```
retrieve symptom
```

This will place the symptom records in the proper file for later processing.  
Disconnect this user by entering:

```
#cp disconnect
```

Log back on the authorized user ID.

3. If the symptom records queued in host storage for this user ID are not wanted, they may be purged. To do this from a user ID authorized for the class **A** or **B** version of the CP RECORDING command, enter:

```
recording symptom purge qid userid
```

Or, the user ID being removed (must be authorized for the class **C**, **E**, or **F** version of the recording command), enter:

```
recording symptom purge
```

This will PURGE all the symptom records queued in host storage for this user ID.

4. Verify the record count is zero and recording is off for this user ID. To do this, enter:

```
query recording
```

**Note:** The deleted user ID remains in the warm start data and in the output of the QUERY RECORDING command until VM is restarted with the COLD option.

5. If the user ID is specified on the SYSTEM\_USERIDS statement in the system configuration file, remove that user ID.

**Note:** The user ID OPERSYMP is the default if the SYSSYMP macroinstruction is omitted and no user ID for SYMPTOM is specified in the system configuration file.

---

## Setting Up a Virtual Machine for Communication Controller Support for Emulator Program (EP)

To manage a 3745 communication controller, one needs to set up a special service virtual machine. Unlike other service virtual machines such as the accounting virtual machine, the z/VM System DDR tapes or DVD do not include a sample virtual machine definition for a communication controller virtual machine. This support requires that Advanced Communications Function for Systems Support Programs (ACF/SSP) be installed on your system.

The networking facilities available with communication controllers are provided through VM/Pass-Through (PVM) licensed program. PVM requires a separate virtual machine to perform the loading and dumping of communication controllers.

The CCLOAD utility, which can be issued by the disconnected service machine, provides automatic loading for the communication controller. The CCDUMP utility can be used to format a communication controller dump file produced by CCLOAD. For the complete syntax of these utilities, see the *z/VM: CP Commands and Utilities Reference*.

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CCLOAD requires access to the read/write A-disk. Loading requires space for SYSIN and SYSPRINT files. If CCLOAD is used for dumping the communication controller either automatically or by user request, it requires enough disk space for the dump files. For direct access storage device (DASD) requirements, see the network program products publications.

Use CCDUMP to format and print the dump files produced by CCLOAD. If you provide another user with shared access to the A-disk of the service machine, CTLR dump files can be printed offline while the service machine monitors the CTLR. If you specify DISK, you must have enough space on the A-disk for the formatted output file. Refer to the network program products publication for DASD requirements. When you format the dump on a printer (PRINTER option), messages do not appear on your console but are included in the SYSPRINT file. If you specify DISK, messages included in the SYSPRINT file are displayed on the console.

To erase the input dump file, you must have write access to the disk where it resides. Do not specify the ERASE option if you are sharing access to files on another user's A-disk (for example, those generated by the CCLOAD EXEC on a disconnected service machine).

The following examples show you how to set up a service virtual machine to perform utility functions for a communication controller:

1. Create a virtual machine definition for each communication controller. Use the virtual machine definition in Figure 8 on page 363 as a sample, but make sure you tailor the directory statements to match your system configuration and network licensed program requirements.

```

USER EP0F7 NOPASS 1M 4M G
** This virtual machine requires only a minimal amount
** of storage and the G privilege class.
**
ACCOUNT 10
AUTOLOG AUTOLOG1 PVM OP1 MAINT
** Depending on how you set up your network, you will want
** this virtual machine to be autologged by either the
** system or another service virtual machine such as
** VM/Pass-Through (PVM).
**
IPL CMS
CONSOLE 01F 3215 T OP1
** If you want the capability to interrupt the service
** virtual machine to manually dump and then reload the
** communication controller, or to terminate the service
** virtual machine, specify a secondary user ID (OP1) on
** the CONSOLE statement.
**
SPOOL 00C 2540 READER A
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A
**
DEDICATE 0F7 0F7
** Dedicates the communication controller to this user.
**
LINK MAINT 343 343 RR RMAINT
** Provides access to ACF/SSP.
**
MDISK 191 3380 900 40 XADISK MR
** Provides space for dumps of the communication controller.

```

Figure 8. Sample Virtual Machine Definition for a Communication Controller

- Set up a PROFILE EXEC for the EP0F7 user ID. Use the sample in Figure 9 as a guideline.

```

access 343 b/a
** Access the ACF/SSP disk.
**
queue 'RUN0F7'
** Stack a command to execute the CCLOAD command.
**

```

Figure 9. Sample PROFILE EXEC for EP0F7 User ID

- Set up the RUN0F7 EXEC to run the CCLOAD EXEC and inform the VM/Pass-Through virtual machine that the communication controller is active, as follows:

```

/**/'exec ccload 0f7 ep0f7 cmd(smsg pvm exec ep0f7)'

```

**Note:** You may need to stop CCLOAD processing while the service virtual machine is disconnected. For example, you may need to free space for dump files. To have the service virtual machine resume monitoring the communication controller, have the secondary user ID (OP1 in this case) issue SEND EP0F7 RUN0F7.

## PVM Example

The following examples illustrate a possible use of the service virtual machine. Refer to PVM publications for details.

## Setting Up SVMs

The PVM configuration file shown in Figure 10 contains definition of EP (emulator program) lines.

```
...
*
* BSC lines on the EP communications controller
* whose base subchannel address is 0F7
*
LINK 030 B0F7A R3270
...
LINK 031 B0F7B R3270
...
LINK 032 B0F7C R3270
...
LINK 033 B0F7D R3270
...
LINK 034 B0F7E R3270
...
LINK 035 B0F7F R3270
...
LINK 036 B0F7G R3270
...
LINK 037 B0F7H R3270
...
```

*Figure 10. Sample PVM Configuration File*

PROFILE PVM additions to use this support are shown in Figure 11.

```
* For each EP communications controller, whose lines are
* owned by PVM, authorize its utility service virtual
* machine to send commands to PVM and AUTOLOG the user ID.
*
AUTHORIZ EP0F7
CP XAUTOLOG EP0F7
...
```

*Figure 11. PROFILE PVM Additions*

The EP0F7 PVM file shown in Figure 12 on page 365 is used to start the EP lines automatically.



```

* START LINE commands for PVM to execute when signalled
* by EP0F7 userid executing CCLoad for CTLR device 0F7
*
CP VARY ON 030
CP ATTACH 030 *
START LINE 030
CP VARY ON 031
CP ATTACH 031 *
START LINE 031
CP VARY ON 032
CP ATTACH 032 *
START LINE 032
CP VARY ON 033
CP ATTACH 033 *
START LINE 033
CP VARY ON 034
CP ATTACH 034 *
START LINE 034
CP VARY ON 035
CP ATTACH 035 *
START LINE 035
CP VARY ON 036
CP ATTACH 036 *
START LINE 036
CP VARY ON 037
CP ATTACH 037 *
START LINE 037

```

Figure 12. Sample EP0F7 File

When the 3745 is first loaded by the service machine and PVM issues the VARY and ATTACH commands, the following response is displayed:

```

xxxx varied online
Line xxxx attached to PVM xxxx

```

Following recovery of a 3745 failure, where the EP control program has been reloaded, CP still considers the EP lines online and attached. When the same PVM command list is executed by the service machine, the VARY command displays the following response message:

```

xxxx already online

```

ATTACH displays the following error message for each line:

```

HCPATR122E Line xxxx already attached to PVM

```

---

## Setting Up Service Pool Virtual Machines

You can establish a collection of virtual machines that are logged on over extended periods. Certain applications use this collection to create tasks on behalf of a user. Such a collection is called a service pool.

The pool of virtual machines, each initialized by an application running on CMS, is available to handle requests for services from programmable workstations. The application makes a logical connection between the functions the virtual machines are executing. These services are managed through a VTAM application running on the Advanced Program-to-Program Communications/VM VTAM Support (AVS) of z/VM. The VTAM application uses an LU 6.2 APPC/VM session to invoke these services. For additional information on AVS, see the *z/VM: Connectivity* book. The application that controls the service pool is called the service pool manager. The

## Setting Up SVMs

service pool manager provides services such as autologging the service pool virtual machines and selecting one to handle a request from a workstation.

To define a range of virtual machines to be defined as a pool, code the POOL directory statement. This assigns a virtual machine definition for each virtual machine to be included in the pool. See “POOL Directory Statement” on page 570 for information on coding the POOL directory statement. If you code the POOL statement in a virtual machine definition, it is assigned the only statement other than a USER or IDENTITY statement in that virtual machine definition. Each virtual machine in the pool must have the same first three characters in its user ID, followed by a number in the range specified in the POOL statement.

You must code other directory statements that apply to the range of virtual machines in the pool in a profile entry in the directory (see “PROFILE Directory Statement” on page 581). The pool definition uses the PROFILE statement as the common user definition information. The PROFILE name must have been defined in the directory before any POOL statement that refers to it.

A password (AUTOONLY) specifies that a virtual machine can only be autologged. Thus, a user at a terminal cannot enter a LOGON command for a virtual machine with the AUTOONLY password. This provides a security and data integrity function for service pool virtual machines without having to administer different, changing passwords for the pool of virtual machines.

---

## Setting Up Print Services Facility/VM Virtual Machines

The Print Services Facility/VM (PSF/VM) licensed program processes the spooled output for advanced function printers. It also uses defaults and options specified in a PSF command and CP SPOOL command to generate printer commands to produce formatted output. PSF/VM supports the following printers:

- 3800 Printing Subsystem Models 3 and 8
- 3812 Page Printer Model 2
- 3820 Page Printer
- 3827 Page Printer
- 3835 Page Printer
- 4224 Printer.

PSF/VM is composed of the following components:

- The PSF command, which places a print file and resource files in a printer spool file for a page printer and places the processing options in an external attribute buffer (XAB).
- The spool file conversion machine (SFCM), which converts the spooled print files into the relevant printer command stream for a specified type of printer driver machine (PDM) (for example, a 3800 PDM or a 3820 PDM) and builds a set of control files for use during processing of the print file.
- The 3800 PDM, which drives a 3800 using the printer command stream and control files created by the SFCM.
- The 3820 PDM, which processes files either for a 3820 or for one or more printers attached through RSCS. For the 3820, the 3820 PDM drives the printer using the printer command stream created by the SFCM.
- The Group3 PDM, which processes files for a Group3 printer using the printer command stream and control files created by the SFCM.

You must define one virtual machine for the SFCM and for each PDM. Depending on the requirements of your installation, you might define a virtual machine owned by the system programmer for maintaining PSF/VM.

For more information about PSF/VM and how to set up the virtual machines required for this product, see the *Print Services Facility/VM System Programmer's Guide*.

---

## Setting Up Virtual Machines for Data Storage Management

The DFSMS/VM is the foundation for system-managed storage in the VM environment. A DFSMS/VM service machine uses the Interactive Storage Management Facility (ISMF) to reduce the amount of manual work that must be performed when data is migrating to newly installed DASD. ISMF automatically formats new minidisks, updates user directories, and automates other functions, providing both speed and predictability during data migration activities.

You can use a DFSMS/VM service virtual machine to provide information about other storage management tasks. For example, you can use DIAGNOSE X'08' to determine the devices allocated to the system. The VMUDQ macroinstruction queries user directory minidisk definitions.

You can configure a DFSMS/VM virtual machine to ensure data integrity and security when you move data to new storage locations. ISMF provides a check utility that performs an integrity evaluation of a CMS minidisk to verify whether its file structure is intact. To ensure data security during and after move operations, a DFSMS/VM machine can rely on the usual access authority checking mechanisms, such as ACI and password validation, as well as stable and exclusive link access options that require specific authorization to allow user access to data.

The LNKSTABL and LNKEXCLU options, specified with the OPTION directory statement for a particular virtual machine, give that machine authority to specify access modes that limit the ability of other users to obtain link access to a minidisk while the service machine is linked to that disk. However, the use of these access-mode options can potentially tie up the system if improperly or indiscriminately used and should be treated as a special resource.

These options are described in more detail in “Using Link Access Control Options” on page 386. In addition, further information on access modes can be found in “LINK Directory Statement” on page 524 and “MDISK Directory Statement” on page 539. The VMUDQ macroinstruction is described in *z/VM: CP Programming Services*.



---

## Chapter 9. Planning for SNA Console Communication Services (SNA/CCS)

The Systems Network Architecture console communication services (SNA/CCS) provide a total data communication structure for transmitting information by using a communications network. SNA communication products perform functions traditionally handled by the main processor (for example, management of communication lines, device-dependent characteristics and control, and data formatting).

SNA/CCS provides full z/VM console capabilities to operators on SNA/CCS terminals. You can use SNA/CCS terminals as virtual machine consoles. The information is transparent. If you are planning to use SNA/CCS processing, you must consider the topics discussed in this chapter.

This chapter describes the SNA environment and tells you how to:

- Establish the SNA/CCS terminal environment
- Do tracing for SNA/CCS.

---

### Structure of the SNA Environment

Three major components contribute to SNA/CCS terminal support:

- SNA console communication services (SNA/CCS)
- Inter-user communication vehicle (IUCV)
- One of the following:
  - VTAM SNA Console Support (VSCS)
  - VTAM Communications Network Application (VCNA) licensed program.

IUCV and SNA/CCS are part of z/VM.

SNA/CCS terminal support is provided through a virtual machine. The VTAM service machine (VSM) is the virtual machine that acts as an interface between SNA/CCS and the SNA network. It runs either VSCS or VCNA. VSCS and VCNA both work with the Advanced Communications Function for Virtual Telecommunications Access Method (ACF/VTAM) in doing their job.

Usually, ACF/VTAM is also in the VTAM service machine. VSCS, however, may be in a different virtual machine. ACF/VTAM manages the SNA network, and VSCS or VCNA acts as the interface to CP.

A VCNA VTAM service machine also requires one of the following operating systems with External Interrupt Support (EIS):

- VSE/Advanced Functions licensed program (latest level)
- OS/VS1 with Basic Programming Extensions licensed program.

VSCS does not require a guest operating system but does require GCS.

---

# Establishing the SNA/CCS Terminal Environment

To allow SNA/CCS terminals to access z/VM:

- VSM must be defined to the system
- SNA/CCS must be defined to the VSM
- SNA communications must be enabled
- VSM must be started in its own virtual machine
- VSM must establish a global IUCV connection with SNA/CCS.

After these tasks are accomplished, individual SNA terminal users may access z/VM through the terminals managed by that VSM.

## Defining the VSM to z/VM

The virtual machine definition for the virtual machine that contains the VSM:

- Must authorize the VSM to use IUCV to communicate with SNA/CCS using the IUCV directory statement.
- Should specify PRIORITY on the IUCV directory statement to allow the use of IUCV priority messages.
- May specify how many IUCV connections are allowed by using the MAXCONN operand on the OPTION directory statement. Note that the MAXCONN operand determines how many SNA/CCS terminal users may access z/VM through the VSM.
- May specify that the virtual machine can be automatically logged on by other virtual machines using the XAUTOLOG directory statement.
- May specify that a named saved system or device is to be loaded when the virtual machine is logged on using the IPL directory statement.
- May specify a secondary user ID on the CONSOLE directory statement if secondary console support is to be used in the operation of the VSM.

## Defining Logos Used by VSMs

Logos used by VSMs are selected via the logo configuration file. You can choose to have one logo picture file for all VSMs, or you can choose a different logo picture for each VSM in your system. You use CHOOSE\_LOGO statements in the logo configuration file to tell CP which logos to use for terminals logging on through VSMs.

For more information about logos used by VSMs, refer to Chapter 7, “The Logo Configuration File,” on page 319; for details, see “CHOOSE\_LOGO Statement” on page 325.

## Defining SNA/CCS to VCNA

The VCNA START parameters that relate to SNA/CCS are described below. They are all operands of the DTIGEN macroinstruction, which is optional.

### CCSMLM

specifies the CP message limit. This is the maximum number of messages to be specified on the IUCV ACCEPT request.

### LGNCMDS

specifies the CP commands that are valid before logon.

### PACE

specifies the pacing value for communication between VM/VCNA and CP.

This value is the maximum number of I/O requests per terminal from CP to VM/VCNA before VM/VCNA must return a pacing response. It is provided to prevent a buffer overrun in VM/VCNA.

### **RDSPTMR**

specifies the redisplay timer value in sixteenths of a second. CP uses this value to force VM/VCNA to redisplay data entered and to unlock the keyboard after the prescribed time has elapsed.

### **TIMEINT**

specifies an interval in seconds that VM/VCNA uses to determine how often timer functions such as MORE, HOLDING, and NOT ACCEPTED are to be performed. A smaller value gives greater accuracy with more timer overhead.

### **VCNAMLM**

specifies the IUCV VM/VCNA message limit. This limit is the maximum number of messages specified by VM/VCNA on the IUCV CONNECT request.

## Defining SNA/CCS to VSCS

The VSCS START parameters that relate to SNA/CCS are described below. They are all operands on the DTIGEN macroinstruction, which is optional.

### **LGNCMDS**

specifies the CP commands that are valid before logon.

### **RDSPTMR**

is the redisplay timer value. CP uses this value to force VSCS to redisplay entered data and to unlock the keyboard after the prescribed time.

### **W3767L**

is the default line size for 3767 and 3777 terminals. This value is the initial setting of the CP TERMINAL LINESIZE command when the user logs on with a 3767 or 3777 terminal.

### **W2741L**

is the default line size for 2741 terminals. This value is the initial setting of the CP TERMINAL LINESIZE command when the user logs on with a 2741 terminal.

### **WTWXL**

is the line length for teletype keyboard printers.

### **VSAMLM**

is the maximum number of messages specified on IUCV ACCEPT and CONNECT requests.

### **DSPACE**

is the pacing value to be used with display terminals.

### **KSPACE**

is the pacing value to be used with keyboard terminals and printers.

## Enabling SNA Communication

Before a VSM can establish communication with SNA/CCS, you must enable SNA communication. In a multiple VSM environment, you must selectively enable or disable SNA communication for a particular VSM. Use the CP ENABLE and DISABLE commands to enable and disable SNA communications.

### Starting the VTAM Service Machine

The VSM operator must initialize the VSM before a user can log on to a terminal controlled by the VSM. The VSM operator logs on to z/VM from a natively controlled terminal to create a virtual machine in which the VSM can be initialized. The VSM consists of the programs loaded into this virtual machine: the operating system, the access method, and VM/VCNA or VSCS. After the VSM is operational, the VSM operator can disconnect, and further commands to the VSM can be entered from a secondary console (perhaps the system operator's console), freeing the virtual machine terminal.

An alternative method, also using secondary console support, does not require a virtual machine terminal that is dedicated to VSM. The VSM is automatically logged on in disconnected mode during CP initialization using XAUTOLOG. Then a PROFILE EXEC (VCNA) or a PROFILE GCS EXEC (VSCS) can bring up the system (saved or newly IPLed), and the VSM can be operated from the designated secondary console from the start.

### Improving SNA/CCS Performance

Because SNA/CCS is implemented using a service virtual machine, you can improve the performance of the SNA/CCS environment by allocating more real processor resources to the VSMs that control the terminals connected to CP. Use the CP SET SRM command or the SHARE directory statement to do this. This performance consideration is not specific to SNA/CCS VSMs but applies to all service virtual machines. For more information on the CP SET SRM command, see the *z/VM: CP Commands and Utilities Reference*. For more information on the SHARE statement, see "SHARE Directory Statement" on page 587. For more information on performance and the use of the CP SET SRM command and the SHARE statement, see the *z/VM: Performance* book.

Some installations may see a performance benefit by using the IPOLL function with GCS to poll for pending replies and messages. By allowing GCS to retrieve up to 102 interrupts on each IPOLL, a significant reduction in the number of interrupts to VSCS when it is flooded with incoming IUCVs can be expected. The benefit is greatest when the VSCS virtual machine is loaded with work. The GCS command SET IPOLL ON enables this function.

### VSM Termination

You can shut down a VSM in the following ways:

- You can use normal CP shutdown processing.
- You can terminate VTAM by using the VTAM HALT command.
- You can deactivate VCNA or VSCS by using the ACF/VTAM commands.
- The VSM operator can enter the VCNA or VSCS QUIT command to terminate VCNA or VSCS.
- The z/VM operator or the VSM operator (if authorized) can enter a CP FORCE command to remove individual users. This, combined with entering the DISABLE SNA command to prevent any new SNA/CCS connections, in effect shuts down the VSM.



---

## Chapter 10. Customizing the CP Message Function

### PI

You can customize the CP message function for your installation by adding code to module HCPMSU, as described in this chapter. HCPMSU is an installation-wide exit.

CP Exit 1210 is provided to allow that same tailoring of the system. If this exit point is activated then the HCPMSU installation code will not be invoked. For more information on CP Exit 1210, see the *z/VM: CP Exit Customization* book.

---

### HCPMSU Module

Module HCPMSU allows alteration of the following message function commands: MESSAGE, MSGNOH, SMSG, and WARNING. You can include code in this module to do any of the following:

- Add further verification
- Change the format or context of the message
- Alter parameters that control the way the message is displayed on the screen
- Process installation-defined message command options.

HCPMSU is included in the CP module at system generation. Later, during system operation, when a user issues a message command, the CP message function calls HCPMSU before sending the formatted message to the designated receiver. If no code has been added to HCPMSU, the module performs no meaningful function.

HCPMSU contains one entry point, HCPMSUEX. Figure 13 provides an overview of the IBM-supplied HCPMSU module, showing the entry point and the area where you can add your own source code.

```

 COPY HCOPTNS
HCPMSU HCPPROLG ATTR=(RESIDENT),BASE=(R12)
*
 COPY HCPEQUAT common system equates
 COPY HCPSAVBK savearea block
*
HCPMSUEX HCPENTER CALL,SAVE=DYNAMIC

*
* Installation-supplied code can be inserted here.
*

 SLR R15,R15 Set return code of 0
MSUEXEND DS 0H Load regs and exit
 ST R15,SAVER15 Store return code
 L R11,SAVER11 Restore register 11
 HCPEXIT EP=HCPMSUEX
 HCPDROP R13
*
 HCPEPILG
```

Figure 13. Module HCPMSU Overview

## Customizing Messages

HCPMSU has the following requirements and restrictions:

1. HCPMSU is written in Assembler H coding language.
2. HCPPROLG, HCPENTER, HCPDROP, HCPEXIT, and HCPEPILG are IBM-supplied macros (in HCPPSI MACLIB) that must be preserved in HCPMSU and used only as shown.
3. The attributes of HCPMSU must be REENTRANT and RESIDENT.
4. Links and accesses from HCPMSU to other modules, data areas, and control blocks are *not* supported.
5. IBM reserves the right to modify the code associated with this exit. IBM will attempt to make any changes as transparent as possible to the customer.
6. Upon entry to HCPMSUEX, register 13 points to a save area mapped by HCPSAVBK, shown in Figure 5 on page 352. The caller's registers are saved in the save area. A ten-fullword work area, beginning at label SAVEWRK, is available for use by installation-supplied code.
7. Register 11, which points to the address of the dispatched VMDBK, and Register 13, which points to the address of the save area, must not be modified by installation-supplied code.

### Entry Point HCPMSUEX

Entry point HCPMSUEX supports installation modifications to the MESSAGE, MSGNOH, WARNING, and SMSG commands. If the specified receiver of a message from one of these commands is logged on and has not turned off display of that message type (using the SET MSG OFF, SET SMSG OFF, or SET WNG OFF command), the CP message function verifies and formats the message, sets up the proper sending parameters, and calls HCPMSUEX before sending the message.

The CP message function uses general-purpose register 1 for input to entry point HCPMSUEX. Register 1 contains the address of a PLIST, which contains a list of addresses. Each fullword address points to a parameter being passed to the module. See "Parameter Values."

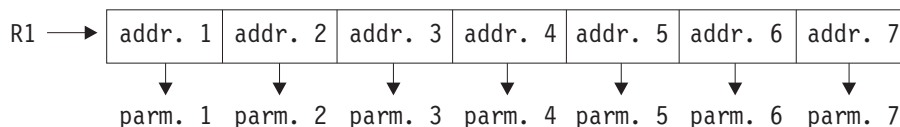
Upon return to the CP message function from entry point HCPMSUEX, general-purpose register 15 must contain one of the following return codes:

| Value       | Meaning                                                                                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0           | Normal processing continues.                                                                                                                                                                                                                                                                                                 |
| <i>nnnn</i> | An error was detected during HCPMSUEX exit processing. The installation-defined return code <i>nnnn</i> can be in the range of 0001 to 9999. The CP message function stops processing and issues the following message:<br>HCPMFS6600E An error was detected by installation-wide exit<br>HCPMSU – return code <i>nnnn</i> . |

See *z/VM: CP Messages and Codes* for further information on this message.

### Parameter Values

General-purpose register 1 contains the address of a PLIST that contains a list of addresses, each pointing to a parameter, as shown in the following figure.



The parameters contain the following values:

1. The first 8 bits of this 32-bit field control the way the message is displayed. More than one bit may be set. You can change the settings to change the way the message is displayed. The possible values are:

| Value                 | Meaning                                                       |
|-----------------------|---------------------------------------------------------------|
| X'80_____'            | A time stamp is appended to the message.                      |
| X'40_____'            | No time stamp is appended to the message.                     |
| X'20_____'            | The message is highlighted when displayed.                    |
| X'10_____'            | The console alarm sounds when the message is displayed.       |
| X'08_____'            | This is a high-priority message and is displayed immediately. |
| X'04_____'-X'_____01' | Reserved for IBM use.                                         |

**Note:** If neither of the first two bits, which control the time stamp, are set, the receiving user's value is used. If both bits are set, a time stamp is appended.

The supplied display values for the message commands are:

| Command | Value | Meaning                                                                                                                |
|---------|-------|------------------------------------------------------------------------------------------------------------------------|
| MESSAGE | X'B0' | Time stamp is appended; message is highlighted; console alarm sounds.                                                  |
| MSGNOH  | X'70' | No time stamp is appended; message is highlighted; console alarm sounds.                                               |
| SMSG    | X'00' | This type of message is not displayed.                                                                                 |
| WARNING | X'B8' | Time stamp is appended; message is highlighted; console alarm sounds; message is high-priority, displayed immediately. |

2. This 32-bit field consists of three subfields:

- a. The first 8 bits indicate the type of message being processed. You can change the setting to change the way the message is processed. Note that if you change this setting, you might also need to change other parameters. The possible values are:

| Value       | Meaning                    |
|-------------|----------------------------|
| X'80'       | MESSAGE command processing |
| X'40'       | MSGNOH command processing  |
| X'20'       | SMSG command processing    |
| X'10'       | WARNING command processing |
| X'08'-X'01' | Reserved for IBM use       |

**Note:** If none of these bits are set, the message type defaults to MESSAGE command processing. If more than one bit is set, the message processing is set to the type indicated by the first bit set.

- b. The next 8 bits indicate which IBM class commands the issuer of the message is allowed to execute. More than one bit may be set. The settings are dependent on the privilege class of the issuer of the message as well as the privilege class of the command entered. This field is included for reference only. Changes made to this field do not affect the way the command is processed. The possible values are:

## Customizing Messages

| Value | Meaning              |
|-------|----------------------|
| X'80' | IBM class A commands |
| X'40' | IBM class B commands |
| X'20' | IBM class C commands |
| X'10' | IBM class D commands |
| X'08' | IBM class E commands |
| X'04' | IBM class F commands |
| X'02' | IBM class G commands |
| X'01' | IBM class H commands |
| X'00' | IBM class ANY        |

c. The final 16 bits are reserved for IBM use.

3. This 8-byte field contains the user ID of the issuer of the command. This field is included for reference only. Changes made to this field do not affect the way the command is processed.
4. This 32-bit field contains the length of the message being processed. It includes the length of any installation-defined option that has been specified. Changes to this field might affect the way the message is displayed.
5. This 32-bit field contains the address of the message being processed. For each type of message, the message buffer looks as follows:

| Message Type | Buffer Contents                        |
|--------------|----------------------------------------|
| MESSAGE      | * MSG FROM <i>userid</i> : <i>text</i> |
| MSGNOH       | <i>text</i>                            |
| SMSG         | <i>text</i>                            |
| WARNING      | * WNG FROM <i>userid</i> : <i>text</i> |

**Note:** The MESSAGE and WARNING messages always contain an initial blank and provide eight spaces for the user ID before the colon regardless of the actual length of the user ID.

Following the text is 100 bytes of unused space which can be used to add to or modify the existing text. If the length of the message is changed, the length field described above should be changed to reflect this or not all text will be displayed.

You can change the address of the message (and also the length of the message, if needed) for such purposes as, for example, pointing around the message header so it is not displayed. However, when the CP message function releases the storage it uses for the message, it releases the storage based on the address passed to HCPMSUEX, not the updated value.

6. This 8-byte field contains the user ID of the receiver of the message. If the value of the receiver's user ID is changed, the message is sent to the new receiver. However, if an error message is issued during normal message-function processing, and the error message includes the receiver's user ID, the user ID used in the error message is the one that was passed to HCPMSUEX, not the changed value.
7. This 32-bit field contains the length of the header for the message being processed. Each message is made up of a header and a text portion. The header includes the header information and the blank delimiter which precedes the text.

The header length is used by the message processing function when messages are sent across the \*MSG, \*MSGALL, and VMCF services. Only the text of the

message is sent. The header is discarded. The header length allows the message function to determine where the message text begins.

Each message type is considered to have a header. For MESSAGE and WARNING types, the header length on entry to HCPMSUEX is 22 characters long. For MSGNOH and SMSG, the header length on entry to HCPMSUEX is 0 characters long.

The header can be increased or decreased by this exit or by later message processing (for example, when a time stamp is added). SMSG never transmits the header while the other types display a header at the terminal if one is present.

## Changing and Adding to the CP Message Function

There are two categories of CP message command modifications:

- A global change is one that takes effect each time the command is used.
- A local change is an installation-defined command option, which takes effect only when the option is used. If you define a new option, you determine where you want the option to appear in the command string. For example:

```
MESSAGE userid option text
```

The CP message function processes the *option* as part of the text and passes it to HCPMSUEX as such.

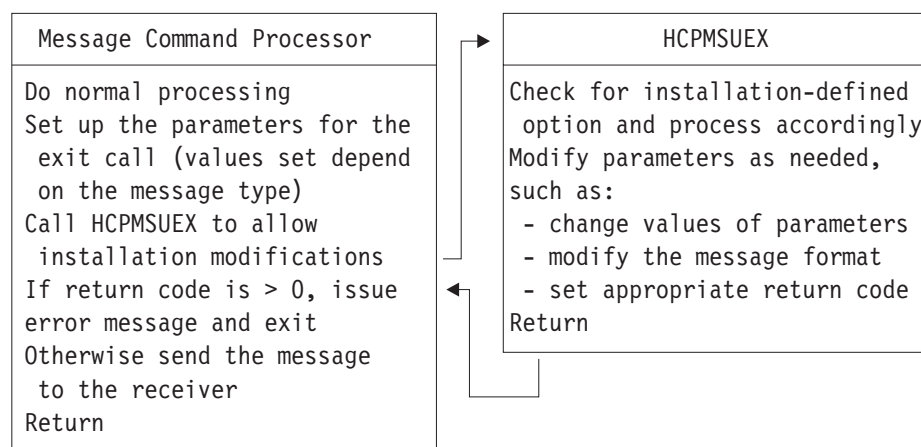


Figure 14. Flow of CP Message Function Customization

Figure 14 illustrates the process of customizing the CP message function. This process is described in the following steps:

1. The message command processor sets up the parameters for the exit call. General-purpose register 1 contains the address of a PLIST that contains a list of addresses, each pointing to a parameter. Parameter values depend on the message type.
2. The message command processor calls entry point HCPMSUEX:
  - a. If you have defined a new message command option, add code to HCPMSUEX to parse the option from the message text and process it accordingly.
  - b. Add code to HCPMSUEX to do your global modifications. The processing required might depend on the values of the parameters passed to HCPMSUEX, which are dependent on the type of message being processed.

## Customizing Messages

You can change these values, reformat the message, and do additional verification. See “Parameter Values” on page 374 for a description of each field and possible values.

- c. Set the appropriate return code in general-purpose register 15.
  - d. Return to the message command processor.
3. If general-purpose register 15 is zero, the message is sent to the receiver.
  4. If general-purpose register 15 is nonzero, the message is not sent to the receiver and error message 6600E is issued.

**PI** end

---

## Chapter 11. Security and Integrity in z/VM

Protection against attempts to breach the security of your system and against inadvertently compromising the integrity of your system and data should be part of the planning and administration for your z/VM system. z/VM has built-in facilities and support for products to aid you in this task. This chapter gives you some points to consider and recommendations to follow that will help you to improve your system security and integrity. In particular, this chapter discusses:

- IBM software products available to enhance the security and integrity of your z/VM system
- Points and recommendations to consider in enhancing the security and integrity of your z/VM system
- z/VM facilities available for detecting and foiling attempts to break system security
- Considerations for maintaining system integrity.

Note that these recommendations are optional and whether you follow them depends on the level of security that your installation requires.

---

### Security-Enhancing Products

The following IBM software products supported by z/VM can be used to enhance the security and integrity of your system:

- Resource Access Control Facility (RACF) for z/VM:

RACF<sup>®</sup> is offered as an optional feature of z/VM. RACF can:

- Help your installation implement its security policy
- Identify and authenticate each user
- Control each user's access to sensitive data
- Log and report events that are relevant to the system's security

For more information, see *z/VM: RACF Security Server General User's Guide*.

- Directory Maintenance Facility (DirMaint)

DirMaint is offered as an optional feature of z/VM. DirMaint provides a safe, efficient, and interactive way to maintain the z/VM user directory. You can manage the directory with DirMaint through the use of its commands. Thus, with DirMaint, you avert errors that are often made during direct updating of the directory source file. You can also use DirMaint to audit security of relevant tasks that it performs.

For more information, see *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

- Interactive System Productivity Facility (ISPF) for VM

ISPF is an IBM licensed program that manages interactive applications and provides services to them. It does this by controlling the interactions of a dialog. In z/VM, it can be used to manage DirMaint and RACF dialogs.

### Security Considerations and Guidelines

To enhance the security and integrity of your z/VM system, consider the following points and recommendations:

- Limit access to READ/WRITE saved segments.
- Between the time you initialize z/VM and the time you initialize RACF/VM, there is a lapse in security. In particular, the OPERATOR and AUTOLOG1 virtual machines run totally unrestrained and without audit. To prevent anyone from taking advantage of this, take the following precautions:
  - Initialize RACF/VM immediately after you initialize z/VM.
  - Make sure that AUTOLOG1 enables only the RACF service virtual machine and no other. Any other virtual machine that must be autologged can be enabled by AUTOLOG2 (for example, the DATAMOVE virtual machine, which is part of DirMaint).
  - Do not enable general-use console terminals until after you install and initialize RACF/VM. Enable only the system console and keep it under strict physical security.
  - Do not perform any major tasks until you install and initialize RACF/VM.
- Use the XAUTOLOG function to log on the DATAMOVE virtual machine. When a minidisk is detached by its owner, it still contains data the owner placed on it. Before you reallocate the same minidisk space to another user, this residual data should be removed. The DATAMOVE virtual machine automates this process. Make sure that the DATAMOVE virtual machine is logged on whenever z/VM is initialized. Place the CP XAUTOLOG command for DATAMOVE in the PROFILE EXEC of the AUTOLOG2 virtual machine.
- Limit and audit access to the system and logo configuration files.
- Limit and audit access to the parm disk and all CP-accessed disks. Use of these disks should be limited to system administrators or system programmers. If the minidisk is simply integrated into the administrator's or programmer's virtual machine, no auditing is possible. One way to audit the disks is to place them in a virtual machine whose password is NOLOG. This forces the administrator to use the CP LINK command—an auditable and controllable event—to access the disks. You can also restrict access and control auditing using an external security manager, like RACF.
- Format any space before converting it to minidisk space. If you convert DASD space (such as spool space, temporary disk space, or paging space) to permanent minidisk space, you should clear the entire space of all data. This prevents a new owner of the space from seeing any residual data left by the former owner. Use the CPFMTXA command to do this.
- Avoid DIAGNOSE code X'98'. DIAGNOSE code X'98' lets an authorized virtual machine lock and unlock virtual pages in storage. It also lets the virtual machine execute its own real channel programs. Thus, the virtual machine could inspect and alter CP or some other virtual machine. Because DIAGNOSE code X'98' is such a powerful function, you should take the following precautions:
  - Audit the use of DIAGNOSE X'98'
  - Remove the DIAG98 operand from the OPTION statement of any virtual machine definition unless it is really necessary for the virtual machine to use this function.
- Limit and audit the use of DIAGNOSE code X'08'. DIAGNOSE code X'08' lets an authorized virtual machine issue a CP command from a program. In some cases,



multiple CP commands can be imbedded in what appears to be a single CP command when the commands are separated by X'15' characters. You should take the following precautions:

- Add the D8ONECMD directory statement to the virtual machine definitions for server virtual machines. With this statement, any time a server virtual machine issues a single CP command that contains imbedded CP commands, the activity can be logged, rejected, or no action taken (the default).
- Audit the use of DIAGNOSE X'08' using the SET D8ONECMD command. This auditing, however, can result in many audit records and degrade system performance.
- Avoid directly accessing the z/VM user directory. A user who has acquired the authorization can directly access the user directory source file and modify it. Without the DirMaint feature, or equivalent directory manager product, this is the only way to maintain the directory. Manually updating the z/VM user directory could compromise system security and integrity.
- When using both the DirMaint and the RACF/VM features, see the instructions in “Step 5. Select RACF-Specific Characteristics” of the *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.
- Limit DirMaint privileged users. Strictly limit the number of user IDs you list in the AUTHFOR CONTROL file. The users you list here can enter DirMaint privileged commands.
- Limit access to the DIRMAINT TRANSLOG file. The DIRMAINT TRANSLOG file, also known as the DirMaint history file, is a time-stamped, sequential listing of DirMaint commands entered against the z/VM user directory and the results of certain other DirMaint procedures. This file contains an audit record of every significant change made to the z/VM user directory and to the DIRMAINT virtual machine. Thus, it is a very sensitive file.

Also, a system administrator can record a message or note in the history file using the DIRMaint LOGMSG command. This can be quite useful, but, in the wrong hands, it could introduce erroneous or deliberately misleading information into the history file.

To limit the number of users with access to the DIRMAINT TRANSLOG file, limit the number of user IDs you authorize for use of command sets A, D, H, or S in the AUTHFOR CONTROL file. By default, users authorized for these command sets can enter the DIRMaint LOGMSG command.

**Note:** Each use of the DIRMaint LOGMSG command appears in the DirMaint audit trail.

- Restrict the use of the single console image facility (SCIF). Also, restrict the use of the CP SET SECUSER command. See the *z/VM: CP Commands and Utilities Reference* for information about the CP SET SECUSER command. This facility allows a virtual machine to control several other disconnected virtual machines simultaneously.
- Consider disabling the use of the DIAL and MESSAGE commands before logon. RACF/VM can be used to disable these commands. See the *RACF Command Language Reference* book for more information. When DIAL and MESSAGE have been disabled before logon, any user attempting to use them before logon will receive an error message. Some things to consider when deciding whether or not to disable these commands before logon are your site's use of DIAL to get to second level systems and the amount of accountability your site desires for the sending of messages.
- Restrict and audit full-pack minidisks. Full-pack minidisks that overlay other individual minidisks should be given only to system administrators. Their use

should be one of the audited privileges of an administrator. However, if the minidisk is simply integrated into the administrator's virtual machine, no auditing is possible.

One way to audit a full-pack minidisk is to place it in a virtual machine whose password is NOLOG. This forces the administrator to use the LINK command—an auditable and controllable event—to access the minidisk.

You should also audit the DIAGNOSE code X'E4', the full-pack minidisk overlay function. If you have RACF installed, the resource name DIAG0E4 must be identified to RACF to authorize the protected functions of DIAGNOSE code X'E4'. Users may request information about their own minidisks without RACF authorization.

- Clear all tapes and DASD areas before reassignment. You should set rules that govern the reassignment of tapes and DASD space. For example, minidisks and temporary disks should be reformatted and tapes erased. (Note that temporary disks can be cleared automatically—see “Clearing Temporary Disk Space” on page 384.)
- Audit the MODIFY commands. The MODIFY commands let you reredefine privilege classes. The privilege class structure defines the subset of CP commands and DIAGNOSE code functions that each user is allowed to enter. Installations may need to modify the privilege class system to accommodate local needs. The ability to modify the privilege class structure is important and highly sensitive.
- Limit and audit the use of the SET PRIVCLASS command. The SET PRIVCLASS command lets you control future SET PRIVCLASS commands or to temporarily change the set of privilege classes for a logged-on user. The ability to dynamically change privilege classes is important and highly sensitive, therefore, you should limit the number of people that you allow to issue this command. This command can be issued only if the FEATURES ENABLE SET\_PRIVCLASS statement has been specified in the system configuration file.
- Restrict the system operator. Certain restrictions on the system operator can increase system security; for example:
  - Ensure a high level of physical security over the IPL system console for the processor. Also, use the programmable operator facility to control what the system operator can do at this console and what the system does for the system operator. The programmable operator facility can increase the efficiency and security of your operations by intercepting all messages and requests directed to the system operator and by handling them according to the rules you have established. For more information on the programmable operator facility, see the *z/VM: CMS Planning and Administration*.
  - Make sure the system operator is aware that DASD areas and tapes must be cleared before they are assigned to new owners.
- With the ability to define the command access to suit your installation's security and system integrity requirements, you have great flexibility and control over each user's access to CP commands. You can use this to enhance security and system integrity at your installation by restricting access to system resources and information controlled by commands, DIAGNOSE codes, or system functions. The CP configuration statement USER\_DEFAULTS with the POSIXOPT of querying the database has a default of ALLOW. If you do not want to allow others to query the database you will need to change this setting. However, when you change the privilege class of commands and make changes to user access, be careful not to inadvertently compromise security or system integrity by allowing users to use commands that could provide access to unauthorized information or that could affect system operation.

## z/VM Security Facilities

z/VM facilities for detecting and foiling attempts to break system security and for detecting and preventing integrity exposures are:

- An interface which allows installation of an external security manager (ESM) to perform the following functions:
  - Auditing of commands, diagnose codes, and security-relevant system functions
  - Protection of selected commands, diagnose codes, and system function
  - Disabling the DIAL and MESSAGE command before logon.
  - Authorizing access to POSIX database and the information it contains
- Storage access verification functions.
- The ability to provide automatic clearing of temporary disks after use to prevent the current user from accessing data left from a previous user of the temporary disk, with the ENABLE CLEAR\_TDISK operand on the FEATURES system configuration file statement.
- The ability to bypass directory password authorization.
- Journaling that allows you to monitor, record, and act on possible attempts to gain unauthorized access to system resources.
- Automatic deactivation of passwords that keeps restricted passwords from being assembled in the object directory.
- The ability to grant a virtual machine authority to restrict temporarily link access to minidisks by other users.
- The ability to suppress the display of passwords entered as part of the LOGON and LINK commands.
- The ability for multiple virtual machines to gain cryptographic capability through access to the Crypto Express optional hardware feature and the Central Processor Assist for Cryptographic Function (CPACF), which is included on the server.

In addition to the above facilities, the CMS shared file system includes various kinds of authority checking. Users can, for example, grant and revoke authority on their files and directories. When a user tries to use a file or directory, the shared file system checks whether the user is authorized to do so. More information about shared file system security can be found in the *z/VM: CMS File Pool Planning, Administration, and Operation* book.

## Using an External Security Manager for Auditing and Protecting

An external security manager (ESM) is a service virtual machine used to maintain z/VM security and integrity. An IBM application you can use for this purpose is RACF/VM. CP can call upon RACF not only to protect certain system resources but also to audit security-relevant events such as CP commands, DIAGNOSE code functions, and communication among virtual machines.

Although all events can be audited, not all events will be audited. They are audited only if you choose. Use RACF to specify which of those events, if any, you care to audit. Any audit task involves longer path lengths, substantial input and output, and heavy use of DASD. Thus, auditing tends to degrade performance of the system. For performance considerations, do not audit more events than necessary.

RACF also provides various forms of authorization control for a subset of CP commands and DIAGNOSE codes. For additional information on using RACF/VM to audit and control CP commands, see the *RACF Security Administrator's Guide* and the *RACF Auditor's Guide*.

If you choose not to use RACF but want to write your own security application, you can use this interface to provide your own auditing. For details on DIAGNOSE code X'A0', see the *z/VM: CP Programming Services* book.

### Verifying Storage Access

Many CP functions allow a user to access the user's own virtual storage. z/VM has functions that prevent such an access from straying outside the space the user is entitled to. Whenever a user invokes one of these CP functions that checks user's authority, for example, IUCV DECLARE BUFFER or DIAGNOSE code X'A0', CP checks whether that user is entitled to access the storage area assigned to the buffer. CP prevents the requested buffer from overlaying any area in which the user has no authority. For example, the space may be protected because it is already occupied by a CMS module. If the requested buffer is in storage-protected space, the user receives a protection exception.

For additional information on the DIAGNOSE codes and the IUCV DECLARE BUFFER function, see the *z/VM: CP Programming Services* book.

### Clearing Temporary Disk Space

In some previous VM systems, CP cleared only cylinder 0, track 0, of a temporary disk before allocating temporary disk space. As a result, data owned by the previous user was available to the current user of the temporary disk. This created a data integrity exposure. With z/VM, temporary disk space can be optionally cleared completely to avoid this integrity exposure.

To eliminate user access to sensitive data remaining on a temporary disk, use the CLEAR\_TDISK operand on the FEATURES system configuration file statement to specify whether temporary disk space is to be cleared. If space is to be cleared, it is cleared at the following times:

- at IPL time,
- when CP volumes that contain temporary disk space are attached to the system, or
- when a temporary disk is detached from a user

if the ENABLE CLEAR\_TDISK operand is specified on the FEATURES system configuration file statement.

Class B system resource operators can query the state of temporary disk clearing by using QUERY TDISKCLR. See *z/VM: CP Commands and Utilities Reference* for additional details on the purpose and syntax of the QUERY TDISKCLR command.

**Note:** If I/O errors occur during clearing of the DASD cylinders, the cylinders not cleared are not marked available for temporary disk space. This prevents the allocation of TDISK space that has not been cleared.

Performance Note: Because clearing takes place asynchronously, a period of time may elapse before the actual clearing occurs. The clearing of temporary disk space happens independently of the tasks that require it. Thus, it does not specifically

affect these tasks, such as IPL, except for contention for the processor and I/O. There should be no significant impact on performance. Nevertheless, the space may not be immediately available.

## Permitting Bypassing of Directory Password Authorization

With z/VM, you can bypass directory password authorization to allow specially designated virtual machines to:

- Link to any other virtual machine's virtual DASD without performance of minidisk password authorization
- Use a subset of the DIAGNOSE X'84' subfunctions to update a virtual machine definition without performance of logon password authorization.

To provide one or both of these functions to a virtual machine, code either or both of the LNKNOPAS and D84NOPAS operands on the OPTION directory statement of the virtual machine definition. For additional information on these operands of the OPTION statement, see "OPTION Directory Statement" on page 561.

## Journaling the LOGON, AUTOLOG, XAUTOLOG, and LINK Commands

LOGON, AUTOLOG, XAUTOLOG, and LINK journaling detects and records certain occurrences of the LOGON, AUTOLOG, XAUTOLOG, and LINK commands. Using the recorded information, you can identify attempts to log on to CP by users who enter invalid passwords. Also, you can identify any user who successfully enters the LINK command to a protected minidisk that user does not own.

Briefly, LOGON, AUTOLOG, XAUTOLOG, and LINK journaling works like this. While journaling is turned on, CP monitors all occurrences of the LOGON, AUTOLOG, XAUTOLOG, and LINK commands. CP counts how many times a user enters one of these commands with an invalid password. CP can be set to take one or more of these actions when the count reaches a threshold value:

- Write a record to the accounting data set to record the incident
- Reject subsequent LOGON, AUTOLOG, XAUTOLOG, and LINK commands entered by the user
- Lock that terminal for a designated period
- Send a message to a designated user ID to alert the installation to the incident.

While journaling is turned on, CP creates an accounting record each time it detects that a user has successfully entered a LINK command to a protected minidisk not owned by that user. A protected minidisk is a minidisk whose password is anything but ALL for the type of LINK attempted, or a minidisk protected by an external security manager.

For a description of the accounting records that CP writes for LOGON, AUTOLOG, XAUTOLOG, and LINK journaling, see "Accounting Record Formats" on page 338.

To make LOGON, AUTOLOG, XAUTOLOG, and LINK journaling available and to specify options, you may use the JOURNALING statement in the system configuration file. For more information, see "JOURNALING Statement" on page 176. To turn journaling on or off, use the class A SET command. To determine whether journaling is on or off, use the class A or C QUERY command. For additional information on these commands, see *z/VM: CP Commands and Utilities Reference*.



### Automatic Deactivation of Restricted Passwords

A facility is available to validate user logon passwords against a set of predefined restricted passwords. The facility automatically validates other user passwords to prevent the accidental use of a restricted (published) password for or by a user. It provides a file that contains a list of IBM restricted passwords. This list, called the RPWLST DATA, is a CMS file that is included on MAINT<sub>vm</sub> 2C2. When you run the DIRECTXA command to convert the source directory to an object directory, passwords are checked against the passwords in this list. You do not need to perform any action to use this list.

You may add your own restricted passwords to this list or remove some of the IBM-restricted passwords from the list as the need arises. To modify the RPWLST DATA file, you simply edit it and create a private copy to be kept with the source directory. You can find this file by using the CMS search order.

You must use the following formatting rules when you edit the RPWLST DATA file:

- The RPWLST DATA file must have a fixed-record-length format.
- The records must be at least 8 characters long but no longer than 80 characters.
- The passwords to be restricted must begin in the first column of each record.
- Columns 1 through 8 must contain only one restricted password and nothing else.
- There may be only one restricted password per record.
- Column 9 must be blank.
- Columns 10 through 80 may be used for comments.

If you do not want automatic deactivation of passwords, edit the RPWLST DATA file and delete all the passwords. Leave one dummy record of an asterisk (\*) in column 1.

### Using Link Access Control Options

You can set up a service virtual machine with the authority to control user access to minidisks and databases. This authority is useful when running database applications and performing data migration tasks where data stability and integrity are essential. To do this, the service machine is configured with directory statement options that allow it to use certain link access modes that temporarily restrict other users from gaining link access to the data the service machine is using.

Two types of access modes can be used to ensure data integrity when linking to another minidisk for a limited period of time. The stable access modes, when requested by an authorized virtual machine, prevent other users from obtaining write access to a disk while the stable access is in effect. The exclusive access modes grant an authorized virtual machine sole access to a minidisk, preventing both read and write access by any other users.

The LNKSTABL and LNKEXCLU operands of the OPTION directory statement authorize a user to use the stable or exclusive access modes of the LINK command or DIAGNOSE X'E4'. This global authority allows a virtual machine to perform a stable link to any minidisk for which it has password level authorization. You can also specify stable and exclusive authority to a specific minidisk using the mode suffix letter (S or E) on the MDISK or LINK directory statements. While stable or exclusive links to a minidisk are in effect, access to that minidisk by any other user will be restricted or denied. For more information on the LNKSTABL and

LNKEXCLU options of the OPTION directory statement, see “OPTION Directory Statement” on page 561. See “LINK Directory Statement” on page 524 and “MDISK Directory Statement” on page 539 for more information about access modes and suffixes.

## Suppressing Passwords Entered on the Command Line

CP can be set to reject LOGON or LINK commands that have the password entered on the same line as the command. Rejecting these commands prevents passwords from being displayed or printed without masking. (Masking a password means overprinting the password so it cannot be read.)

This capability is also available to virtual machines that issue LINK commands by DIAGNOSE code X'08'. For a description of DIAGNOSE code X'08', see *z/VM: CP Programming Services*.

To request password suppression, specify it as an option on the FEATURES statement in the system configuration file. Once requested, password suppression is always on; an operator cannot turn it off. See “FEATURES Statement” on page 150 for information on how to use the FEATURES PASWORDS\_ON\_CMDS operand.

## Cryptographic Acceleration

The Crypto Express features of the IBM System z are designed to satisfy high-end server security requirements. They can be configured as coprocessors for secure key transactions or as accelerators for Secure Sockets Layer (SSL) acceleration, providing significant improvements in the performance of cryptographic algorithms used for encryption and public-private keypair generation and verification. z/VM makes Crypto Express available to guests with either dedicated access for use for both secure-key and clear-key operations, or with shared access for clear-key operations. Information on making Crypto Express available to a virtual machine can be found in the description of the APVIRTUAL and APDEDICATED operands in the “CRYPTO Directory Statement” on page 483.

The CP Assist for Cryptographic Function (CPACF) is a part of each processor in the IBM System z server. It provides a set of cryptographic functions that focuses on the encryption/decryption function of SSL, Virtual Private Network (VPN), and data-storing applications. The CPACF is used by SSL/TLS functions included in the z/VM Lightweight Directory Access Protocol (LDAP) client and server, and by the SSL functions provided by the z/VM SSL server. Any virtual machine can access the functions of the CPACF by using the Message-Security Assist (MSA) extensions of the IBM System z processor architecture. No explicit z/VM authorization or configuration is required. Information on MSA instructions can be found in *z/Architecture Principles of Operation*.

For more information on the specific capabilities of Crypto Express and CPACF, consult the documentation for your processor.

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## Maintaining System Integrity

Your z/VM system has integrity if it can prevent the circumvention, subversion, and disabling of its security mechanisms. In general, this is achieved by keeping users separate from each other, separate from the operating system, and limiting their access only to data which they need to do their jobs.

Quite simply, system integrity is your system's ability to:

## Security and Integrity in z/VM

- Resist compromise of its security controls through misuse and manipulation
- Ensure that its resources can only be accessed through authorized routes by authorized users.

To put it another way, system integrity is the inability of any program running in your system to:

- Obtain control in real supervisor state, with privilege class authority or directory capabilities greater than assigned
- Use CP to circumvent the system integrity of any guest operating system which itself has system integrity
- Circumvent z/VM real storage protection or auxiliary storage protection
- Access, without authority, a z/VM password-protected resource
- Access, without authority, a resource protected by an external security manager (ESM), like RACF.

The IBM z/Architecture, upon which z/VM is based, is at the center of the system's ability to maintain integrity. One crucial aspect of this is your system's ability to keep each virtual machine absolutely isolated from every other virtual machine. This isolation especially extends to CP, which is logically separate from all virtual machines in the system.

For the sake of integrity, z/VM exploits the z/Architecture in several other ways:

- The addresses in a virtual machine are virtual addresses. They have no meaning outside the virtual machine in which they are generated and used. Whenever required, these virtual addresses are translated into real addresses by ART (access register translation) and DAT (dynamic address translation), for the address space referenced by the user. Using ART and DAT, the system keeps these address spaces absolutely separate from one another. This means that it is impossible for one user to access an address space of another user unless the owner allows the other user to do so. Additional information about accessing data spaces can be found in the *z/VM: CMS Application Development Guide*.
- z/VM translates the addresses in all channel programs, except those initiated by DIAGNOSE X'98'. Channel programs are programs built and run by virtual machines that request auxiliary storage devices to perform input and output tasks. z/VM identifies the storage device and performs the I/O operation on behalf of the virtual machine.
- Every z/VM virtual machine runs in interpretive-execution mode which processes most privileged and non-privileged instructions and handles virtual storage address translation without requiring intervention of z/VM.
- z/VM uses page protection to prevent read-only saved segments from being modified. A saved segment is a block of data or reentrant code in virtual, shared storage that many users can share simultaneously. However, if a user has a legitimate reason for wanting to change a read-only saved segment, the user must specifically request an exclusive copy of the saved segment and be authorized to do so in the user directory. The unmodified code remains shared among the other virtual machines. See "Protection of Shared Storage" under "Storage Handling" on page 396 for more information.

## z/VM System Integrity Requirements

There are many things z/VM provides to support system integrity. You should be aware of them and make certain that all programs and users cooperate with them.

System Modification Requirements:



A program added to the z/VM system does not weaken the latter's integrity as long as it:

- Uses only documented, unrestricted z/VM interfaces
- Runs only with privilege class G authority
- Does not supply services to more than one user from within a single virtual machine
- Does not require the use of special CP user directory options
- Does not share VM or other passwords with any other program running in any virtual machine.

Your installation probably will add several programs to the system to fulfill local needs. Since z/VM's integrity can be affected by these, consider the following questions before you add any to your system:

Does the program (or any of its parts):

- Run with a user ID which, if an ESM is installed, requires special privileges?
- Require the use of CP DIAGNOSE functions that are restricted to classes other than G or ANY?
- Require CP directory options?
- Modify z/VM code?
- Modify z/VM by adding or changing a z/VM command?
- Run as a multiuser service machine?

If the answer to any of these questions is yes, the program could seriously weaken the integrity of z/VM. Carefully reconsider whether you should add the program to your system. If you must add a program that threatens to weaken your system's integrity, keep the following in mind:

- z/VM maintains storage protection in one of two ways, depending upon the nature of the object:
  - Access register translation (ART) and dynamic address translation (DAT) protect the storage of nonshared segments; that is, storage that is reserved exclusively for one user. ART and DAT are hardware facilities used by z/VM during the execution of any instruction to translate a virtual address into the corresponding real address. The system uses ART and DAT to provide secure, separate address spaces for each virtual machine in the system. This means that it is impossible for one user to access an address space of another user unless its owner allows the other user to do so. Additional information about accessing data spaces can be found in the *z/VM: CMS Application Development Guide*.
  - z/VM's shared segment protection mechanism gives any user that tries to alter a read-only saved segment a protection exception. This preserves the integrity of data or code being shared simultaneously by other users.
- You may wish to use an ESM to protect sensitive system data and work areas from access by unauthorized users and to protect any proprietary information automatically stored on external media. Such protection requires several things of the user:
  - The user must protect proprietary information from all other users except those properly authorized. Proprietary information includes passwords, cryptographic keys, user register contents, user data areas, and buffers.
  - The user must clear all proprietary data from any storage device or buffer before it is released. Temporary disks (T-disks) are the exception. If ENABLE

CLEAR\_TDISK is specified on the FEATURES system configuration file statement, z/VM clears each T-disk before it is assigned to anyone.

- The user must not use z/VM commands and DIAGNOSE codes that bypass (or allow the bypassing of) security checks, integrity controls, or validation procedures. That is, limit the use of commands and functions that allow direct and uncontrolled access to basic system resources. (See "Sensitive z/VM Commands to Restrict" and "Sensitive DIAGNOSE Functions to Restrict" under "z/VM Integrity and CP Function" on page 391.) Use z/VM privilege classes, DIRMAINT, or an ESM to control access to these resources.

**User Identification Requirements:** To identify a user means to firmly establish who is using the system to perform a particular act. Every command, DIAGNOSE, and other security-relevant event must be directly attributable to a user whose identity has been well-established. With POSIX, however, you can have multiple user IDs associated with a single UID. Authorities can be given to the one UID and therefore multiple user IDs. Determining the identity becomes difficult. For this reason, it is not recommended that you have multiple user IDs associated with a single UID. User identification requires the following:

- System and user resources must be separated from one another and identified. Otherwise, system resources may be counterfeited or one system resource may be substituted for another.
- Before a privileged program passes user data to another privileged program, it is necessary to define who is responsible for validating the user data. Then, of course, the data must be validated.

**Validation Requirements:** Validation is an important term that can mean several things:

- z/VM routines that access areas of storage based on user-supplied addresses must first validate that the user has the appropriate kind of access (READ, WRITE, and so forth).
- During the validating process, the system can use only previously validated and protected data. Using non-validated or unprotected data during the validation process invalidates the process itself.
- When a user wants to access an area that spans a page boundary, the system must confirm that the user has authority to access the entire range of addresses involved.
- z/VM routines that simulate CPU instructions or translate channel programs must do so according to the architecture of the CPU or device involved.
- Parameters passed to the system must be validated for the purpose intended.

**Serialization Requirements:** Serialization is a method used to prevent the asynchronous altering of variables, whose validity must be checked, until after the operation for which they are validated is complete.

A gap can occur between the time when a variable is checked and approved and the time when the variable is actually used in an operation. During this time, the variable is vulnerable to change by some unauthorized, asynchronous function. The solution is to protect each validated variable from asynchronous alteration until it is used.

**Note:** z/VM system integrity does not specifically include the protection of data among several users of a single CMS batch system nor does it apply to virtual machines using the nondisruptive transition (NDT) support.

## z/VM Integrity and CP Function

There are several CP resources that can affect system integrity:

**Privilege Classes:** A privilege class is a subset of z/VM commands and DIAGNOSE codes. Each user is assigned to a particular privilege class, depending upon his responsibilities, level of skill, and place in the organization's hierarchy. Every user is a member of at least one privilege class.

If a user attempts to issue a command that is outside his privilege class, the system ignores the command. The main benefit of this is that no user can alter the system in any way that goes beyond his expertise and authority.

IBM designed the structure of z/VM privilege classes with the typical organizational hierarchy at the typical computing installation in mind. If you find the IBM privilege class structure inappropriate to your organization's needs, you can modify it or completely replace it. It is possible for your organization to precisely define up to 32 privilege classes of its own that partly or completely redefine the privilege class structure that comes with your system. For more information, see Chapter 16, "Redefining Command Privilege Classes," on page 443.

**Sensitive z/VM Commands to Restrict:** Very few CP commands and DIAGNOSE functions have no security and integrity relevance. Some affect the security and integrity of your system more than others, and there are some CP commands and DIAGNOSE functions that allow direct, uncontrolled access to basic system resources.

Change the CP privilege classes or use an external security manager to limit the use of the following sensitive CP commands:

### CPACCESS

identifies a CMS-formatted minidisk to CP and makes the files on that minidisk available to CP by establishing a file mode letter for the files.

### CPCACHE

causes CP to cache a file on a CP-accessed minidisk.

### CPRELEASE

releases a CP-accessed minidisk.

### DEFINE CPOWNER

lets a user define new entries or to change existing entries in the list of CP-owned DASD volumes.

### DEFINE TIMEZONE

lets a user define a new time zone or change an existing time zone definition.

### DISPLAY (Host Storage)

displays the contents of host storage at the user's terminal.

### DUMP (Host Storage)

prints the contents of host storage at the spooled virtual printer.

### LOCATE

determines the address of a particular user's CP control block, the address of a virtual device, or the address of a real device.

### SET D8ONECMD

lets a user change the D8ONECMD settings for their or other's virtual

machine. The D8ONECMD settings control whether CP will accept multiple commands imbedded in a single command and separated by X'15' characters.

### **SET MDCACHE SYSTEM**

turns minidisk caching on and off for the whole system. Turning minidisk caching off at the system level disables caching enabled at the device or record level.

### **SET OBSERVER**

changes the observer user ID associated with your virtual machine or another user's virtual machine.

### **SET PRIVCLASS**

controls future SET PRIVCLASS commands or temporarily changes the set of privilege classes for a logged-on user.

### **SET RDEVICE**

changes or adds devices to the system's definition of a set of real devices.

### **SET SECUSER**

changes the secondary user ID associated with your virtual machine or another user's virtual machine.

### **SET SYSOPER**

changes the user ID of the primary system operator on your system.

### **SET TIMEZONE**

changes the system's active time zone ID and time zone offset.

### **SET VDISK SYSLIM**

limits the total resource available for allocating virtual disks in storage. Users may suddenly find that they cannot create as many virtual disks in storage as they had been able to.

### **SHUTDOWN**

systematically ends all system functions and checkpoints the system for an eventual warmstart. May also perform an automatic warmstart of the nucleus.

### **SNAPDUMP**

takes a dump identical to a hard abend dump, without shutting down the system. Could stop the system long enough to cause communication lines to be dropped.

### **STORE (Host Storage)**

allows the user to alter the contents of host storage.

**Sensitive DIAGNOSE Functions to Restrict:** Change the CP system of privilege or use an external security manager to limit the use of the following sensitive DIAGNOSE functions:

### **DIAGNOSE X'04'**

allows the user to examine host storage.

### **DIAGNOSE X'08'**

allows a virtual machine running in supervisor state to issue CP commands. Usually, this presents no danger to your system's security or integrity. Often, z/VM commands are issued on behalf of authorized users by privileged server virtual machines. However, if a server virtual machine were to issue a CP command on behalf of an unauthorized virtual machine, your system's security and integrity would be threatened. Each

server should check carefully the identity and authorization of each machine for whom it does work, like DIRMaint does.

### **DIAGNOSE X'28'**

allows channel programs modified after STARTIO (but before the I/O operation is complete) to execute correctly.

### **DIAGNOSE X'3C'**

allows the user to dynamically update the CP user directory.

### **DIAGNOSE X'4C'**

allows a user with the ACCT option in his virtual machine definition to generate accounting records.

### **DIAGNOSE X'7C'**

allows a program to drive a logical 3270 terminal as though it were a real, locally attached 3270.

### **DIAGNOSE X'84'**

allows a user to replace certain data in the CP user directory.

### **DIAGNOSE X'98'**

allows a virtual machine authorized to use it to lock and unlock virtual pages in storage. It also allows the virtual machine to execute its own real channel programs.

## Data Structures That Can Enhance System Integrity

z/VM maintains many directories, tables, and control blocks that manage the system. Many of these data structures contribute to your system's security and integrity.

**System Configuration File:** The system configuration file contains definitions for your system and how it should operate. The items in this file that pertain to security and integrity include:

- FEATURES ENABLE CLEAR\_TDISK statement, specifying that all previously written data and directory areas on temporary disk DASD space should be cleared automatically
- FEATURES PASSWORDS\_ON\_CMDS statement, specifying whether the facility that suppresses the password on the command line should initially be part of the system.
- JOURNALING statement, specifying whether the facility that journals events should be part of the system, whether the system can set and query the journaling facility, and what to do if someone tries to log on to the system or link to a disk without a valid password.

**CP User Directory:** The CP user directory is a table maintained on DASD, which contains virtual machine definitions that describe the configuration of particular virtual machines in your system. To put it another way, the CP user directory tells z/VM exactly which system resources are available to each virtual machine, how each is built, and how access to each is governed.

The items in each virtual machine definition that pertain to security and integrity include:

- CP log on passwords
- Minidisk passwords
- LINK statements

- CLASS statement, describing what kind of user this is and what class of commands and instructions the user will be allowed to issue
- DIAG98 option on the OPTION directory statement, letting the user invoke the DIAGNOSE X'98' function.
- LNKNOPAS and D84PAS options on the OPTION directory statement.
- POSIXINFO statement for the UID and GID|GNAME
- POSIXGLIST statement for listing the groups that the user belongs to

**RSCS Configuration File Options:** The RSCS configuration file defines the RSCS network, and includes such information as:

- Local node identifier
- Identifier of each node with which the local node can communicate
- Network links over which the local node communicates with the remote nodes.

**VM/Pass-Through Directories:** VM Pass-Through (PVM) allows a user to interactively access a virtual machine in some remote system. Your system's PVM virtual machine maintains a directory called a configuration file. This file includes:

- Local and remote node identifiers
- Link and routing definitions
- Authorization of certain users to issue restricted commands.

**Directory Update-in-Place:** DIAGNOSE X'84' gives a privilege class B user the ability to replace data in the CP user directory. Note that this doesn't authorize the user to add new entries or to delete existing ones.

As z/VM is delivered, all privilege class B users can issue DIAGNOSE X'84'. For the sake of security, strictly limit the number of privilege class B users in your system. Of course, your organization may have chosen to change the privilege class structure that IBM has built into your system. If so, be certain to limit the number of users who can issue DIAGNOSE X'84'.

**Dumps:** A dump is a snapshot, taken at a particular moment, of the contents of a computer's storage. Most dumps are created by highly privileged users to help them solve system problems.

There is no way to predict what storage contains when the dump is created. Passwords or poorly encrypted data may be present, or the dump may contain other material that your organization considers proprietary and confidential. Therefore, take great care that only authorized personnel handle the dumps generated by the system. What's more, never send a dump to anyone outside your organization unless you are certain it contains nothing proprietary or confidential.

**Composite Reader File:** The composite reader file is a spool file that contains a group of CMS files. From CMS's point of view, the composite reader file is many files; from z/VM's point of view, however, it is all one spool file. This difference in perspective can create security and integrity problems.

To illustrate, consider the following sequence of commands issued by a user named MARY to create a composite reader file in the virtual reader of a user named JOHN.

```
CP SPOOL PUNCH JOHN CONT
PUNCH PROFILE EXEC
PUNCH PROFILE XEDIT
PUNCH CALENDAR DATA
```



```

:
PUNCH NOVEMBER REPORT
CP SPOOL PUNCH CLOSE NOCONT

```

If JOHN issues a CP QUERY READER command, the response indicates that there is only one file in his reader, NOVEMBER REPORT. But because this is a composite spool file, there are several other files present that are hidden from any QUERY. The presence of these other files is neither implicit nor apparent.

Now, assume that JOHN already has a file called PROFILE EXEC. When he reads in NOVEMBER REPORT, all the other files are read in, too. JOHN's PROFILE EXEC disappears, overwritten by the new PROFILE EXEC. JOHN may or may not consider that desirable. At the very least, he should be informed of the loss of his file.

To prevent security and integrity problems like this from arising, z/VM provides several options to the DISK LOAD, READCARD, RECEIVE, and DEFAULTS commands:

#### **FULLPROMPT**

Specifies that a prompt message is issued for each file.

#### **MINPROMPT**

Specifies that a prompt message is issued when the name of the first file differs from the name of the spool file. The prompt message for the first file does not appear when it has the same name as the spool file.

#### **NOPROMPT**

Specifies that a prompt is not issued when a file is received.

#### **REPLACE**

Specifies that if a file with the same file name and file type already exists, then it is to be replaced with this one.

#### **NOREPLACE**

Specifies that no file ever overlays an existing file on the receiving disk.

## **z/VM Options That Can Enhance System Integrity**

z/VM offers several options that can help you to enhance the integrity of your system.

**Real Channel Program Support:** DIAGNOSE X'98' lets an authorized virtual machine lock and unlock virtual pages in storage. It also allows the virtual machine to execute its own real channel programs. That would make it possible for the virtual machine to access real storage beyond the legitimate end of its address space. It would then be possible for the virtual machine to inspect and alter CP or some other virtual machine. That would not be sound security practice.

The ability to invoke this function is an extremely powerful privilege, which the system administrator should either restrict or eliminate.

There are two ways to prevent the use of DIAGNOSE X'98':

- Remove DIAG98 from the OPTION statement of each virtual machine definition in the CP user directory in which it appears.
- Set DIAGNOSE X'98' to an unused privilege class.

If an unauthorized user attempts to use DIAGNOSE X'98', he receives an operation exception.

### Storage Handling

Your z/VM system maintains the security and integrity of its storage, as follows:

**Protection of Host Storage:** z/VM provides both fetch and store protection for host storage. No user may store in or fetch from a segment of host storage unless the user's key matches the protection key of that storage.

z/VM protects host storage using the privilege class structure. As the system is delivered, only privilege class C users can alter host storage. Of course, your organization may have chosen to change the privilege class structure that IBM has built into your system.

**Allocation of Host Storage:** Host storage is allocated to a user when the user first refers to a virtual page for which a backing frame has not yet been allocated. Allocation continues, as needed, up to and including the maximum storage size indicated in the user's virtual machine definition.

Before z/VM allocates a frame of real storage, that frame is cleared of any data that may have been left behind by another user. This prevents a user from having access to data for which that user has no authorization. z/VM maintains a frame table that is used to identify the usage state of every frame in host real storage.

**Paging:** In z/VM, many users share host storage simultaneously. But not every page of storage could possibly be active every second of the time. When a resident page of guest storage is not being actively accessed by a user, the system transfers its contents to expanded storage or DASD. This is known as paging out. The space in host real storage that it abandons then becomes available to another user who really needs it. When and if that same guest page is needed again, the system transfers the contents from expanded storage or DASD back to host real storage. This is known as paging in.

z/VM maintains a set of page and segment tables that contain precise information on the location of every page and segment of guest storage, whether paged in or paged out. The system follows them rigorously, helping to maintain the integrity of the system.

**Protection of Shared Storage:** Virtual storage space is routinely shared by users of z/VM. These shared segments help the system manage its storage more efficiently.

Shared segments can be read/only or read/write blocks of storage containing code or data shared by many users. Sharing one copy of something, like XEDIT, is preferable to giving each user his own copy.

As z/VM is delivered, only a user with privilege class E can define and save a shared segment. Of course, your organization may have chosen to change the privilege class structure that IBM has built into your system. If so, take care that the ability to define and save shared segments is not given out indiscriminately.

**Clearing Residual Data from Minidisks:** You can tailor DIRMAINT to automatically clear DASD space whenever a minidisk is detached. This applies when you release an entire minidisk and when you permanently reduce the size of a minidisk. This prevents the next user to whom the space is allocated from seeing information he may not be authorized to see.



**Clearing Residual Data from Temporary Minidisks:** You can also tailor your system to automatically clear each temporary minidisk (T-disk) before it is reassigned. Simply add the ENABLE CLEAR\_TDISK operand on the FEATURES system configuration file statement.

**Clearing Residual Data from Tapes:** Sometimes, a user finds that he no longer needs the data on a reel or cartridge of tape. This does not mean that the data is no longer sensitive. Hence, you must establish procedures to ensure that each reel or cartridge of tape is degaussed before it is assigned to a new user.

## Program Stack, Security, and Integrity

While executing, many programs and EXECs place data on the program stack. Ideally, this data should be used to accomplish useful work and then promptly discarded. In reality, though, it may be left behind in the stack after the program terminates. In fact, many programs intentionally leave data on the program stack so that they can pass information to other routines. While this practice may be clever, it is not risk free.

As a rule, when a program or EXEC terminates or relinquishes control, the program stack should be exactly as it was when the program or EXEC gained control. This should apply to both normal and abnormal termination. The program or EXEC that terminates before restoring the program stack can cause serious security and integrity problems.

For example, suppose a privileged server virtual machine runs a program that obtains data from a virtual reader or other communication channel and places it in the program stack. An unscrupulous party comes along and feeds his own commands to the program through the communication channel. Dutifully, the program places them on the program stack until the attacker somehow forces the program to fail. If the program is designed to restore the program stack, no harm is done. However, if the program does not restore the stack, then the attacker's commands are executed by the privileged server machine!

Many programmers prudently avoid using the program stack altogether by using GLOBALV variables to pass information to other routines. Some programmers use other techniques, such as managing the program stack with the CMS MAKEBUF and DROPBUF commands and the StackBufferCreate and StackBufferDelete CSL routines. These commands and routines enable a user to manage a new, separate buffer that can be used without affecting the contents of any buffers previously defined.

Study the following examples.

### *A Simple EXEC that Manages the Stack with MAKEBUF and DROPBUF*

```
ADDRESS COMMAND
SIGNAL ON HALT /* FORCE ANY INTERRUPTION TO COME OUT
 OF MAIN EXIT */
'MAKEBUF' /* GET A BUFFER TO HOLD ANY GARBAGE */
BUFNO = RC /* KEEP ITS NUMBER */
:
:
(MAIN PROCESSING)
:
:
HALT: /* MAIN EXIT FROM PROGRAM */
SRC = RC /* KEEP LAST "RC" FOR EXIT */
'DROPBUF' BUFNO /* DISCARD GARBAGE */
EXIT SRC
```

### *A More Complex EXEC Calling a Subroutine*

```
ADDRESS COMMAND
SIGNAL ON HALT /* FORCE ANY INTERRUPTION TO COME OUT
 OF MAIN EXIT */
'MAKEBUF' /* GET A BUFFER TO HOLD ANY GARBAGE */
BUFNO = RC /* KEEP ITS NUMBER */
:
:
(MAIN PROCESSING)
:
:
'MAKEBUF' /* GET ANOTHER BUFFER TO PASS DATA
 TO SUBROUTINE */
QUEUE 'SOMETHING FOR SUBROUTINE'
CALL SUBROUTINE
SRC = RC /* KEEP "RC" FROM SUBROUTINE */
'DROPBUF' BUFNO + 1 /* DISCARD ANYTHING NOT CLEARED BY SUBROUTINE */

 /* AT THIS POINT, TEST RETURN CODE FROM
 SUBROUTINE, USING "SRC" INSTEAD OF "RC" */
:
:
(MORE PROCESSING)
:
:
HALT: /* MAIN EXIT FROM PROGRAM */
SRC = RC /* KEEP LAST RC FOR EXIT */
'DROPBUF' BUFNO /* DISCARD GARBAGE */
EXIT SRC
```

### *An EXEC Called as a Subroutine and Returning Data in the Program Stack*

```
ADDRESS COMMAND
SIGNAL ON HALT /* FORCE ANY INTERRUPTION TO DO
 FINAL PROCESSING */
'MAKEBUF' /* GET A BUFFER TO HOLD ANY GARBAGE */
BUFNO = RC /* KEEP ITS NUMBER */
:
:
(MAIN PROCESSING)
:
:
SRC = RC /* KEEP LAST "RC" FOR EXIT */
'DROPBUF' BUFNO /* DISCARD GARBAGE */
QUEUE 'SOMETHING FOR CALLING ROUTINE'
EXIT SRC /* MAIN EXIT FROM PROGRAM */
HALT: /* SPECIAL EXIT FROM PROGRAM IF
 INTERRUPTED BY "HI" */
'DROPBUF' BUFNO /* DISCARD GARBAGE */
EXIT
```

## Reporting z/VM Integrity Problems

The authorized program analysis report (APAR) is the formal mechanism for reporting to IBM problems you are having with z/VM. These problems may include:

- Integrity exposures
- Logic errors in the programming
- Documentation errors
- Program distribution problems.

You should never use the APAR process to:

- Comment on or suggest improvements to z/VM
- Report minor stylistic, grammatical, spelling, or punctuation errors in a z/VM document
- Report on the packaging or quality of the items you received from IBM.

IBM also accepts security APARs involving z/VM or any product that runs on it. A security APAR reports problems in existing z/VM security mechanisms where the problem is not quite an integrity problem but does represent a threat to the security of the system as a whole or to one of its components.

If you discover an integrity problem in z/VM, proceed as follows:

1. Consider your problem in light of the discussion of system integrity under “Maintaining System Integrity” on page 387. If it is truly a system integrity problem, proceed to the next step.
2. Confirm that you have the current version, release, and modification level of each of the software products in your system.
3. Examine the appropriate documentation to see if there is a solution to your problem.
4. Remove any modifications you may have applied to z/VM to be certain that this is not the cause.
5. If your modification has caused the problem, do not replace it until it is repaired. If none of your modifications is the problem (or if you have made none), try to isolate the problem to a particular component of z/VM.
6. Gather and retain the necessary materials that document your problem: dumps, output listings, tapes, messages, return codes, and so forth. Be certain that none of this material is considered proprietary by your organization. If it is, try to replicate the problem resulting in data that is not proprietary.
7. Notify IBM service.

To resolve your problem, IBM may:

- Correct IBM code or documentation
- Document a temporary or permanent restriction
- Notify you that it is aware of the problem (IBM either provides an immediate solution or waits until the next release of the program or document)
- Notify you that someone or something at your installation is the cause of the problem (IBM then advises you on a solution).

If, to solve your problem, IBM must correct its code or documentation, the company alerts all z/VM customers to the problem and provides a program temporary fix (PTF). A PTF is a temporary solution to or bypass of a problem identified by IBM as the result of a defect in a current, unaltered release of the software product. Your system administrator is responsible for installing all PTFs; IBM provides any necessary PTF documentation.



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## Chapter 12. The Stand-Alone Dump Utility

CP can produce several formats of dumps: a CP dump, a snapdump, a stand-alone dump and a virtual machine dump. Dumps are especially helpful in analyzing problems such as wait states, infinite loops, and abends. This chapter describes how to create a stand-alone dump device and use it. For more information on debugging various types of problems, the other dump types, and other problem diagnosis tools, see *z/VM: Diagnosis Guide*.

A new stand-alone dump utility has been written for z/VM V6.3.0 that creates a dump that contains only storage that is in use by CP. It is able to create a CP hardabend format dump which is usually much smaller than a storage dump and the dump will be written to either ECKD or SCSI DASD. It also supports larger memory sizes.

The former stand-alone dump utility based on the HCPSADMP utility is still shipped with the z/VM product and except for rare situations, its use is not necessary. It dumps all non-zero pages of storage, whether or not they are in use by CP. It dumps real memory up to 512 GB to tape devices, and its use should be limited to dumping stand-alone utilities, such as SAPL and DDR. Refer to Appendix C, “Stand-Alone Dump Program (Uses Tapes),” on page 845 for more information.

z/VM includes a CMS-based utility, SDINST, that you will use to create an IPL'able stand-alone dump DASD device that is tailored according to your installation's configuration. After you install z/VM, you should create the stand-alone dump device for emergency use. This is usually done by the system programmer, not a general user. If, after a system failure, CP cannot create an abend dump, the operator can IPL the stand-alone dump device to dump CP storage.

**Attention:** The PTF for APAR VM65126, “FIXES TO FCP DUMP SIMULATION,” is required on first level systems where the new stand-alone dump program (SDINST) is used to dump second level systems. The PTF is included on V540 RSU1202, V610 RSU1301, and V620 RSU1202. It is important for the first level system to have this fix because various ABENDs or incorrect operation of the new stand-alone dump program could occur.

This chapter describes the stand-alone dump installation utility, SDINST, and provides information about using the stand-alone dump device to create a dump.

---

### Creating the Stand-Alone Dump Utility

Your installation can generate a stand-alone dump device customized to your system configuration. This gives you control over the DASD used to IPL the stand-alone dump program and the additional output devices for the dump. To install the stand-alone dump program, a CMS based utility, SDINST EXEC, prompts for setup information and then formats and initializes the IPL and DUMP DASD.

To use the SDINST utility, your userid must have:

- Access to the SDINST EXEC which usually resides on MAINT 190
- At least 128 MB of virtual storage

## The Stand-Alone Dump Utility

- A virtual reader at device number 00C and virtual punch at 00D
- No Class N reader or punch spool files
- A read/write 191 minidisk that is accessed as file mode A with at least ten 4K blocks of free space, and
- A read/only 400 minidisk, preferably MAINT 400, which contains the following files:
  - SADU71 IMAGE
  - SSPI71 IMAGE
  - SSPK71 IMAGE
  - SSPP71 IMAGE

SDINST can run interactively to build its configuration file, SDINST DUMPCONF, or it can use an existing configuration file, which is useful if you are reinstalling to the same devices.

1. Upon invocation, the utility will check for an existing SDINST DUMPCONF file. If the file exists, you will be given the option of re-using that file or creating a new one. If the file is re-used, the utility verifies the information in the dump configuration file before formatting and initializing the DASD.
2. If a new file is to be created, the user is first asked for the virtual device number of a 3390 DASD or FCP device desired for the stand-alone dump IPL disk. This disk is where the stand-alone dump program will be written and will also contain the first part of the dump.
  - a. The utility will then ask for the real device number of the 3390 or FCP that will be used at dump time.
  - b. If the device is a 3390, the utility then asks if the volume label found is correct. The label will be useful to verify the correct disk will be formatted at install time, as well as when the dump is written at dump time. The DASD will be checked to ensure it is accessible and writeable.
  - c. If the device is an FCP, the utility will continue by asking for the WWPN and LUN. These values are used at install time by the DASD formatting program and also at dump time. Only one FCP / WWPN / LUN combination is allowed per LUN.
  - d. After gathering information about the IPL device, the utility asks if there are additional dump devices. If there are, the previous steps for obtaining device information are repeated. There can be a maximum of 30 dump devices, including the IPL device.
3. Once the utility has all the information, it will create the dump configuration file on the user's 191 disk which must be accessed as file mode A. Then the utility punches the DASD formatting program files to the user's virtual reader. After the user confirms that they are ready to format the DASD, SDINST will IPL the reader and format and initialize the DASD. When it completes, the user must re-IPL CMS.

An example of the prompts and replies that appear on the virtual machine console during SDINST EXEC execution is shown in "Examples for Generating the Stand-Alone Dump Utility" on page 403.

---

## Additional Information about Stand-Alone Dump

Mixing DASD types is not allowed. If you use 3390 DASD as the IPL DASD, all additional dump DASD must also be 3390. If you use SCSI DASD as the IPL DASD, the additional dump DASD must be SCSI as well.

If using 3390 DASD, the device must already have a label, which may be the result of the DASD being CP-formatted, CMS formatted or previously formatted by SDINST. If your device does not have a label, you can quickly put a label on it by using the CMS FORMAT command and formatting just 1 cylinder.

The IPL and all additional DUMP devices must be available in read/write mode.

For dumping a first level system (LPAR), each dump device is an entire 3390 or SCSI LUN. Currently, a 3390 used by stand-alone dump is limited 65520 cylinders when allocated on an IBM TotalStorage DASD subsystem. That is about 45 GB of data. The maximum SCSI device support is limited to about 1 TB because VM's EDEVICE support is used when loading the dump.

When using the stand-alone dump program to dump a second level system, minidisks may be used. The minidisk used for the IPL device must be at least 75 cylinders. Minidisks for additional dump devices could be as small as 1 cylinder but that is not a reasonable size for dump devices. The minimum SCSI LUN sizes are equivalent: 53 MB for the IPL device and 0.7 MB for additional dump devices.

The size of the dump produced by stand-alone dump will be approximately the same size as a SNAPDUMP or CP hard abend dump of the same system. To determine how many dump devices will be needed, use the output of the CP QUERY DUMP command from the running system under a heavy load, multiplied by 1.5, to get an estimate of the number of 4K pages that the dump will contain. This estimate should be used as a minimum value and may not be sufficient in some situations, such as if dumping a system that had a "memory leak" problem. To be safe and cover every situation, allocate dump space equal to the configured storage size of the LPAR. Each cylinder on a 3390 DASD holds 180 4K pages. Note that the first part of the IPL device (45 cylinders on a 3390, or approximately 32 MB for SCSI) is used by the stand-alone dump program and the rest of the IPL device will hold the first piece of the dump. All of the space on any additional dump devices is used to hold the dump.

If dumping storage for a problem that occurred during CP IPL, such as a disabled wait state, the dump size will be approximately 2% of the LPAR's real memory plus 32 MB. The 32 MB accounts for 16 MB for the CP nucleus plus 16 MB for the System Execution Space Page Management Table.

---

### Examples for Generating the Stand-Alone Dump Utility

The following is an example of generating the stand-alone dump utility. In this example:

- The IPL and DUMP DASD are on 3390 DASD with an address of 555.
- There is only one device for IPL and DUMP.

Under CMS, enter:

**SDINST**

The exec replies:

```
HCPSDI8682I STAND-ALONE DUMP INSTALLER V6.3
ENTER 'QUIT' AT ANY PROMPT TO TERMINATE EXECUTION.
HCPSDI8654A PLEASE ENTER THE VIRTUAL DEVICE ADDRESS OF THE IPL DASD
```

Enter:

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555

HCPSDI8655A PLEASE ENTER THE REAL DEVICE ADDRESS FOR THIS DASD  
OR ENTER Y TO USE 0555  
Y

HCPSDI8674A DASD HAS EXISTING VOLID DSD555.  
DO YOU WISH TO CONTINUE? (Y/N)  
Y

HCPSDI8658A ARE THERE ANY ADDITIONAL DUMP DASD TO SPECIFY? (Y/N)  
N

|        |       |      |    |        |      |                     |
|--------|-------|------|----|--------|------|---------------------|
| SSPK71 | IMAGE | F1 F | 80 | 113581 | 1738 | yyyy-mm-dd hh:mm:ss |
| SSPP71 | IMAGE | F1 F | 80 | 1      | 1    | yyyy-mm-dd hh:mm:ss |
| SSPI71 | IMAGE | F1 F | 80 | 76478  | 1494 | yyyy-mm-dd hh:mm:ss |
| SADU71 | IMAGE | F1 F | 80 | 15655  | 306  | yyyy-mm-dd hh:mm:ss |

CP SPOOL PUNCH CL N TO \* NOHOLD NOEOF NOKEEP  
RDR FILE 1146 SENT FROM MYUSERID PUN WAS 1146 RECS 114K CPY 001 N ...  
RDR FILE 1147 SENT FROM MYUSERUD PUN WAS 1147 RECS 0001 CPY 001 N ...  
RDR FILE 1148 SENT FROM MYUSERID PUN WAS 1148 RECS 076K CPY 001 N ...

CP SPOOL RDR CL N NOHOLD EOF  
SPOOL RDR OPTIONS HAVE BEEN CHANGED TO CLASS N, NOHOLD AND EOF.  
IF FOLLOWING IPL IS SUCCESSFUL, YOU WILL NEED TO RESTORE SPOOL  
RDR OPTIONS MANUALLY BECAUSE CONTROL DOES NOT RETURN TO THIS EXEC.

EVERYTHING IS READY. ANSWER Y TO CONTINUE AND IPL THE DASD FORMATTING  
PROGRAM. ANY OTHER RESPONSE EXITS WITHOUT DOING THE IPL.  
Y

CP IPL 00C CLEAR PARM loglevel=0 sspmod=SADU71:400  
nnnnnnnn FILES CHANGED  
CPSDI8660I SETTING DEVICE 0191 ONLINE.  
HCPSDI8662I FORMATTING 3339 CYLINDERS ON DEVICE 0555.  
HCPSDI8664I WRITING PARTITION TABLE TO DEVICE 0555.  
HCPSDI8666I CREATING FILE SYSTEM FOR IPL PARTITION ON DEVICE 0555.  
HCPSDI8668I INSTALLING STAND-ALONE DUMP TO THE IPL PARTITION ON  
DEVICE 0555.  
HCPSDI8670I STAND-ALONE DUMP INSTALLATION IS COMPLETE.  
YOU MAY RE-IPL CMS.  
HCPGSP2629I The virtual machine is placed in CP mode due to a  
SIGP stop from CPU 00.

Do not be concerned by the FILES CHANGED message. The program issues a  
CHANGE RDR ALL KEEP NOHOLD command to prevent accidental deletion of  
any reader files.

---

## Taking the Stand-Alone Dump

To take a stand-alone dump:

1. Stop the system. If the system is at a disabled wait state, it is already stopped. Otherwise use the Stop All function on the HMC. For a second level system, use the CP STOP CPU ALL command.
2. Use the Store Status function on the HMC or check the **Store Status** box when you do the Load function in the next step. Type STORE STATUS on the CP command line if dumping a second level system.
3. IPL the dump device. Use the Load Normal function on the HMC.

**Attention:** Do not use the CLEAR option.

If the dump device is SCSI, check the **SCSI DUMP** box, specify the FCP device number as the Load Address, and specify the necessary WWPN and LUN



values. Specify 0 for Boot program selector and Boot record logical block address fields and blanks for Load parameter and Operating system specific load parameters.

For dumping a second level system using 3390 DASD, use the IPL command without the CLEAR operand. If using SCSI devices, first use the CP SET DUMPDEV command to define the location of the dump device using the same values as described in previous paragraph. Then use the CP IPL command with the DUMP operand.

The dumper displays messages on the system console as it progresses. For example, these messages were displayed when dumping a 10 GB second level system to a 3390 DASD at device number 555.

**CP STOP CPU ALL**

**STORE STATUS**

Store complete.

**TERM CONMODE 3215**

**IPL 555**

Booting default...

Starting Stand-alone Dump

Done initializing disks

Dumping Frame Table

Dumping memory:

00000000 / 00000047 MB

00000008 / 00000047 MB

00000016 / 00000047 MB

00000024 / 00000047 MB

00000032 / 00000047 MB

00000040 / 00000047 MB

00000047 / 00000047 MB

Stand-alone Dump was successful.

HCPGSP2629I The virtual machine is placed in CP mode due to a SIGP stop from CPU 00.

## Processing the Stand-Alone Dump Data

Re-IPL the z/VM system. To read the dump from the dump devices, use the DUMPLD2 utility and specify the DASD operand. Attach the dump devices to a userid before invoking the DUMPLD2 utility. The following example shows loading a dump from virtual device 777 to filemode B and naming the dump TEMPLOAD.

**ATTACH 555 \* 777**

DASD 0555 ATTACHED TO OPERATNS 0777 WITH DEVCTL

Ready;

**DUMPLD2 DASD OUTFILE TEMPLOAD TO B**

HCPDL8278A Enter virtual device number of first dump device.

**777**

DUMP ON 0777 WAS CREATED yyyy-mm-dd hh:mm:ss

TOTAL PAGES 32626 DUMPER RC 0

| DASD<br>TYPE | DUMPLD2<br>VDEV | DUMP PAGES<br>VOL-ID | DUMP PAGES<br>ON DEVICE | DUMP<br>RDEV | DUMP<br>RC |
|--------------|-----------------|----------------------|-------------------------|--------------|------------|
| 3390         | 0777            | DSD55                | 32626                   | 0555         | 0          |

A total of 1 file(s) (32626 records each) will be created.

HCPDL8210I 1 TEMPLOAD MDMPxxxx file(s) will be created on disk B

## The Stand-Alone Dump Utility

```
Continue - Y/N ?
y
HCPDL8213I Created TEMPLOAD MDMP0001 B
Ready;
```

After loading the dump to CMS DASD, use the VM Dump Tool to process the dump. For details on using DUMPLD2, see *z/VM: CP Commands and Utilities Reference*. For details on using the VM Dump Tool, see *z/VM: VM Dump Tool*.

---

### Example for Generating the Stand-Alone Dump Utility on SCSI

The following is an example of installing the stand-alone dump utility on to SCSI devices. In this example, the IPL SCSI device uses FCP device number 1F01 and the additional dump device uses FCP 1F02. A separate FCP device must be used for each DASD.

```
vary on 1f01
1 device(s) specified; 1 device(s) successfully varied online
Ready;
```

```
att 1f01 * 1401
FCP 1F01 ATTACHED TO OPERATNS 1401
Ready;
```

```
vary on 1f02
1F02 varied online
1 device(s) specified; 1 device(s) successfully varied online
Ready;
```

```
att 1f02 * 1402
FCP 1F02 ATTACHED TO OPERATNS 1402
Ready;
```

```
SDINST
HCPSDI8682I STAND-ALONE DUMP INSTALLER V6.3
ENTER 'QUIT' AT ANY PROMPT TO TERMINATE EXECUTION.
HCPSDI8654A PLEASE ENTER THE VIRTUAL DEVICE ADDRESS OF THE IPL DASD.
1401
```

```
HCPSDI8655A PLEASE ENTER THE REAL DEVICE ADDRESS FOR THIS DASD
OR ENTER Y TO USE 1F01
y
```

```
HCPSDI8656A PLEASE ENTER THE 16 HEXADECIMAL DIGIT WWPB FOR THIS DASD.
50050763040313DE
```

```
HCPSDI8657A PLEASE ENTER THE 16 HEXADECIMAL DIGIT LUN FOR THIS DASD.
4011402900000000
```

```
HCPSDI8658A ARE THERE ANY ADDITIONAL DUMP DASD TO SPECIFY? (Y/N)
y
```

```
HCPSDI8654A PLEASE ENTER THE VIRTUAL DEVICE ADDRESS OF THE ADDITIONAL DUMP DASD
1402
```

```
HCPSDI8655A PLEASE ENTER THE REAL DEVICE ADDRESS FOR THIS DASD
OR ENTER Y TO USE 1F02
y
```

```
HCPSDI8656A PLEASE ENTER THE 16 HEXADECIMAL DIGIT WWPB FOR THIS DASD.
50050763040313DE
```

```
HCPSDI8657A PLEASE ENTER THE 16 HEXADECIMAL DIGIT LUN FOR THIS DASD.
4011402A00000000
```

HCPSDI8658A ARE THERE ANY ADDITIONAL DUMP DASD TO SPECIFY? (Y/N)

n

|        |       |      |    |        |      |                     |
|--------|-------|------|----|--------|------|---------------------|
| SSPK71 | IMAGE | A1 F | 80 | 113581 | 1738 | yyyy-mm-dd hh:mm:ss |
| SSPP71 | IMAGE | A1 V | 80 | 1      | 1    | yyyy-mm-dd hh:mm:ss |
| SSPI71 | IMAGE | A1 F | 80 | 79108  | 1546 | yyyy-mm-dd hh:mm:ss |
| SADU71 | IMAGE | A1 F | 80 | 15779  | 309  | yyyy-mm-dd hh:mm:ss |

CP SPOOL PUNCH CL N TO \* NOHOLD NOEOF NOKEEP

RDR FILE 0004 SENT FROM OPERATNS PUN WAS 0004 RECS 114K CPY 001 N N...

RDR FILE 0005 SENT FROM OPERATNS PUN WAS 0005 RECS 0001 CPY 001 N N...

RDR FILE 0006 SENT FROM OPERATNS PUN WAS 0006 RECS 079K CPY 001 N N...

CP SPOOL RDR CL N NOHOLD EOF

SPOOL RDR OPTIONS HAVE BEEN CHANGED TO CLASS N, NOHOLD AND EOF.

IF FOLLOWING IPL IS SUCCESSFUL, YOU WILL NEED TO RESTORE SPOOL

RDR OPTIONS MANUALLY BECAUSE CONTROL DOES NOT RETURN TO THIS EXEC.

EVERYTHING IS READY. ANSWER Y TO CONTINUE AND IPL THE DASD FORMATTING PROGRAM. ANY OTHER RESPONSE EXITS WITHOUT DOING THE IPL.

y

CP IPL 00C CLEAR PARM loglevel=0 sspmod=SADU71:191

NO FILES CHANGED

HCPSDI8660I SETTING DEVICE 0191 ONLINE.

HCPSDI8664I WRITING PARTITION TABLE TO DEVICE 1401.

HCPSDI8666I CREATING FILE SYSTEM FOR IPL PARTITION ON DEVICE 1401.

HCPSDI8664I WRITING PARTITION TABLE TO DEVICE 1402.

HCPSDI8668I INSTALLING STAND-ALONE DUMP TO THE IPL PARTITION ON DEVICE 1401.

HCPSDI8670I STAND-ALONE DUMP INSTALLATION IS COMPLETE.

YOU MAY RE-IPL CMS.

HCPGSP2629I The virtual machine is placed in CP mode due to a SIGP stop from CPU 00

Do not be concerned by the FILES CHANGED message. The program issues a CHANGE RDR ALL KEEP NOHOLD command to prevent accidental deletion of any reader files.

## Taking the Stand-Alone Dump on SCSI

To take a stand-alone dump:

1. Stop the system. If the system is at a disabled wait state, it is already stopped. Otherwise use the Stop All function on the HMC. For a second level system, use the CP STOP CPU ALL command.
2. To IPL from SCSI on the real processor, access the **Load** window on the processor console and click the **SCSI dump** box. To IPL from SCSI in a virtual machine, you will specify the virtual device number of the FCP device and use the DUMP operand on the IPL command. Also, you will use the CP SET DUMPDEV command to specify the additional information that you specify on the **Load** HMC panel.
  - \* Specify the load address of the FCP device of the IPL DASD.
  - \* Specify all blanks in the Load Parameter field.
  - \* Specify the world wide port name (PORT on the SET DUMPDEV command)
  - \* Specify the logical unit number (LUN)
  - \* Specify 0 for the boot program selector (BOOTPROG)
  - \* Specify 0 for the boot record logical block address (BR\_LBA)
  - \* Specify all blanks in the OS specific load parameters field (SCPDATA)

## The Stand-Alone Dump Utility

To continue the example from “Example for Generating the Stand-Alone Dump Utility on SCSI” on page 406, specify 1F01 as load address, WWPN as 50050763040313DE and LUN as 4011402900000000.

3. To see the progress of the stand-alone dump, open the SYSC console on the HMC (Operating System Messages). If using z/VM, type CP TERM CONMODE 3215.
4. IPL the dump device. For dumping a second level system, use the CP IPL command with the DUMP operand.

The dumper displays messages on the system console as it progresses. For example, these messages were displayed when dumping a 200 GB first level system.

```
HCPLDI2816I Acquiring the machine loader from the processor controller.
HCPLDI2817I Load completed from the processor controller.
HCPLDI2817I Now starting the machine loader.
MLOEVL012I: Machine loader up and running (version v2.3).
MLOPDM003I: Machine loader finished, moving data to final storage location.
Starting Stand-alone Dump
Done initializing disks
Dumping Frame Table
Dumping memory:
00000000 / 00001747 MB
00000291 / 00001747 MB
00000582 / 00001747 MB
00000874 / 00001747 MB
00001165 / 00001747 MB
00001456 / 00001747 MB
00001747 / 00001747 MB
Stand-alone Dump was successful.
```

---

## Processing the Stand-Alone Dump Data on SCSI

Re-IPL the z/VM system. To read the dump from the dump devices, use the DUMPLD2 utility and specify the DASD operand. For this procedure, the dump devices will be accessed using z/VM's EDEVICE support. The edevices must be defined and then attached to the userid as virtual devices before trying to load the dump. If you do not know all of the dump devices that were used, run DUMPLD2 twice. The first time, specify the first device and DUMPLD2 will find the dump and display information about the dump devices. When it asks if it should continue, type n and then attach the additional dump devices as necessary. Run DUMPLD2 again and answer y when asked to continue.

**Note:** The EDEVs must be attached to the user using consecutive virtual device numbers, such as 1401, 1402, and so on.

The following example shows loading a dump from virtual EDEVs 1401 and 1402 to filemodes C and D and naming the dump MYSAD. The same FCP devices, WWPNs and LUNs that were used in the previous sections are used here.

```
vary on 1f01-1f02
1F01 varied online
1F02 varied online
2 device(s) specified; 2 device(s) successfully varied online
Ready;
```

```
CP SET EDEVICE 1401 TYPE FBA ATTR 2107 FCP_DEV 1F01
 WWPN 50050763040313DE LUN 4011402900000000
EDEV 1401 was created.
Ready;
```

```
CP SET EDEVICE 1402 TYPE FBA ATTR 2107 FCP_DEV 1F02
```

```
WWPN 50050763040313DE LUN 4011402A00000000
EDEV 1402 was created.
Ready;

vary on 1401
1401 varied online
1 device(s) specified; 1 device(s) successfully varied online
Ready;

vary on 1402
1402 varied online
1 device(s) specified; 1 device(s) successfully varied online
Ready;

att 1401 * 1401
DASD 1401 ATTACHED TO OPERATNS 1401
Ready;

att 1402 * 1402
DASD 1402 ATTACHED TO OPERATNS 1402
Ready;

dumpld2 dasd small outfile mysad to C D
HCPDL8278A Enter virtual device number of first dump device.
1401
DUMP ON 1401 WAS CREATED yyyy-mm-dd hh:mm:ss
TOTAL PAGES 1184452 DUMPER RC 0

DASD DUMPLD2 DUMP PAGES
TYPE VDEV ON DEVICE FCP WWPN LUN DUMP

SCSI 1401 1040375 1F01 50050763040313DE 4011402900000000 0
SCSI 1402 144077 1F02 50050763040313DE 4011402A00000000 0

A total of 19 file(s) (65536 records each) will be created.
HCPDL8210I 15 MYSAD MDMPxxxx file(s) will be created on disk C
HCPDL8210I 4 MYSAD MDMPxxxx file(s) will be created on disk D
Continue - Y/N ?
y
HCPDL8213I Created MYSAD MDMP0001 C
.
.
.
HCPDL8213I Created MYSAD MDMP0019 D
Ready;
```

## The Stand-Alone Dump Utility

---

## Chapter 13. Creating and Modifying Image Libraries for Printers

This chapter describes how to:

- Create text decks for IBM 3800 and impact printers
- Install and modify image libraries
- Display information about image libraries
- Purge image libraries
- Find information on how to back up image libraries
- Find more information about printers.

For a printer to work properly, it must have access to an *image library*. This image library is a set of modules that define the spacing, characters, and copy modification data the printer needs to format and print information. For each printer type there can be a number of IMAGE libraries, but the IMAGE library used for any one file must contain both the UCS images and the FCB images required for the printer to properly format and print the file.

An image library requires a *text deck* as its input file. The procedure for creating a text deck for a 3800 is different from the procedure for creating a text deck for an impact printer. This chapter explains both methods.

If your installation dedicates a printer to a virtual machine, use the facilities of the operating system you run in the virtual machine to build the appropriate image libraries. If your installation is going to use a printer as a CP spooling device (that is, a device that CP uses to print data for one or more virtual machines), you can follow the procedures described in this book to install image libraries.

---

### Creating Text Decks

A text deck is the input file required to produce an image library. A text deck contains forms control buffers (FCBs), copy modifications, character arrangement tables, graphic character modifications, or library character sets.

#### Creating Text Decks for the 3800

IBM supplies a 3800 image library feature tape. This feature tape is preinstalled on the z/VM System DDR, source is excluded. Control files for a 3800 image library are included.

Character sets supplied by IBM are supplied as separate files on the S disk; they are named XTB1xxxx TEXT S. These fonts are described in the *IBM 3800 Printing Subsystem Programmer's Guide*.

If you are modifying a 3800 image library or creating your own 3800 image library, you need to use the GENIMAGE utility to create a text deck for that image library.

The following is an example of the command to initiate GENIMAGE:

```
genimage sysin file * sysprint listing al
```

## Creating and Modifying Image Libraries

*sysin file \**

is the file name, file type, and file mode of the CMS input file. (The file mode can represent an accessed minidisk or an accessed shared file system directory.)

*sysprint listing al*

is the file name, file type, and file mode of the file in which GENIMAGE places a message listing. (The file mode can represent an accessed minidisk or an accessed shared file system directory.) GENIMAGE produces two groups of output files: a message listing and a text deck.

For more information on the GENIMAGE utility, see the *z/VM: CP Commands and Utilities Reference* book. For information on creating your own FCBs, copy modifications, and library character sets for a 3800, see the *IBM 3800 Printing Subsystem Programmer's Guide*.

## Creating Text Decks for Impact Printers

With the z/VM System DDR tapes or DVD, IBM supplies text decks, assemble files, and control files, which you can use to create image libraries for impact printers. Impact printers supported by z/VM are listed in the *z/VM: General Information* book.

If you are modifying an image library or creating your own image library, you need to create a text deck for that image library. To do so, you must:

1. Code the appropriate macroinstructions to add universal character sets (UCSs) and FCBs to produce assemble files. For more information on the naming restrictions and conventions for FCBs and UCSs, see “Universal Character Sets and FCBs Supplied by IBM,” “Forms Control Buffers Supplied by IBM” on page 418, and “Naming Conventions for UCS Buffer Images and FCBs” on page 416.
2. Process the assemble file with the VMFHASM utility. The output of VMFHASM is a text deck. If you have the H Assembler then use the VMFHASM command. If you have the High Level Assembler then use the VMFHLASM command.

### Universal Character Sets and FCBs Supplied by IBM

The IBM-supplied buffer images for each printer are located in an assemble file of the form *nnnnxxxx ASSEMBLE* (*nnnn* is the printer type, *xxxx* is the buffer image name).

For example, the AN buffer image associated with the 3203 is located in 3203AN ASSEMBLE.

IBM supplies the following UCS buffer images for the 3203 printer:

| Name | Meaning                                                   |
|------|-----------------------------------------------------------|
| AN   | Normal alphanumeric notation character set arrangement    |
| HN   | Normal hexadecimal notation character set arrangement     |
| PCAN | Preferred alphanumeric notation character set arrangement |
| PCHN | Preferred hexadecimal notation character set arrangement  |
| PN   | PL/I—60 graphics                                          |
| QN   | PL/I—60 graphics                                          |
| QNC  | PL/I—60 graphics                                          |
| RN   | FORTTRAN, COBOL commercial                                |
| SN   | Text printing 84 graphics                                 |
| TN   | Text printing 120 graphics                                |
| YN   | High-speed alphanumeric                                   |



IBM also supplies the following UCS buffer images for devices that emulate the 3211 printer.

**Name    Meaning**

**A11**    Standard commercial  
**H11**    Standard scientific  
**G11**    ASCII  
**P11**    PLI  
**T11**    Text printing

IBM supplies the following UCS buffer images for the 3262 printer:

**Name    Meaning**

**P48**    USA EBCDIC  
**P52**    Austria/Germany character set  
**P63**    USA EBCDIC  
**P64**    USA EBCDIC  
**P96**    USA EBCDIC  
**P128**   Katakana character set

IBM supplies the following FCB images for the 3203, 3262, 4245, and 4248 printers and devices that emulate the 3211 printer:

**Name    Meaning**

**FCB1**   Space—6 lines per inch; Length of page—66 lines

| Line Represented | Channel Skip Specification |
|------------------|----------------------------|
| 1                | 1                          |
| 3                | 2                          |
| 5                | 3                          |
| 7                | 4                          |
| 9                | 5                          |
| 11               | 6                          |
| 13               | 7                          |
| 15               | 8                          |
| 19               | 10                         |
| 21               | 11                         |
| 23               | 12                         |
| 64               | 9                          |

**FCB8**   Space—8 lines per inch; Length of page—68 lines

| Line Represented | Channel Skip Specification |
|------------------|----------------------------|
| 1                | 1                          |
| 4                | 2                          |
| 8                | 3                          |
| 12               | 4                          |
| 16               | 5                          |
| 20               | 6                          |
| 24               | 7                          |
| 28               | 8                          |
| 32               | 10                         |
| 36               | 11                         |
| 63               | 12                         |
| 66               | 9                          |

## Creating and Modifying Image Libraries

FCBS Space—8 lines per inch; Length of page—68 lines

| Line Represented | Channel Skip Specification |
|------------------|----------------------------|
| 1                | 1                          |
| 54               | 2                          |
| 55               | 3                          |
| 56               | 4                          |
| 57               | 5                          |
| 58               | 6                          |
| 59               | 7                          |
| 60               | 8                          |
| 61               | 10                         |
| 62               | 11                         |
| 63               | 12                         |
| 64               | 9                          |

For the exact contents of these buffer images, see the *IBM 3211 Printer, 3216 Interchangeable Train Cartridge, and 3811 Printer Control Unit Component Description and Operator's Guide*.

### Notes:

1. During print line buffer (PLB) loading, the 3211 attaches to the end of the UCS a 64-byte associative field. This buffer is used to ensure that each character that is loaded into the PLB for printing is also on the print train.  
For the 3203, the dualing and uncomparable table (DUCT) serves a similar purpose. For more information on coding the DUCT, see the *IBM 3203 Printer Model 5 Component Description and Operator's Guide*.
2. The forms control buffer (FCB) for a virtual 3203, 3262 Model 5, 4245, 4248 or a device that emulates a 3211 should be compatible with the FCB that is loaded in the real counterpart; otherwise, the results will be unpredictable.

## Adding New Universal Character Set Buffer Images

If the UCS buffer images that IBM supplies do not meet your needs, you can change a buffer image or create a new buffer image.

With z/VM, two UCS macroinstructions define a UCS for any impact printer. To create the text deck to add a new print buffer image to z/VM, you must:

1. Provide a buffer image name and a 12-byte header for the buffer load by coding the UCSI macroinstruction.
2. Provide the exact image of the print chain.
3. Code the UCSICCW macroinstruction and produce the appropriate ASSEMBLE file. The UCSICCW macroinstruction marks the end of the print image and optionally creates a CCW to print the image.
4. Process the assemble file with the VMFHASM utility. The output of VMFHASM is a text deck. For more information on VMFHASM, see “Using VMFHASM or VMFHLASM to Create a Text Deck” on page 422.

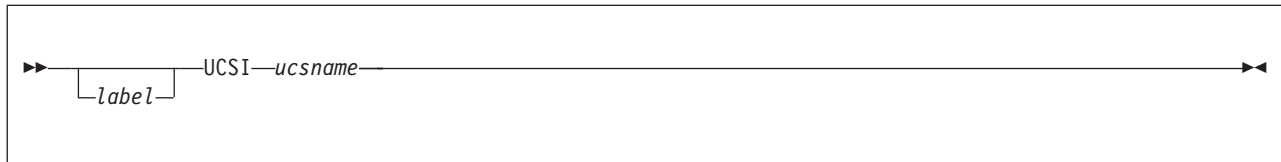
**Note:** Only one UCS may be defined in an ASSEMBLE file.

Macros are available that make the process of adding new print buffer images relatively easy. The following procedures tell you how to use these macroinstructions. Using them also helps you avoid error.

**The UCSI Macro:** The UCSI macroinstruction creates a 12-byte header record for the buffer load for any supported impact printer. CP uses the header record during processing of the LOADBUF and START commands.

Note that the UCS buffer contains up to 512 characters.

The syntax of the UCSI macroinstruction is:

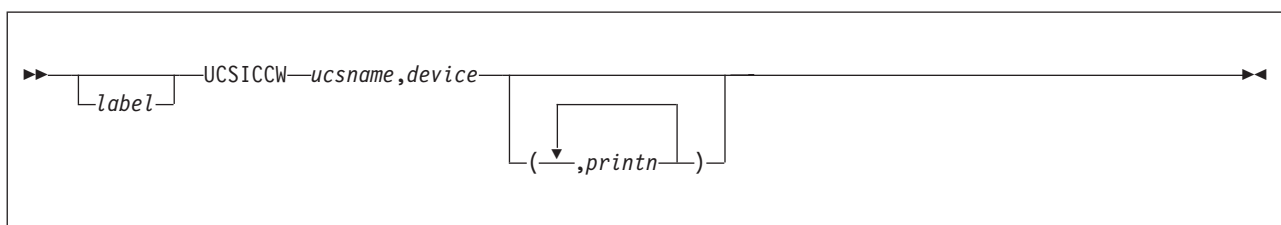


*uciname*

is a 1- to 4-character name that is assigned to the buffer load.

After you have coded the UCSI macroinstruction, you must supply the exact print image. To supply the print image, code DCs in hexadecimal or character format. The print image may consist of several DCs and may be up to 512 characters in length. The image consists of a train image and possibly a dualing and uncomparable character table (DUCT). The length of the data for each of these areas varies depending on the the printer type. Refer to the appropriate hardware manual for details. A list of some useful hardware manuals appears near the end of this chapter.

**UCSICCW Macro:** After you have supplied the print image, code the UCSICCW macroinstruction. The UCSICCW macroinstruction marks the end of the print image and optionally creates a CCW string to print the buffer load image when the operator specifies VERIFY on the LOADBUF command. This macroinstruction applies to any supported impact printer. The syntax of the UCSICCW macroinstruction is:



*uciname*

is a 1- to 4-character name assigned to the buffer load by the UCS macroinstruction.

*device*

is the device name of the printer with which the buffer is associated.

*printn*

are the line lengths to be printed. The variable *print1* represents the number of characters printed on the first line, *print2* represents the number of characters printed on the second line, and so on. Each count specified must be between 1 and the maximum length of the print line for the printer you specify. Up to 12 print fields may be specified. However, the total number of characters to be

## Creating and Modifying Image Libraries

printed may not exceed the maximum for that printer. If the lengths are not specified, the default is 48 characters per line for the entire UCS buffer image.

**Naming Conventions for UCS Buffer Images and FCBs:** When you modify or create a new UCS or FCB, follow the naming conventions listed below.

- The name of the file containing UCS or FCB macroinstructions is composed of the printer type followed by the name of the character set. For the 3203 printer with the PN character set, UCS macroinstructions are found in 3203PN ASSEMBLE. This naming convention means that, for a given printer, no UCS may have the same name as an FCB.
- The CSECT name in an assemble file is the name of the character set. In 3203PN ASSEMBLE, the CSECT name is PN.
- Text files have the same file name as the associated assemble file and have a file type of TEXT. The text file associated with 3203PN ASSEMBLE is 3203PN TEXT.
- Each UCS must be defined in a separate ASSEMBLE file.

Examples of coding assemble files for printers are given in this chapter. For information on creating text decks, see “Using VMFHASM or VMFHLASM to Create a Text Deck” on page 422.

### Examples of New 3203 UCS Buffer Images:

*Example 1:* This example defines a buffer image called EX01. The associated module in which you include the code for EX01 should be called 3203EX01 ASSEMBLE.

You do not have to specify the line length for verification of the buffer load. Insert the following code in 3203EX01 ASSEMBLE:

```
EX01 CSECT
 SPACE
 COPY HCPCW0EQ
 COPY HCPEQUAT
 SPACE
EX01 CSECT ,
 UCSI EX01
 DC 5C'1234567890A...Z1234567890*/'
 DC X'0010101010101010101010004000404000' 240-255
 DC X'4010101010101010101010004040400000' 256-271
 DC X'4040101010101010101010004000000000' 272-287
 DC X'1010101010101010101010000000404000' 288-303
 UCSICW EX01,3203
 END EX01
```

The buffer image is five representations of a 48-character string containing:

- The alphabetic characters
- The numeric digits, twice
- The special characters asterisk (\*) and slash (/).

*Example 2:* This example defines a buffer image called NUM1. The associated module in which you include the code for NUM1 should be called 3203NUM1 ASSEMBLE. Insert the following code in 3203NUM1 ASSEMBLE:

```

EX02 CSECT
 SPACE
 COPY HCPCW0EQ
 COPY HCPEQUAT
 SPACE
EX02 CSECT ,
 UCSI NUM1
 DC 24C'1234567890'
 DC X'001010101010101010004000404000' 240-255
 DC X'401010101010101010004040400000' 256-271
 DC X'40401010101010101010004000000000' 272-287
 DC X'10101010101010101010000000404000' 288-303
 UCSICW NUM1,3203,(60,60,60,60)
 END NUM1

```

The NUM1 print buffer consists of twenty-four 10-character entries. If, after 3203NUM1 ASSEMBLE is reloaded, you enter the command:

```
loadbuf 00e ucs num1 ver
```

four lines of 60 characters (the 10-character string repeated six times) are printed to verify the buffer load.

**Examples of New 3211 UCS Buffer Images:** This example defines a buffer image called A11. The associated module in which you include the code for A11 should be called 3211A11 ASSEMBLE.

Enter the following code for the A11 UCS buffer image in 3211A11 ASSEMBLE:

```

ALL CSECT
 SPACE
 COPY HCPCW0EQ
 COPY HCPEQUAT
 SPACE
ALL CSECT ,
* all standard commercial 48 graphics 3211
 UCSI ALL
 DC 9C'1<.+IHGFEDCBA*$-RPQONMLKJ%,&&ZYXWVUTS/@#098765432'
 DC X'000000' 433-435
 DC X'000000000000000000000000101010' 436-450
 DC X'101010101010100040404240004010' 451-465
 DC X'1010101010101000404041000040' 466-480
 DC X'4010101010101010100040400000000' 481-495
 DC X'1010101010101010100040404448' 496-510
 DC X'0000' 511-512
 UCSICW ALL,3211,(48,48,48,48,48,48,48,48,48)
 END ALL

```

Note that the DC specification contains 49 characters and the UCSICW macroinstruction specifies 48 characters. The ampersand (&) must be coded twice to be accepted by the assembler. The single quotation mark (') must also be specified twice in order to be accepted.

**Examples of New 3262 UCS Buffer Images:** This example defines a buffer image called P48. The associated module in which you include the code for P48 should be called 3262P48 ASSEMBLE.

Enter the following code for the P48 UCS buffer image in 3262P48 ASSEMBLE:

```

P48 CSECT
 SPACE
 COPY HCPCW0EQ
 COPY HCPEQUAT
 SPACE
P48 CSECT ,
* 'usa ebcdic 48 character'
 UCSI P48
 SPACE
*
 0 1 2 3 4 5 6 7 8 9 a b c d e f
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 000
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 010
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 020
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 030
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 040
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 050
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 060
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 070
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 080
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 090
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 0A0
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 0B0
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 0C0
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 0D0
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 0E0
DC X'F1F2F3F4F5F6F7F8F9F07B7C61E2E3E4' 0F0
DC X'E5E6E7E8E9506B6CD1D2D3D4D5D6D7D8' 100
DC X'D9605B5CC1C2C3C4C5C6C7C8C94E4B7D' 110
UCSICW P48,3262,(48,48,48,48,48,48)
END P48

```

### Forms Control Buffers Supplied by IBM

z/VM provides three FCB images: FCB1, FCB8, and FCBS. These FCBs are located in assemble files of the form *nnnnxxxx* ASSEMBLE, where:

- The variable *nnnn* is the printer type
- The variable *xxxx* is the buffer image name.

For example, the FCB1 buffer image associated with the 4248 printer is located in 4248FCB1 ASSEMBLE.

### Adding a New Forms Control Buffer

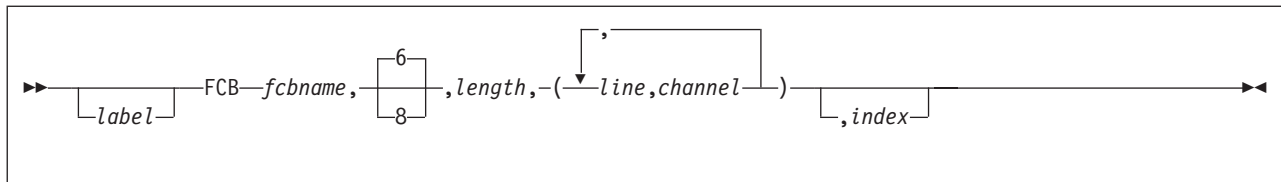
To add a new forms control buffer for your real or virtual printer, use the FCB macroinstruction. This macroinstruction applies to the following printers:

```

3203 Model 5
Devices that emulate the 3211
3262 Model 5
4245
4248.

```

When you add a new FCB, make sure you follow the naming conventions given under “Naming Conventions for UCS Buffer Images and FCBs” on page 416. The format of the FCB macroinstruction for the printers listed above is:



*fcbyname*

is the name of the forms control buffer. The variable *fcname* can be 1 to 4 alphanumeric characters in length.

*space*

is the number of lines per inch. Valid specifications are 6 and 8. This operand can be omitted; the default is six lines per inch. When the space operand is omitted, a comma (,) must be coded. This operand has no meaning for a virtual printer.

*length*

is the number of print lines per page or carriage tape (2 to 255).

(line,channel...)

shows which print line (*line*) corresponds to each channel (*channel*). The values for *channel* range from 1 to 12. The entries can be specified in any order.

*index*

is an index value from 1 to 31. The variable *index* specifies the print position that is to be the first printed position. It is valid only for devices that emulate the 3211 printer.

To create the text deck that will add a new FCB:

1. Code the FCB macroinstruction in the appropriate assemble file.
2. Process the assemble file with the VMFHASM utility. The output of VMFHASM is a text deck. If you have the H Assembler then use the VMFHASM command. If you have the High Level Assembler then use the VMFHLASM command. For more information on VMFHASM or VMFHLASM, see “Using VMFHASM or VMFHLASM to Create a Text Deck” on page 422.

**Notes:**

1. If you code the FCB macroinstruction with more than one channel designated for one print line, the macroinstruction includes only the last channel in the buffer for that print line. (A buffer byte can only be loaded with one channel code.)
2. The forms control buffer *must* have compatibility with channel 1; that is, channel 1 and line 1 must be the same physical line for all FCBs that are built. If they are not, the forms will be misaligned.
3. Each FCB assemble file should only contain one FCB or message HCPCSB241E will be issued when you try to load any FCB other than the first FCB into the printer.
4. Make sure you access the disk that contains the HCPOM2 MACLIB before assembling your file. The HCPOM2 MACLIB contains the CP version of the FCB MACRO. Otherwise, the CMS version of the FCB MACRO might be found in the DMSOM MACLIB and that will not create a valid text deck.

*Example:*

Code the FCB macroinstruction (using the name SPEC), if you want:

## Creating and Modifying Image Libraries

- Your printer to print 8 lines per inch
- Your printer to print 60 lines per page
- Channel 1 to correspond to print line 1
- Channel 12 to correspond to print line 40
- Channel 9 to correspond to print line 60
- Print position 10 to be the first print position.

```
fcb spec,8,60,(1,1,40,12,60,9),10
```

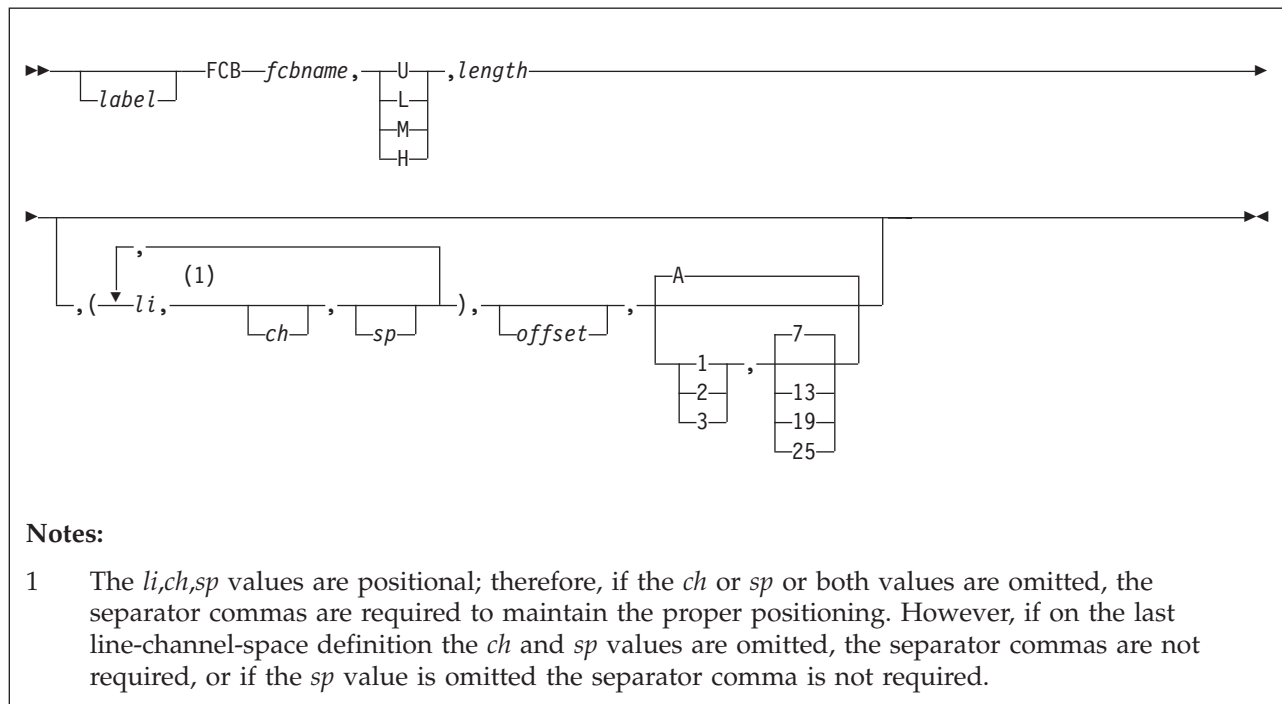
If you want another forms control buffer, called LONG, to be exactly the same as SPEC with the exception that only six lines are printed per inch, code either of the following:

```
fcb long,6,60,(1,1,40,12,60,9),10
```

```
fcb long,,60,(1,1,40,12,60,9),10
```

### Adding an Extended Forms Control Buffer for the 4248 Printer

To add an extended forms control buffer for your real or virtual 4248 printer, use the following format of the FCB macroinstruction:



#### *fcbname*

is the name of the forms control buffer. The variable *fcbname* can be from 1 to 4 alphanumeric characters in length.

#### *speed*

is the speed at which the 4248 printer runs. The value of *speed* must be one of the following:

| Value | Meaning   |
|-------|-----------|
| U     | Unchanged |
| L     | Low       |
| M     | Medium    |
| H     | High      |



### *length*

is the number of lines on the output page (2 to 256).

### *li,ch,sp*

is the information that defines a line in the FCB. You can specify multiple lines by separating the lines with commas. Enclose the entire line definition with one pair of parentheses.

*li* specifies the line number on the page. This must be between 1 and the value you specified for *length*.

*ch* specifies the channel code (1 to 12), or can be omitted. If you omit this operand, no channel is defined on this line.

*sp* specifies the lines-per-inch (LPI) spacing. Spacing is variable with each line. Acceptable values are 6 and 8; or, you can omit this operand. If omitted, the line spacing already in effect does not change.

### *offset*

specifies the character position in which the duplicate copy begins if you require the duplicate feature. If you omit this operand, no duplicate copy prints.

### *levels*

controls the level of the paper stacker. Acceptable values are:

#### **Value    Meaning**

|          |                                                       |
|----------|-------------------------------------------------------|
| <b>A</b> | Automatic stacker level control, which is the default |
| <b>1</b> | Paper tray lowered 1 inch below automatic position    |
| <b>2</b> | Paper tray lowered 2 inches below automatic position  |
| <b>3</b> | Paper tray lowered 3 inches below automatic position  |

### *rate*

specifies the paper stacker drop rate. Acceptable values are:

#### **Value    Meaning**

|           |                                                              |
|-----------|--------------------------------------------------------------|
| <b>7</b>  | Drop the paper tray after seven sheets, which is the default |
| <b>13</b> | Drop the paper tray after 13 sheets                          |
| <b>19</b> | Drop the paper tray after 19 sheets                          |
| <b>25</b> | Drop the paper tray after 25 sheets                          |

**Note:** If you specify the automatic stacker level control, the stacker drop rate is ignored.

### **Notes:**

1. If you code the FCB macroinstruction with more than one channel designated for one print line, the macroinstruction includes only the last channel in the buffer for that print line. (A buffer byte can only be loaded with one channel code.)
2. The forms control buffer *must* have compatibility with channel 1; that is, channel 1 and line 1 must be the same physical line for all FCBs that are built. If they are not, the forms will be misaligned.
3. Each FCB assemble file should only contain one FCB or message HCPCSB241E will be issued when you try to load any FCB other than the first FCB into the printer.
4. Make sure you access the disk that contains the HCPOM2 MACLIB before assembling your file. The HCPOM2 MACLIB contains the CP version of the FCB MACRO. Otherwise, the CMS version of the FCB MACRO might be found in the DMSOM MACLIB and that will not create a valid text deck.

## Creating and Modifying Image Libraries

*Example:*

If you want:

- Your printer to run at medium speed, print 8 lines per inch, and 60 lines per page
- Channel 1 to correspond to print line 1
- Channel 12 to correspond to print line 40
- Channel 9 to correspond to print line 60
- To begin the duplicate copy at position 67
- To set the paper tray 2 inches below the automatic position
- To drop the paper tray after 25 sheets.

code the FCB macroinstruction (using the name SPEC) as:

```
fcf spec,m,60,(1,1,8,40,12,,60,9),67,2,25
```

If you want another forms control buffer, called LONG, to be exactly the same as SPEC with the exception that, at line 40, the spacing be 6 lines per inch, code the following:

```
fcf long,m,60,(1,1,8,40,12,6,60,9),67,2,25
```

## Using VMFHASH or VMFHLASM to Create a Text Deck

After you have created the appropriate assemble files to modify a UCS or FCB buffer image, use the VMFHASH or VMFHLASM EXEC to create a text deck. If you have the High Level Assembler then use the VMFHLASM command. If you have the H Assembler then use the VMFHASH command. *Example*

To create a text deck from the file 3203PN ASSEMBLE, enter:

```
vmfhlasm 3203pn fn
```

where:

**3203pn**

is the file name of the 3203PN ASSEMBLE file.

**fn** is the file name of a control file whose file type is CNTRL. You can create your own control file or you can use the HCPVM CNTRL file that is supplied by IBM. Refer to *z/VM: VMSES/E Introduction and Reference* for the format of a control file. The important thing about the control file that you use is that the CP maclibs should precede the CMS maclibs on the "MACS" statement. Specifically, HCPOM2 must precede DMSOM so that the correct FCB MACRO is used for the assembly.

VMFHASH or VMFHLASM creates the file 3203PN TEXT, which you can then use to create an image library.

For more information on the VMFHASH or VMFHLASM execs see the *z/VM: VMSES/E Introduction and Reference* book. For information on image libraries, see "Installing Your Own Image Library" on page 423.

---

## Image Libraries

This section describes the tasks associated with image libraries.

## Default Image Library Names

The default image library used for a printer is `IMAGnnnn`, where *nnnn* is the device type of the printer.

Some types of printers may be configured to emulate another type of printer. In these cases, *nnnn* is the device type of the emulated printer, because that is the device type that is defined to CP. For example, a 4248 may emulate a 3211. In this case, the default image library is `IMAG3211` because the printer is defined to CP as a 3211.

Whether you use the default image library name or override the default by specifying a name on either the `RDEVICE` statement or `CP START` command, before an image library can be used, it must be installed as described below.

## Installing the Image Library That IBM Provides

As part of the z/VM System DDR tapes or DVD, IBM provides sample image library control files. For example, the image library control file for a 3800 printer is in a CMS file named `IMAG3800 CNTRL`. These control files are normal CMS files that can reside in an accessed Shared File System directory or on a minidisk. If you find that these control files do not meet your needs, you can change them or create your own. Whether you use the control files supplied by IBM or create your own, you must issue the `IMAGELIB` utility to install the image library associated with those control files. “Installing Your Own Image Library” below describes how to do this.

For additional information on the `IMAGELIB` utility, refer to the *z/VM: CP Commands and Utilities Reference* book.

## Installing Your Own Image Library

Use the `IMAGELIB` utility to install your own image library or the image library provided by IBM. Before you issue `IMAGELIB`, you must create a control file whose file name is the same as the image library you want to build and whose file type is `CNTRL`. The control file is a normal CMS file that can reside in an accessed shared file system directory or on a minidisk. The format of this file is one statement per text deck you want included, with names in columns 1 to 8.

The general format of `IMAGELIB` is as follows:

```
imagelib libname
```

The variable *libname* is the 1- to 8-character alphanumeric file name of the image library you want to install. (Keep in mind that image library members must be in files with a file type of `TEXT`, and the names of the library parts must be in a `CNTRL` file.)

*Example 1:*

To install an image library for which the components are listed in the file named `3800LIB1 CNTRL`, enter:

```
imagelib 3800lib1
```

*Example 2:*

To install an image library for which the components are listed in the file named `3203LIB2 CNTRL`, enter:

```
imagelib 3203lib2
```

## Creating and Modifying Image Libraries

For additional information about the IMAGELIB utility, refer to the *z/VM: CP Commands and Utilities Reference* book.

### Modifying Image Libraries

Use the IMAGEMOD utility to alter existing image libraries or to create a map of an image library. For additional information about the IMAGEMOD utility, refer to the *z/VM: CP Commands and Utilities Reference* book.

#### Adding Files to an Image Library

Use the ADD operand of IMAGEMOD to add files to an existing image library. For example, to ADD the images XT10 and XT12, from the IBM supplied text decks XTB1XT10 and XTB1XT2, to the image library named IMAG3800, enter:

```
IMAGEMOD ADD IMAG3800 XTB1XT10 XTB1XT12
```

**Note:** For names of other IBM supplied images for the 3800, refer to “Creating Text Decks for the 3800” on page 411.

#### Deleting Members from an Image Library

Use the DEL operand of IMAGEMOD to delete members from an existing image library. For example, to delete the members named XTB1ODA and XTB1ONA from the image library named IMAG3800, enter:

```
IMAGEMOD DEL IMAG3800 XTB1ODA XTB1ONA
```

#### Replacing Members or Modules in an Image Library

Use the REP operand of IMAGEMOD to replace existing modules of an image library with modules of the same name. For example, to replace the modules named XTB1GS10, XTB1GS12, and XTB1GS15, enter:

```
IMAGEMOD REP IMAG3800 XTB1GS10 XTB1GS12 XTB1GS15
```

#### Creating an Image Library Map

Use the MAP operand of the IMAGEMOD command to create a map of an image library. Use the TERM, PRINT, and DISK options to specify where you want the map sent.

*Example 1:*

To create a map of an image library named IMAG3800 and send the map to your console, enter:

```
imagemod map imag3800 (term
```

*Example 2:*

To create a map of an image library named IMAG3211 and send the map to your virtual printer, enter:

```
imagemod map imag3211 (print
```

*Example 3:*

To create a map of an image library named IMAG3800 and place the map in a CMS file on your A disk, enter:

```
imagemod map imag3800 (disk
```

Note that the map will be contained in a file named IMAG3800 MAP A5.

## Displaying Information about Image Libraries

Use the QUERY IMG command to display information about your image libraries. (Note that QUERY IMG can be entered by class A, B, C, D, and E users.)

For example, to display information about all of your image libraries, enter:

```
query img all
```

To display information about a particular image library, for example, the one named IMAG3800, enter:

```
query img name imag3800
```

In response to these commands, CP displays information similar to the following:

| OWNERID | FILE | TYPE | CL | RECS | DATE  | TIME     | FILENAME | FILETYPE | ORIGINID |
|---------|------|------|----|------|-------|----------|----------|----------|----------|
| userid  | spid | IMG  | c  | nnnn | mm/dd | hh:mm:ss | filename | filetype | originid |

For the meanings of these fields, refer to the *z/VM: CP Commands and Utilities Reference* book.

## Purging Image Libraries

Use the PURGE IMG command to get rid of unwanted files that contain image libraries. (Note that PURGE IMG can be entered by class A, B, C, D, and E users.)

For example, to purge a 3800 image library named IMAGTEST, enter:

```
purge img name imagtest
```

After this command is entered, CP purges IMAGTEST *unless* a printer is still using it. If a printer is still using IMAGTEST, CP places the file in a *pending-purge* state. CP purges the file as soon as the printer releases it.

To determine whether a file is in pending-purge state, enter the QUERY IMG command. If the file is in pending-purge state, CP's response shows that the file is class P.

## Keeping Backup Copies of Image Libraries

CP uses system spooling space to store image libraries. Because you may not always be able to recover spooling space after a CP abnormal termination, you should use the CP SPXTAPE command to keep backup copies of image libraries on tape. (Note, however, that the system tries to preserve system data files [SDFs] over a cold start.) For more information, see the *z/VM: System Operation* or *z/VM: CP Commands and Utilities Reference* books.

---

## Where to Find More Information about Printers

For information on using the GENIMAGE utility to create text decks that contain 3800 FCB images, copy modifications, character arrangement tables, graphic character modifications, and library character sets, see the *z/VM: CP Commands and Utilities Reference* book.

For information on operating a 3800 printer as a real spooling device, see the *z/VM: System Operation* book.

For detailed information on the 3800 printer itself, see:

## Creating and Modifying Image Libraries

- *Introducing the IBM 3800 Printing Subsystem and Its Programming*
- *IBM 3800 Printing Subsystem Programmer's Guide, OS/VS1, OS/VS2*
- *Reference Manual for the IBM 3800 Printing Subsystem.*

For more information on other printers mentioned in this chapter, see:

- *IBM 3203 Printer Model 5 Component Description and Operator's Guide*
- *IBM 3262-1/11 Printer Component Description*
- *IBM 3262-2/12 Printer Component Description*
- *IBM 3262-3/13 Printer Component Description*
- *IBM 3262-1/11 Printer Operator's Guide*
- *IBM 3262-2/12 Printer Operator's Guide*
- *IBM 3262-3/13 Printer Operator's Guide*
- *IBM 4245-1 Printer Component Description and Operator's Guide*
- *IBM 4248-1 Printer Operator's Introduction and Reference*
- *IBM 4248-2 Printer Operator's Introduction and Reference.*

---

## Chapter 14. CCW Translation

This chapter describes how to code the macroinstructions used at installation time to change the way CP handles CCWs.

---

### Using CCW Translation

An installation can control how CP handles specific CCWs. CP uses a set of tables to translate the guest's virtual channel programs into real channel programs that CP issues to the real device. These tables identify the characteristics of each CCW command (00 - FF) for the device class and type. An installation with only supported DASDs would not need to alter these tables. However, if the installation contains devices that act slightly different from supported DASD, a system installation programmer would want to slightly alter specific CCW entries in these tables.

The table name is the same as the file name of an ASSEMBLE file that must be updated, assembled, and incorporated in place of the standard table TEXT file when building the CP system.

Table 16 shows the table module's file name and the macroinstruction name associated with each device class.

*Table 16. Table and Macroinstruction Names for Device Classes*

| Table  | Macroinstruction | Device Class             |
|--------|------------------|--------------------------|
| HCPTCS | HCPCHSCD         | Check sorter             |
| HCPTDD | HCPDDPCD         | Dedicated DASD           |
| HCPFBD | HCPDDPCD         | Dedicated FBA DASD       |
| HCPTUD | HCPDDPCD         | DASD, unsupported        |
| HCPTMD | HCPMDPCD         | Minidisk                 |
| HCPFBM | HCPMDPCD         | FBA Minidisk             |
| HCPTTP | HCPTPPCD         | Tape                     |
| HCPUTT | HCPTPPCD         | Tape, unsupported        |
| HCPTMT | HCPCONCD         | Terminal, 3215           |
| HCPTMT | HCPDSPCD         | Terminal, 3270           |
| HCPTMT | HCPTRMCD         | Terminal, TERM           |
| HCPTUT | HCPTRMCD         | Terminal, unsupported    |
| HCPTUR | HCPURPCD         | Unit record              |
| HCPUUR | HCPURPCD         | Unit record, unsupported |

---

### Coding the Device Class Macroinstruction

To code a device macroinstruction to change the way that CP handles a specific CCW for the device:

1. Display the *filename* ASSEMBLE file for the device class. (The *filename* is the same as the table name in Table 16 for the device class. For example, to view the information for minidisks, display the HCPTMD ASSEMBLE file.)
2. Locate the table name associated with the device type and model you want to change. The table name appears in the specifications section of the assemble file listing. For example, the table name for 9345 minidisks is TMD93451. The specification section of the assemble file contains other information and notes

that you may want to review; for example, the device macroinstruction parameters that are valid for the device class.

3. Locate the CCW entry within the table that you want to change.
4. Code the CCW exactly as it appears in the *filename* ASSEMBLE file but change the conditions to satisfy your needs. You must code a change for each CCW you want to redefine. See “Device Macroinstruction” on page 429 for the valid parameter choices.
5. When all CCW changes are coded, code one more entry with LAST=YES.
6. Assemble the changed table and include the generated text deck when building the CP system nucleus.

**Note:** If I/O is still rejected after making CCW table updates, contact z/VM service to determine if something else is preventing the request from being accepted.

---

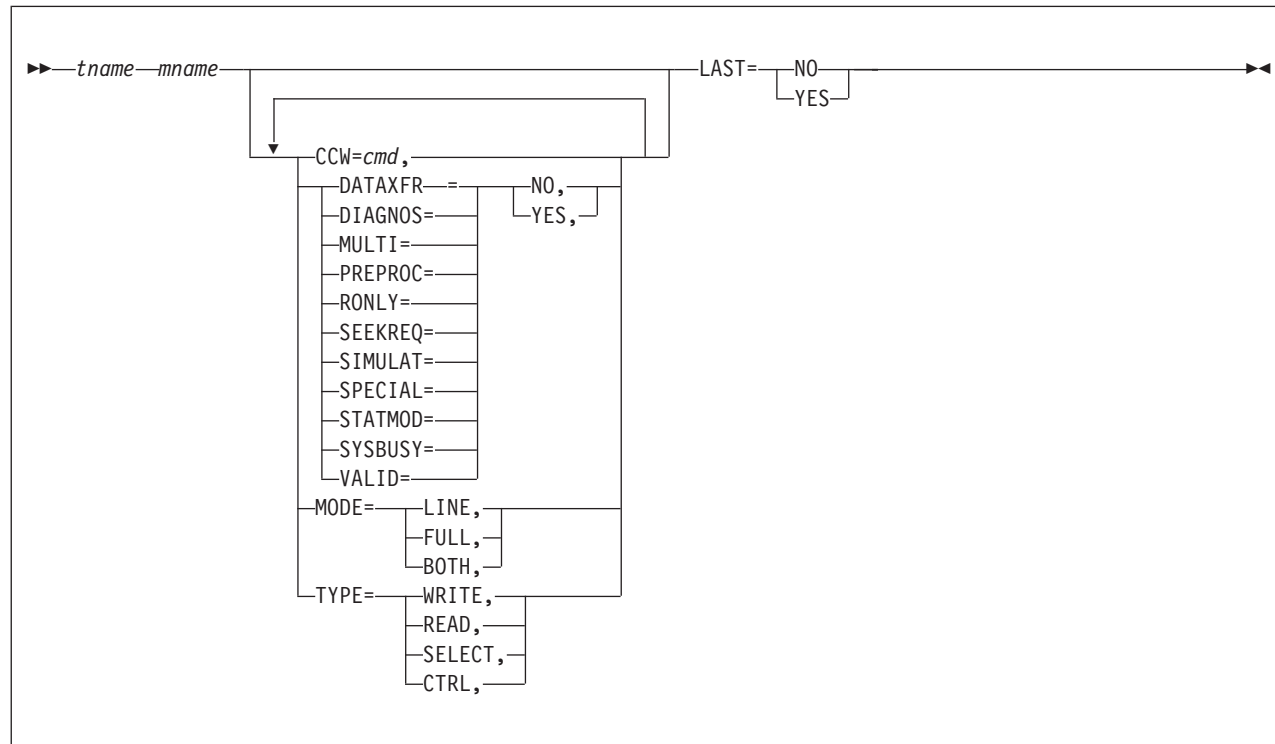
## Unsupported Devices Tables

The unsupported device tables each contain one table for how CP should treat that class of unsupported device. All unsupported devices of the same class are treated identically.

CP treats an unsupported DASD, for example, in many of the same ways that it treats a supported dedicated DASD. The only exceptions are those specified in the unsupported DASD table. CP handles channel program CCWs as you specified them in the table.



## Device Macroinstruction



### Parameters

*tname mname*

identifies the device translation table and macroinstruction for the device class. These must match the table and macroinstruction names shown in Table 16 on page 427. These cannot be changed because CP code references these names.

**CCW=cmd**

identifies the command code. The *cmd* is expressed in hex in the range X'00' to X'FF'.

**DATAXFER=NO**

**DATAXFER=YES**

indicates if the command causes a data transfer on the channel.

**DIAGNOS=NO**

**DIAGNOS=YES**

indicates if the command is a diagnostic CCW.

**MULTI=NO**

**MULTI=YES**

indicates if the command is a multitrack operation. This is an internal CP flag.

**PREPROC=NO**

**PREPROC=YES**

indicates if preprocessing is required. This is an internal CP flag.

**RONLY=NO**

**RONLY=YES**

indicates if the command is prohibited (command rejected) on a read-only device.

## CCW Translation

**SEEKREQ=NO**

**SEEKREQ=YES**

indicates if orientation is required. That is, this CCW must have been preceded in the channel program by a SEEK CCW.

**SIMULATE=NO**

**SIMULATE=YES**

indicates if CCW simulation is required. This is an internal CP flag.

**SPECIAL=NO**

**SPECIAL=YES**

indicates that further checking is required, such as:

- Certain opcodes need no data translation
- Certain opcodes must be first in the channel program
- For certain opcodes, user class is checked.

This is an internal CP flag.

**STATMOD=NO**

**STATMOD=YES**

indicates if the device can set STATUS MODIFIED.

**SYSBUSY=NO**

**SYSBUSY=YES**

indicates if the command is allowed to be issued to a tape device that is currently marked as busy with a system function such as SPXTAPE. If it is not allowed, a unit check is returned with command reject set in the sense data.

**VALID=NO**

**VALID=YES**

indicates if the command is valid. VALID=NO causes a command reject for this CCW.

**MODE=LINE**

**MODE=FULL**

**MODE=BOTH**

indicates the screen mode.

**TYPE=WRITE**

**TYPE=READ**

**TYPE=SELECT**

**TYPE=CTRL**

indicates type of command.

**LAST=NO**

**LAST=YES**

indicates if this is the last invocation for a particular device table. It must be specified as YES for the last invocation in order to generate a device table.

## Examples

Examples are not provided because you should be using the ASSEMBLE files as the base for your changes.

You cannot create new tables, labels, device classes, or supported device types. You can modify only existing tables and entries.

---

## Chapter 15. z/VM HiperDispatch

z/VM's HiperDispatch support is designed to improve your workload's performance in the memory subsystem.

z/VM HiperDispatch improves performance by working with the System z hardware to run virtual servers in a cache-advantaged way. This section first explains how the memory hardware is organized and why this is important for performance. Next, you learn how Processor Resource/System Manager (PR/SM) and z/VM work together to take advantage of the hardware configuration. Finally, you learn how to plan and configure your z/VM system to exploit HiperDispatch.

---

### Background on System z Cache Structure

System z<sup>®</sup> connects its CPUs to memory through a layered cache structure.

First, each CPU has its own cache (L1 and L2). Several CPUs are then grouped together on a chip, and they share a cache at this level (L3). Chips are then grouped together into multi-chip modules. Each multi-chip module is put onto a book, which has its own cache (L4). Finally, the books contain memory. This organization of CPUs into chips and books with shared cache is referred to as topology.

The amount of time it takes to resolve a memory reference is directly related to the number of caches that must be traversed. References resolved in the L1 cache are the fastest, while references that must be found in memory take the longest.

Exact CPU topology and number of cache levels varies by machine. In the following example there is one book, which has its own L4 cache and memory. The book contains four chips, each chip sharing the L4 cache. The CPUs on each chip share the L3 cache. Each CPU on a chip has its own L1 and L2 cache.

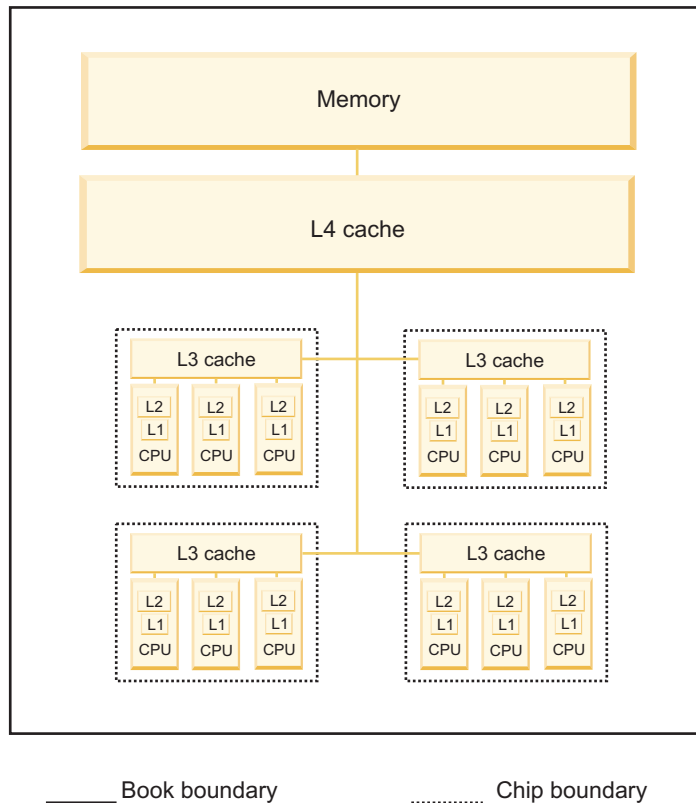


Figure 15. Example of a book with cache structures

## Software Performance Considerations

Software gets the best performance when its memory references are resolved in the cache levels closest to the CPU.

A guest on a hypervisor, for instance, would benefit from its virtual CPUs being consistently run on the same, or nearby, real CPUs. Two real CPUs are considered to be nearby if they share all caches except for the per-CPU cache. Ideally, virtual CPUs from different guests would run on different real CPUs to avoid putting unrelated memory contents into the cache. In the world of virtualization, however, it would not be efficient, or even possible, to assign only one virtual CPU to each real CPU. Thus, the hypervisor must balance the cache benefits to guests against the efficient use of CPUs.

## PR/SM Concepts

To understand HiperDispatch, you need to understand PR/SM entitlement, horizontal polarization mode, and vertical polarization mode.

### Entitlement

To understand how PR/SM uses machine topology information, first you should know how PR/SM determines entitlement for a partition. Entitlement is the amount of real CPU time each partition is guaranteed. Entitlement for a partition with shared CPUs is a function of the LPAR's weight, the sum of the weights for all other shared partitions, and the number of shared physical CPUs in the Central

Processing Complex (CPC). Entitlement is calculated separately for each CPU type as the number of shared CPUs multiplied by the ratio of an LPAR's weight to the sum of the weights of all shared partitions.

Figure 16 shows a CPC with three shared LPARs and three physical CPUs (each of type CP) and the relationship between weight and entitlement on each LPAR.

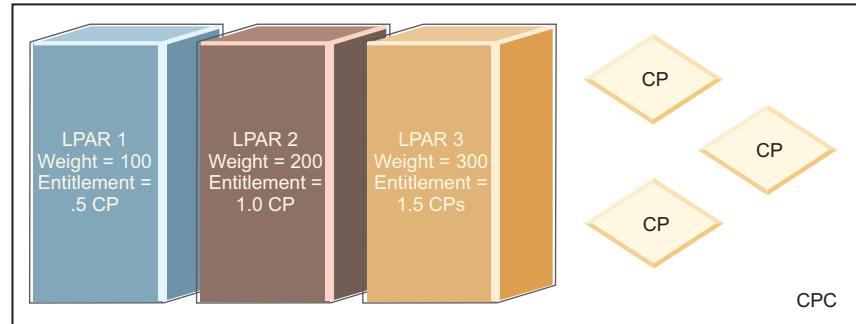


Figure 16. The relationship between weight and entitlement on each LPAR

While each partition is entitled to a certain amount of CPU time, it may use more or less than its entitlement. A partition might be running a workload that does not require all of its entitlement. This situation creates unused CPU time that other partitions can use if they need it. For example, partition LPAR 1 might be running a workload that needs more than its entitled CPU time. If another partition (LPAR 2) is using less than its entitlement, LPAR 1 might use the excess time. Partitions can use more than their entitlement only if they are not capped.

Entitlement for dedicated partitions is different than for shared ones. In a partition with dedicated logical CPUs, entitlement for each logical CPU equals 100% of one real CPU.

## Horizontal Polarization Mode

Historically, z/VM did not use topology information and ran in a *horizontal polarization mode* partition. To understand horizontal polarization mode, consider a partition with 16 online logical CPUs of type CP that has an entitlement equal to 12 real CPUs worth of power. In this mode:

- PR/SM distributes entitlement equally across all logical CPUs, so each of the 16 logical CPs is entitled to 75% of a physical CPU. When all other partitions consume their entitlements, each of these 16 will get no more than 75% of a real CPU.
- PR/SM does not necessarily make much effort to run a z/VM partition's logical CPUs over and over on the same real CPUs. So the 75% of a real CPU that each logical CPU receives could be spread across several real CPUs. This weak affinity can have serious effects on caches, leading to longer memory references.
- Furthermore, even if the logical CPU were always mapped to the same real CPU, as much as 25% of the time the real CPU could be running completely unrelated work, possibly even consisting of a number of low-consuming logical CPUs from other partitions, diluting cache even more.

These cache effects can have serious consequences for guest performance. Clearly, a better solution is needed.

## Vertical Polarization Mode

Beginning with the IBM System z10, PR/SM has been able to give operating systems two cache advantages. First, PR/SM can provide information about where logical CPUs are placed in the physical topology. Second, PR/SM can place logical CPUs to increase cache benefits. In *vertical polarization mode* PR/SM maps logical CPUs to real CPUs as closely to one another as possible and moves these mappings as little as possible.

PR/SM also tries to consolidate a partition's entitlement onto a subset of the logical CPUs that it places topologically near to one another. To do this, PR/SM divides logical CPUs into three types: vertical-highs, -mediums and -lows. Each vertical-high (Vh) CPU is entitled to 100% of one physical CPU, a vertical-medium (Vm) CPU is entitled to 50-100% of one physical CPU (except in cases where the partition's entitlement is less than 50%), and a vertical-low (Vl) CPU is entitled to 0% of one physical CPU. Vertical-medium and -low CPUs can consume CPU beyond their entitlement if other shared logical CPUs on the CPC are not consuming their entitlements.

## Communication between PR/SM and the Operating System

PR/SM offers interfaces to allow an operating system to exploit topology information for its benefit. The operating system (such as z/VM) can request to change between vertical and horizontal modes or can query the current mode. The operating system can also sense its own entitlement, as well as the entitlement and consumption of other partitions, so the operating system can calculate whether there is any excess CPU available. Finally, the operating system can query the topology of the real CPUs to which its logical CPUs are assigned and whether this mapping has changed recently. A smart operating system or hypervisor can use this information to improve performance for itself and its guests.

---

## The Objective of z/VM HiperDispatch

The objective of HiperDispatch is to help guest workloads get improved performance from the memory subsystem.

To accomplish this objective, z/VM can switch the partition to vertical polarization mode and exploit partition topology information. Topology awareness lets z/VM more efficiently use processors and run guest CPUs in topologically intelligent ways. Topological information about where the partition's entitlement is concentrated lets z/VM consolidate workloads onto a smaller set of logical CPUs.

Topology awareness has important advantages for z/VM's dispatcher. It can now group together virtual CPUs belonging to the same guest, so they are dispatched on logical, and in turn real, CPUs that share cache. z/VM also tries to keep guest CPUs running on the same logical CPUs, again, for cache benefits.

z/VM also takes advantage of the ability to query usage across the CPC. When running in vertical polarization mode, z/VM monitors CPU usage of other partitions to project whether there will be any excess CPU power. This information is then combined with information z/VM itself collects about its partition's use of CPU time. The information includes current as well as predicted CPU usage and what fraction of the CPU time used was used by guests themselves. The ratio of total CPU used to CPU consumed by virtual CPUs, called T/V ratio, when low, means that guest workload should be spread across as many CPUs as possible, for cache benefits. When T/V ratio is high it means a larger percentage of CPU is

being consumed by z/VM's Control Program instead of the guests. In this case, it is helpful for the workload to be consolidated onto fewer CPUs to reduce the number of CPUs that are competing for locks in the Control Program. Using all of these projections, z/VM determines which of its online logical CPUs should be in use.

Unnecessary or superfluous logical CPUs are placed into a new state called *parked*. CPUs put into parked state are not assigned work and remain in wait state until unparked. CPUs are placed into parked or unparked state based on the projections mentioned above. Partition topology information is used to decide which CPUs are most cache advantageous to unpark.

Remember that usage and entitlement are calculated separately for each CPU type. Thus, if running a partition with some Central Processors (CPs) and some Integrated Facility for Linux processors (IFLs), there might be different numbers of each unparked, depending upon workload, entitlement, and excess CPU available. Unentitled (vertical-low) CPUs are parked first, but vertical-high and vertical-medium CPUs might also be parked, if it would be advantageous to the system's workload.

Figure 17 is an example of a mapping of logical CPUs to real CPUs in a vertical partition with entitlement equal to 10.2 CPs and 2.7 IFLs, where there are 21 logical CPs and 7 logical IFLs defined. Each of the 9 vertical-high CPs and 2 vertical-high IFLs has an entitlement of 100% of a real CPU. Each vertical-medium CP will have an entitlement of 60%, for a total of 1.2 CPUs. The vertical-medium IFL has an entitlement of 70% of a real CPU. The calculated usage projection for this LPAR is 18 CPs and 5 IFLs, which is illustrated by the unparked (in use) CPUs. Because some vertical-low CPUs are unparked, this means there is excess CPU available on the CPC.

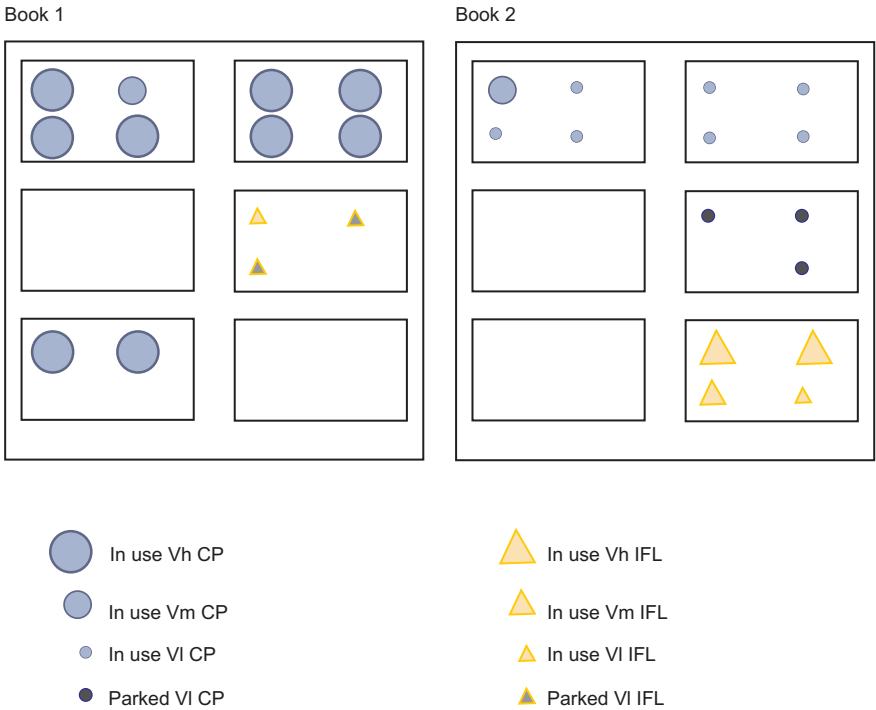


Figure 17. Example of a mapping of logical CPUs to real CPUs

**Note:** z/VM does not virtualize CPU topology or vertical polarization for guests. However, guests receive benefit from z/VM's topology-directed dispatching of virtual CPUs.

---

## Questions and Answers: How to Take Advantage of HiperDispatch

The following are answers to your questions about configuring and administering your system to take advantage of HiperDispatch.

### **How do I know whether my workload would benefit from z/VM HiperDispatch?**

For information about the characteristics of workloads that benefit from z/VM HiperDispatch, see the following z/VM Performance web site:

IBM: VM Performance Resources (<http://www.ibm.com/vm/perf/>)

### **Is there any special way to set up my partition so that HiperDispatch works better?**

If you decide to use vertical polarization mode, be sure to turn on Global Performance Data (GPD) for the partition. GPD is a setting turned on in the partition's activation profile on the HMC (Hardware Management Console) or SE (Support Element). This setting allows PR/SM to tell a partition about usage on other partitions within the CPC. You can use the QUERY SRM command to see whether Global Performance Data is enabled.

### **How do I switch from horizontal polarization to vertical polarization mode (or vice versa)?**

To switch between horizontal polarization and vertical polarization mode, use the new POLARIZATION option on the SET SRM (System Resource Manager) command or the new SRM system configuration statement.

#### **Notes:**

- When running second level, only horizontal polarization mode is allowed. If you attempt to go to vertical polarization mode you receive an error message.
- You can switch between horizontal polarization and vertical polarization mode at any time; however, there might be a short delay before the system begins to work optimally. When switching from vertical polarization mode to horizontal polarization, it can take up to two seconds to unpark all processors. Similarly, the switch from horizontal polarization mode to vertical can take up to two seconds for all appropriate processors to park.
- First level z/VM systems IPL in vertical polarization mode by default. To IPL in horizontal polarization mode, you must specify the SRM system configuration statement.

### **How do I query which mode is currently running?**

Polarization mode appears in several places. You can use an option on the QUERY SRM command, POLARIZATION, to see which polarization mode is currently running. To view the polarization of each CPU, use INDICATE LOAD command or the QUERY PROCESSORS TOPOLOGY command (discussed further below). If you collect monitor records, you can see this information in the System, Monitor and Scheduler domains or on z/VM screens.



## How do I know my partition topology and can I change it?

Use the TOPOLOGY operand on QUERY PROCESSORS to see the topology, but there are caveats. This operand is allowed only when topology is available; you get an error message when running second level. You see topology information when running first level in horizontal polarization mode, but remember the affinity between real and logical CPUs is not as strong as when running in vertical polarization mode.

You cannot change the mapping between real and logical CPUs. PR/SM determines this based on a partition's entitlement and number of logical CPUs. The mapping can change for a variety of reasons, including a new partition being activated, logical CPUs being varied off or on, or hardware errors.

Example:

```
q proc topo
TOPOLOGY
 NESTING LEVEL: 02 ID: 01
 NESTING LEVEL: 01 ID: 01
 PROCESSOR 01 ALTERNATE CP VH 0006
 PROCESSOR 02 ALTERNATE CP VM 0006
 PROCESSOR 03 ALTERNATE CP VH 0006
 PROCESSOR 04 ALTERNATE CP VH 0006
 NESTING LEVEL: 01 ID: 02
 PROCESSOR 05 MASTER CP VH 0004
 PROCESSOR 06 ALTERNATE CP VH 0004
 PROCESSOR 07 ALTERNATE CP VH 0004
 PROCESSOR 08 ALTERNATE CP VH 0004
 NESTING LEVEL: 01 ID: 04
 PROCESSOR 19 ALTERNATE IFL VL 0008
 PROCESSOR 1A PARKED IFL VL 0008
 PROCESSOR 1B PARKED IFL VL 0008
 NESTING LEVEL: 01 ID: 05
 PROCESSOR 09 ALTERNATE CP VH 0003
 PROCESSOR 0A ALTERNATE CP VH 0003
 NESTING LEVEL: 02 ID: 02
 NESTING LEVEL: 01 ID: 01
 PROCESSOR 0B ALTERNATE CP VM 0005
 PROCESSOR 0C ALTERNATE CP VL 0005
 PROCESSOR 0D ALTERNATE CP VL 0005
 PROCESSOR 0E ALTERNATE CP VL 0005
 NESTING LEVEL: 01 ID: 02
 PROCESSOR 0F ALTERNATE CP VL 0001
 PROCESSOR 10 ALTERNATE CP VL 0001
 PROCESSOR 11 ALTERNATE CP VL 0001
 PROCESSOR 12 ALTERNATE CP VL 0001
 NESTING LEVEL: 01 ID: 03
 PROCESSOR 13 PARKED CP VL 0002
 PROCESSOR 14 PARKED CP VL 0002
 PROCESSOR 1C PARKED CP VL 0002
 NESTING LEVEL: 01 ID: 06
 PROCESSOR 15 ALTERNATE IFL VH 0007
 PROCESSOR 16 ALTERNATE IFL VH 0007
 PROCESSOR 17 ALTERNATE IFL VM 0007
 PROCESSOR 18 ALTERNATE IFL VL 0007
Ready;
```

## How do I tell how my guest's CPUs are dispatched on logical CPUs?

You cannot see or influence how z/VM is dispatching guest CPUs on logical CPUs. z/VM's internal algorithms determine how to dispatch guests.

## While running in vertical polarization mode, how can I tell z/VM how many logical CPUs to use (unpark)?

You cannot specifically tell z/VM which CPUs to keep online and in use (unparked). This is determined by z/VM's internal algorithms based on usage and topology information. If your system is running in vertical polarization mode, you can make adjustments to change how many processors are kept unparked:

- You can specify how much additional CPU capacity to keep unparked by using the SRM command and configuration statement option CPUPAD. This is a pad beyond what the system is projected to use. The pad is important only when the T/V ratio is high and the work is being consolidated onto fewer CPUs than PR/SM would provide CPU power for at the moment. This option is useful when the load on the system exhibits high T/V and is known to be “bursty,” that is, having periodic spikes in CPU usage. In this case, the administrator would want z/VM to provision the system's capacity with some “headroom” so that if there is a sudden spike in utilization before z/VM next adjusts the system's capacity, there will be enough unparked capacity available to handle the spike. The default for CPUPAD is 100%, or one vertical-high CPU.
- The SRM option EXCESSUSE controls how aggressively the system attempts to use the excess CPU capacity on the CPC. Setting this option to HIGH is most useful on systems that have been underprovisioned relative to their usage and the available excess CPU on the CPC. In this case there would be many vertical-low CPUs that the workload would like to keep unparked. The LOW setting is useful in cases where there is excess CPU available, but because the workload is low priority, it is preferable to use less of the available excess; that is, keep more vertical-low CPUs parked. The default for this option is MEDIUM.
- Finally, you could change the partition's entitlement to be high enough to handle the workload's anticipated spikes. z/VM then parks entitled CPUs only if the workload and T/V ratio recommend it. You can change entitlement in the partition's activation profile on the HMC or SE, although that requires a shutdown of the z/VM system to put it into effect.

## Did HiperDispatch make any changes to how z/VM's dispatcher works?

The default z/VM work distribution algorithm is called *reshuffle*. This algorithm periodically alters the home assignments of the running virtual CPUs in order to balance the number of virtual CPUs running on each logical CPU. HiperDispatch changed the reshuffle algorithm to make it more aware of partition topology and to make it more aware of the special dispatching needs of virtual MP guests.

HiperDispatch also introduced a second work distribution algorithm, called *rebalance*. This algorithm tracks guest CPU utilization and periodically alters the home assignments of virtual CPUs in order to afford reliable CPU affinity to guests with intensive CPU utilization, to keep virtual CPUs of MP guest close to one another in the topology, and to balance the CPU demands on the logical CPUs. The rebalance algorithm is suitable for use for only those workloads having specific, easily identifiable resource consumption characteristics. You should use the rebalance algorithm only if IBM assesses your system and specifically directs you to use it. You can select the rebalance algorithm by using the DSPWDMethod option on the SET SRM (System Resource Manager) command or the SRM system configuration statement.

For more information on reshuffle and rebalance, see the following z/VM Performance web site at:

IBM: VM Performance Resources (<http://www.ibm.com/vm/perf/>)

## **Are there any other changes to z/VM for HiperDispatch?**

Yes, some commands, directory statements and system configuration statements have changed due to HiperDispatch support.

### **MAXUSERS**

The default is now the system-defined limit of 99,999 logged on users.

### **DEDICATE**

The DEDICATE command is not allowed in vertical polarization mode. Any DEDICATE statements in directory entries result in an error message at logon. If your system is running in horizontal polarization mode and logged-on user(s) have dedicated virtual CPUs, you cannot switch to vertical polarization mode.

### **INDICATE LOAD**

The AVGPROC value now represents the average value of the portion of a real CPU that each logical CPU consumed. Previously, this value was calculated using a measure of how often z/VM loaded a wait state on the processor. This technique did not properly represent partially entitled logical CPUs.

### **INDICATE QUEUES EXPANDED**

You no longer see the App output column, which showed affinity between logical and virtual CPUs. You can see information about where virtual CPUs were dispatched by examining monitor records in the User domain or Performance Toolkit screens.



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## **Part 3. User Planning and Administration**



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## Chapter 16. Redefining Command Privilege Classes

You can extend the privilege class structure of CP commands, DIAGNOSE codes, and certain CP system functions from eight classes to as many as 32 classes. By creating a more elaborate class structure, an installation gains greater control over the functions that each user can perform. The user classes can thus become more focused and specialized, increasing system integrity and security.

---

### IBM-Defined Privilege Classes

z/VM CP commands are divided into eight groups, each represented by a privilege class. The privilege class indicates the type of user from whom the system accepts commands.

In general, the system programmer who creates the user directory assigns each user one or more privilege classes as part of the virtual machine definition in that directory.

Privilege classes are denoted by the letters A through Z, the numbers 1 through 6, or the word “Any”. These classes, and the type of user who uses the commands belonging to each privilege class set, are summarized in Table 17. Classes I through Z and numbers 1 through 6 are reserved so that your installation can define them to suit its needs.

Users whose password is NOLOG have no privilege class and can only receive spooled output as punched cards or printed forms. The NOLOG assignment controlled by directory statements; see “USER Directory Statement” on page 609 or “IDENTITY Directory Statement” on page 502 for more information about NOLOG users.

Table 17. IBM-Defined Privilege Classes

| Class | User and Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A     | <i>System Operator:</i> The class A user controls the z/VM system. The system operator is responsible for the availability of the z/VM system and its resources. In addition, the system operator controls system accounting, broadcast messages, virtual machine performance options, and other options that affect the overall performance of z/VM.<br><b>Note:</b> The class A user who is automatically logged on during CP initialization is designated as the primary system operator. |
| B     | <i>System Resource Operator:</i> The class B user controls all the real resources of the z/VM system, except those controlled by the system operator and the spooling operator.                                                                                                                                                                                                                                                                                                              |
| C     | <i>System Programmer:</i> The class C user updates or changes system-wide parameters of the z/VM system.                                                                                                                                                                                                                                                                                                                                                                                     |
| D     | <i>Spooling Operator:</i> The class D user controls spool files and the system's real reader, printer, and punch equipment allocated to spooling use.                                                                                                                                                                                                                                                                                                                                        |
| E     | <i>System Analyst:</i> The class E user examines and saves system operation data in specified z/VM storage areas.                                                                                                                                                                                                                                                                                                                                                                            |
| F     | <i>Service Representative:</i> The class F user obtains, and examines in detail, data about input and output devices connected to the z/VM system. This privilege class is reserved for IBM use only.                                                                                                                                                                                                                                                                                        |

## Redefining Command Privilege Classes

Table 17. IBM-Defined Privilege Classes (continued)

| Class          | User and Function                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G              | <i>General User:</i> The class G user controls functions associated with a particular virtual machine.                                                                                                        |
| Any            | Commands belonging to class “Any” are available to any user, regardless of the user's privilege class. These commands are primarily those used to gain access to, or relinquish access from, the z/VM system. |
| H              | Reserved for IBM use.                                                                                                                                                                                         |
| I - Z<br>1 - 6 | These classes are reserved for redefinition by each installation for its own use (using MODIFY statements or commands).                                                                                       |

## Planning a New User Class Structure

While planning the new class structure, you should:

- Define each user's needs
- Assign commands to types of users
- Associate privilege classes with users and commands

## Defining Users' Needs

The first step in restructuring command classes is to determine the different types of users and what types of functions each user needs to perform.

Consider a fictional insurance company with a variety of users and job responsibilities. The installation has decided to define a new class structure. The system administrator examines the users' needs and produces the categories as shown in Table 18.

Table 18. A Sample Scenario: Different System Users and Their Responsibilities

| Job Title                 | Abbreviation | Duties                                                                                                                                                                |
|---------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System administrator      | SAD          | General management of the system and determining how the system will be structured and used.                                                                          |
| Senior system programmers | SSP          | Planning, generating, maintaining, extending, and controlling the use of the operating system with the aim of improving the general productivity of the installation. |
| Junior system programmers | JSP          | Similar to senior system programmers, but with less control over the system.                                                                                          |
| System analysts           | SA           | Analyzing the system to determine what new applications, system programs, and devices are needed by the installation.                                                 |
| Primary system operators  | SO           | Ensuring the smooth running of the system and carrying out such duties as changing tapes and disk packs.                                                              |
| Database administrator    | DBA          | Administering resources associated with, and having access to, the main database of the system, and resources associated with spooling, printing, and archiving.      |



Table 18. A Sample Scenario: Different System Users and Their Responsibilities (continued)

| Job Title         | Abbreviation | Duties                                                                                                                                                                                                                      |
|-------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Service engineers | SE           | Obtaining and examining certain data about I/O devices connected to the system. Also, controlling intensive error recording and some machine check error recording.                                                         |
| General users     | U1, U2       | Two different types of general users with different requirements were identified, the first more sophisticated than the second. (All users, even if classified above, will also be classified as one type of general user.) |

## Assigning Commands to Types of Users

After you have produced these categories, you need to list all the commands, DIAGNOSE codes, and system functions that each user group will need to execute.

In our insurance company example, the system administrator produces a list of commands with the user types listed across the top. (For the sake of brevity, the table presented here lists only a few commands. In reality, all CP commands, DIAGNOSE codes, and system functions should be listed, except those with an IBM-defined class of ANY.) After you have produced this list, you need to identify which commands you want each user type to be able to access. For our example, an asterisk (\*) is placed in the column for each user that should have access to the command in the first column. See Table 19.

Table 19. Example of How to Assign Commands, Diagnose Codes, and System Functions to Types of Users

| Command  | IBM-Defined Class | New Class | SAD | SSP | JSP | SA | SO | DBA | SE | U1 | U2 |
|----------|-------------------|-----------|-----|-----|-----|----|----|-----|----|----|----|
| ACNT     | A                 |           |     |     |     |    | *  |     |    |    |    |
| ATTN     | G                 |           |     |     |     |    |    |     |    | *  | *  |
| XAUTOLOG | A                 |           | *   | *   |     |    |    |     |    |    |    |
| XAUTOLOG | B                 |           |     |     | *   | *  | *  | *   |    |    |    |
| XAUTOLOG | G                 |           |     |     |     |    |    |     |    | *  |    |
| CHANGE   | D                 |           |     |     |     |    | *  | *   |    |    |    |
| CHANGE   | G                 |           |     |     |     |    |    |     |    | *  | *  |
| DEDICATE | A                 |           |     | *   |     |    |    |     |    |    |    |
| DEFINE   | A                 |           |     |     |     |    | *  |     |    |    |    |
| DEFINE   | G                 |           |     |     |     |    |    |     |    | *  | *  |
| IPL      | G                 |           |     |     |     |    |    |     |    | *  | *  |
| MESSAGE  | A                 |           |     | *   | *   |    |    |     |    |    |    |
| MESSAGE  | B                 |           |     |     |     |    | *  |     |    |    |    |
| SAVESYS  | E                 |           |     | *   | *   |    |    |     |    |    |    |
| SPOOL    | G                 |           |     |     |     |    |    |     |    | *  | *  |
| DIAG04   | C,E               |           | *   | *   | *   |    | *  |     |    |    |    |
| DIAG3C   | A,B,C             |           | *   | *   | *   | *  |    |     |    |    |    |

## Redefining Command Privilege Classes

### Notes:

1. Do not list commands with an IBM-defined class ANY. You cannot limit access to these commands.
2. Some commands have more than one IBM-defined class. For a list of these commands, see the *z/VM: CP Commands and Utilities Reference* book. You need to list these separately so that you can assign them to different user groups.
3. Restricting the user class on a console command does not restrict the function of the directory statement that does the same function. For example, if there is a LINK directory statement in a user's directory, that statement takes effect at logon time, even though you have restricted the LINK command.

## Associating Privilege Classes with Users and Commands

After you have associated the commands with the types of users, you can assign a different class to each type of user. Then, each command can be assigned a list of classes that correspond to the users who need access. In the example table, each asterisk is replaced by a new user class, and then these classes are collected to the "New Class" column for each command. See Table 20.

Table 20. Example of How to Associate Privilege Classes with Commands and Users

| Command  | IBM-Defined Class | New Class | SAD I | SSP J | JSP K | SA L | SO M | DBA N | SE O | U1 P | U2 Q |
|----------|-------------------|-----------|-------|-------|-------|------|------|-------|------|------|------|
| ACNT     | A                 | L         |       |       |       | L    |      |       |      |      |      |
| ATTN     | G                 | PQ        |       |       |       |      |      |       |      | P    | Q    |
| XAUTOLOG | A                 | IJ        | I     | J     |       |      |      |       |      |      |      |
| XAUTOLOG | B                 | KLMN      |       |       | K     | L    | M    | N     |      |      |      |
| XAUTOLOG | G                 | P         |       |       |       |      |      |       |      | P    |      |
| CHANGE   | D                 | MN        |       |       |       |      | M    | N     |      |      |      |
| CHANGE   | G                 | PQ        |       |       |       |      |      |       |      | P    | Q    |
| DEDICATE | A                 | J         |       | J     |       |      |      |       |      |      |      |
| DEFINE   | A                 | M         |       |       |       |      | M    |       |      |      |      |
| DEFINE   | G                 | PQ        |       |       |       |      |      |       |      | P    | Q    |
| IPL      | G                 | PQ        |       |       |       |      |      |       |      | P    | Q    |
| MESSAGE  | A                 | JK        |       | J     | K     |      |      |       |      |      |      |
| MESSAGE  | B                 | M         |       |       |       |      | M    |       |      |      |      |
| SAVESYS  | E                 | IJ        | I     | J     |       |      |      |       |      |      |      |
| SPOOL    | G                 | PQ        |       |       |       |      |      |       |      | P    | Q    |
| DIAG04   | C,E               | IJKM      | I     | J     | K     |      | M    |       |      |      |      |
| DIAG3C   | A,B,C             | IJKL      | I     | J     | K     | L    |      |       |      |      |      |

An important distinction to make here is that the user classes with access to system functions and resources (classes I through O) do not have access to any commands that are useful for controlling their own virtual machines (for example, SPOOL). Only the two general user classes (P and Q) have access to these commands. Class P users have more access to more powerful commands than do class Q users. With this arrangement, the system administrator can independently control a user's access to system and virtual machine commands. To assign classes to each user, the system administrator defines at least two classes to key

sophisticated users such as system programmers. An unsophisticated general user might be assigned to class Q; a system programmer would be assigned to classes J and P. In this way, the system programmer gains access to both the class J system commands and to the class P virtual machine commands.

Note also that whereas the class A and B MESSAGE commands are listed, the class ANY MESSAGE command is not. User class modification does not affect class ANY commands.

### Further Considerations

While customizing the command privilege class structure of your system, you should keep in mind:

**Help Files:** You may also want to update the HELP files if changes to the command classes affect a class G command. See the *z/VM: CMS User's Guide* for information on tailoring the HELP Facility.

**Documentation Considerations:** If you change the privilege class for commands, DIAGNOSE codes, or system functions, the privilege classes documented in this and other publications may no longer be correct for your installation.

---

### How to Modify a Command or Diagnose Code

You can alter the following attributes of a CP command or a Diagnose code:

- Privilege class, or PRIVCLASSANY
- Name of the routine used to process the command or DIAGNOSE code

To redefine commands and DIAGNOSE codes during system initialization, use the MODIFY COMMAND (or MODIFY CMD) and MODIFY DIAGNOSE statements in the system configuration file. For more information, see “MODIFY COMMAND / CMD Statement” on page 181 and “MODIFY DIAGNOSE Statement” on page 185.

To redefine commands and DIAGNOSE codes after initialization, use the MODIFY COMMAND (or MODIFY CMD) and MODIFY DIAGNOSE commands. For information about these commands, see *z/VM: CP Commands and Utilities Reference*.

### Modifying a Command

This section shows examples of using the MODIFY COMMAND command to change the attributes of a CP command.

If multiple versions of a command or subcommand are defined but only a single version is to be altered, then the IBMCLASS keyword is required to select the appropriate version.

Suppose that you wish to alter the IBM class A version of the MESSAGE command and change it to PRIVCLASS G. Because there are 3 versions of the MESSAGE command (IBM class 0 for the PRIVCLASSANY version, IBM class A, and IBM class B), you must supply the IBMCLASS keyword.

```
CP MODIFY COMMAND MESSAGE IBM A PRIVCLASS G
Ready;
```

MODIFY has the additional property that it will remember (if it is not presently doing so) the attributes of the command that is being altered. If it is remembering

## Redefining Command Privilege Classes

the attributes for a command, it can restore those attributes by using the RESET operand, at which time it stops remembering any prior attributes.

Suppose that MODIFY were performed 3 times for the IBM class A version of the MESSAGE command, and then a MODIFY RESET was performed. After the MODIFY RESET, the command would once again be a PRIVCLASS A command. An immediate MODIFY RESET would make no changes, because the prior MODIFY RESET would have discarded any saved information.

```
* This command changes privilege class to G
CP MODIFY COMMAND MESSAGE IBM A PRIVCLASS G
Ready;

* This command changes privilege class to 123456
CP MODIFY COMMAND MESSAGE IBM A PRIVCLASS 123456
Ready;

* This command changes privilege class to ACDEILNOPY.
* Notice that the classes are allowed to be specified in any order.
CP MODIFY COMMAND MESSAGE IBM A PRIVCLASS ENCYCLOPAEDIA
Ready;

* This command changes privilege class back to A
CP MODIFY COMMAND MESSAGE IBM A RESET
Ready;

* This command makes no change because we just performed a RESET
CP MODIFY COMMAND MESSAGE IBM A RESET
Ready;
```

The name of the routine to process the command may be changed, but all versions of the command must have the same routine name.

```
CP MODIFY COMMAND MESSAGE IBM A EPNAME HCPSRC00
HCPZPM770E MODIFY is not valid for command MESSAGE because different
EPNAMEs would be set
Ready(00770);

CP MODIFY COMMAND MESSAGE EPNAME HCPSRC00
Ready;
```

The subcommands that make up the set of QUERY subcommands are divided into two groups and are controlled by two separate MODIFY commands. For example, QUERY DASD is a subcommand and QUERY VIRTUAL DASD is a separate subcommand. You must specify the "VIRTUAL" operand on the MODIFY command if you wish to change the QUERY VIRTUAL DASD subcommand. Because of the additional granularity that is provided by the MODIFY command, you must issue two MODIFY commands if you wish to change both the virtual and non-virtual subcommands of QUERY. For example, to change all versions of the QUERY DASD and QUERY VIRTUAL DASD subcommands so that only user privilege class 'X' can issue them, enter the following:

```
modify cmd query virtual subcmd DASD ibmclass * privclasses x
modify cmd query subcmd DASD ibmclass * privclasses x
```

The first MODIFY command changes the QUERY VIRTUAL subcommands while the second changes the QUERY subcommands.

You should also note that there are a number of commands in the system which share generic command control blocks. For example, QUERY 000E (class b version) shares the same generic command control block with QUERY L00E (class b version). The determination of the actual command being issued is not made until the command handler gets control. The generic command blocks only exist for

class B and G commands. In addition, they exist on the virtual subcommand chain. To change these commands you must specify "VIRTUAL SUBCMD \*" and the appropriate IBMCLASS. For example, to add a user privilege class x to the class b version, you would enter the following:

```
modify cmd query virtual subcmd * ibmclass b privclasses bx
```

### Modifying a Diagnose Code

This section shows examples of using the MODIFY DIAGNOSE command to change the attributes of a DIAGNOSE code.

Because there are no multiple versions of a Diagnose code, there is no IBMCLASS keyword.

Suppose that you wish to alter the privilege class of Diagnose code X'7C' from PRIVCLASSANY to PRIVCLASS L. Because there is only one version of any Diagnose code, only the Diagnose code is specified.

```
CP MODIFY DIAGNOSE 7C PRIVCLASS L
Ready;
```

The MODIFY DIAGNOSE command has the same RESET capability that was discussed for the MODIFY COMMAND command.

The MODIFY DIAGNOSE command has the same capability to change the name of the processing routine that was discussed for the MODIFY COMMAND command. But, Diagnose code routines have an additional interface to the Diagnose code router that allows register 15 to contain a return code upon return to the Diagnose code router. If the routine that processes the Diagnose code is changed, it may be that the interface selected by the routine (whether to pass a return code or not) will be different. If so, then the CHECKR15 keyword should be used to specify which interface this routine is using.

```
CP MODIFY DIAGNOSE 7C EPNAME HCPSRC00 CHECKR15 YES
Ready;
```

---

### Another Way of Changing the Privilege Class of Certain CP Functions

Privilege classes for the following CP functions can be changed without using the MODIFY statement or command:

- Logging on as the primary system operator
- Intensive error recording
- Using the read function of the CP IOCP utility
- Using the write function of the CP IOCP utility
- Specifying the default user class.

If you want to change some or all the privilege classes assigned to these CP functions, you must specify your changes by using the PRIV\_CLASSES statement in the system configuration file. For more information on the PRIV\_CLASSES statement, see "PRIV\_CLASSES Statement" on page 212.

In our insurance company example, the classes of three system functions were changed:

- Classes for the primary system operator
- Classes authorized to perform intensive error recording

## Redefining Command Privilege Classes

- Default classes for users who do not have a class defined in their virtual machine definitions.

Instead of including them in the MODIFY statement or command, the system administrator could have entered the PRIV\_CLASSES statement as:

```
PRIV_CLASSES OPERATOR IJ HW_SERVICE L USER_DEFAULT P
```

You can also use the CP SET PRIVCLASS command to change the privilege classes for individual users, who are logged on to the system, rather than an entire class of users. This command lets you be more selective in the privileges that you grant users. For a brief description of the SET PRIVCLASS command, see “Changing the Setting for a Logged-On Virtual Machine.” For a detailed description of the SET PRIVCLASS and QUERY PRIVCLASS commands, see the *z/VM: CP Commands and Utilities Reference* book.

---

## Changing the Directory

After changing the user class structure, you must update the directory, as it contains the class or classes of commands that each user can successfully execute. The directory statements in the directory that define the command privilege classes for a virtual machine are the USER and CLASS statements. The IDENTITY statement also defines the command privilege classes for a virtual machine. However, the examples do not include virtual machines defined with IDENTITY statements. (For more information about the directory and how to generate it, see Chapter 17, “Creating and Updating a User Directory,” on page 453.) Use the privilege class operand of the USER statement to define the new privilege classes for the virtual machine.

If you cannot fit all the new privilege classes onto the USER statement, you can add the optional CLASS statement to the directory immediately following the USER statement. You can define up to 32 classes.

**Note:** Make sure you have enough free disk space before editing and making changes to the existing directory so that you can file the updated directory. See “Directory Space” on page 650 for information on how to allocate DASD space for the directory.

## Defining Privilege Classes for a Virtual Machine

The privilege classes for a virtual machine can be changed by changing the definition of a logged on virtual machine or changing the definition in the user directory.

### Changing the Setting for a Logged-On Virtual Machine

Authorized users can change the privilege classes definitions for logged on virtual machines. These users are authorized by the FEATURES ENABLE SET\_PRIVCLASS statement in the system configuration file. To change the privilege classes, the user just issues the CP SET PRIVCLASS command.

For example, if you want the user whose virtual machine user ID is DATABASE to be able to use commands with the privilege classes C, D, H, and I, you would enter:

```
set privclass database =cdhi
```

The FEATURES ENABLE SET\_PRIVCLASS statement is described in “FEATURES Statement” on page 150. For more information on the SET PRIVCLASS command, see the *z/VM: CP Commands and Utilities Reference* book.

## Changing the User Directory

To change the definition of privilege classes for a virtual machine, perform the following steps:

1. Use the XEDIT command to edit the user directory. Unless you have defined a different file name, this file has a file ID of USER DIRECT.
2. Find the USER directory statement for the virtual machine whose privilege classes you wish to change.
3. This next step depends on whether you can fit all the new classes onto the USER directory statement.

If you can fit all the new classes onto the USER directory statement:

- a. Change the privilege class operand to the classes that you want this virtual machine to have. The privilege class operand consists of EBCDIC characters (with no intervening blanks) that can be A through Z and 1 through 6. These characters define privilege classes for the virtual machine. If you do not specify a privilege class, the default is G (or whatever you have specified using the USER\_DEFAULT operand of the PRIV\_CLASSES statement in the system configuration file ).

For example, if you want the user whose virtual machine user ID is DATABASE to be able to use commands with the privilege classes C, D, H, and I, code the USER directory statement as follows:

```
USER DATABASE pass stor mstor CDHI pri le ld cd es
```

If you cannot fit all the new classes onto the USER directory statement:

- a. Change the privilege class operand to an asterisk (\*).
- b. Following the USER directory statement, insert a CLASS directory statement. The format of the CLASS directory statement is described under "CLASS Directory Statement" on page 475.

For example, if you want to assign privilege classes A through Q to a virtual machine that belongs to a user whose user ID is SYSADM, code the USER directory statement and the CLASS directory statement as follows:

```
USER SYSADM pass stor mstor * pri le ld cd es
CLASS ABCDEFGHIJKLMNOPQ
```

4. After you make all the desired changes to the directory, file the directory file.
5. To verify that the CMS file can be used as a directory file, enter the DIRECTXA utility with the EDIT option. (For more on the DIRECTXA utility, see "Running the User Directory Program" on page 463.) If you made a syntax error, you will receive an error message.
6. When you have verified that the directory file is correct, replace the old directory with the updated directory by entering the following:

```
directxa filename
```

**Note:** The virtual machine that enters the DIRECTXA command must have write access to the volume that is to contain the new directory. If you create a directory that is to be written on the active VM/ESA system residence volume, your virtual machine's current virtual machine definition must have write access to the volume that contains the current directory.

7. After the directory is updated, directory changes for a virtual machine currently logged on to the system do not take effect until the user logs off the system and then logs back on.

**Virtual Machine Definition Example:** For our example of the insurance company, the directory might include the USER and CLASS directory statements shown in



## Redefining Command Privilege Classes

Figure 18.

```
DIRECTORY 250 3390 VMSRES
* CP DIRECTORY FOR 'OUR INSURANCE COMPANY'
*
* NOTES:
* (1) KEY TECHNICAL USERS NEED PRIVILEGE CLASS 'P' BESIDES
* THEIR PRIMARY FUNCTIONAL CLASS. THIS ENABLES THEM
* TO FULLY CONTROL A VIRTUAL MACHINE. GENERAL USERS
* WILL NEED ONLY CLASS 'Q'.
*
* (2) USERID ZZZMAINT IS SET ASIDE FOR EMERGENCY USE. THIS
* USER HAS ACCESS TO ANY CP COMMAND REGARDLESS OF THE
* USER CLASS STRUCTURE. THE PASSWORD SHOULD BE
* KNOWN BY ONLY A ***VERY*** FEW KEY PEOPLE.
*
USER ZZZMAINT SECRET 2M 8M *
 CLASS ABCDEFGHIJKLMNOPQRSTUVWXYZ123456
 (other directory statements)
*
USER SAD1 XXXXXXXX 2M 8M IP
 (other directory statements)
*
USER SSP1 XXXXXXXX 1M 2M JP
 (other directory statements)
*
USER JSP1 XXXXXXXX 1M 2M KP
 (other directory statements)
*
USER JSP2 XXXXXXXX 1M 2M KP
 (other directory statements)
*
USER SA1 XXXXXXXX 1M 2M LP
 (other directory statements)
*
USER OPERATOR XXXXXXXX 1M 2M MP
 (other directory statements)
*
.
.
.
(and so on)
```

Figure 18. Virtual Machine Definition Example Using USER and CLASS Statements

### How Users Can Find Which Commands They Can Enter

To find out which commands are available, the user can enter the QUERY COMMANDS command. For example, if the IBM-defined classes are in effect for all commands, a user whose virtual machine is assigned privilege class B would receive a list of all class B commands, DIAGNOSE codes, and system functions, as well as all class ANY commands.

To find out what operands of the QUERY and SET commands are available, the user can enter QUERY COMMANDS QUERY or QUERY COMMANDS SET.



---

## Chapter 17. Creating and Updating a User Directory

This section tells you how to:

- Create the z/VM user directory
- Run the user directory program
- Change the directory
- Check the directory for errors
- Specify a directory that contains VM/SP directory statements
- Use directory profiles
- Use each of the directory statements summarized in Table 23 on page 459.

---

### Overview of the User Directory

The z/VM user directory specifies the configuration and operating characteristics of virtual machines. A z/VM user directory exists in two forms: a source form that consists of one or more CMS files, and an object form, created from the source, on a CP-formatted disk. Multiple object directories can be accessed by the z/VM system, but only one object directory can be active (online) for a system at any given instant.

**Important:** When operating in an SSI cluster environment, you should use a single source directory to create the object directory for each member in the SSI cluster. Using a single source directory results in consistent set of virtual machine configurations on each system in the SSI cluster.

The source form of the user directory consists of directory statements that define the CP-formatted volume on which the object directory is created and the configuration and operating characteristics of the virtual machines that are known to the z/VM operating system. The directory statements are divided into blocks called *entries*. An entry begins with one of the following statements: GLOBALDEFS (global definitions entry), PROFILE (profile entry), USER (user entry), IDENTITY (identity entry), or SUBCONFIG (subconfiguration entry).

A *virtual machine definition* is the group of entries that define a virtual machine. A virtual machine definition can define one of two virtual machine definition types:

#### Single-configuration virtual machine definition

A virtual machine definition that consists of a user entry and any included profile entry. Only one virtual machine instance can be created from a single-configuration virtual machine definition. For example, you can specify a USER1 single-configuration virtual machine and log on to a z/VM system as USER1.

In an SSI cluster, the virtual machine can be logged on to only one SSI member at a time.

#### Multiconfiguration virtual machine definition

A virtual machine definition that consists of an identity entry, any included profile entry, and all associated subconfiguration entries. In an SSI-enabled source directory, this virtual machine definition allows multiple virtual machine instances to be defined, which enables the user ID to be logged on concurrently to multiple members of the SSI cluster. Each of these virtual

## Creating and Updating a User Directory

machine instances can have a different configuration from the others. For example, you can define a MAINT multiconfiguration virtual machine and concurrently log on to all the members of an SSI cluster as MAINT.

Figure 19 is an abbreviated view of two virtual machine definitions, one a single-configuration virtual machine and the other a multiconfiguration virtual machine. The sample source directory defines USER1 as a single-configuration virtual machine through the USER and associated directory statements, allowing USER1 to log onto one member of the SSI cluster at a time. In this case, USER1 has logged onto SYS4. The sample source directory defines MAINT as a multiconfiguration virtual machine through the IDENTITY, BUILD, SUBCONFIG, and associated directory statements, allowing MAINT to log onto all members of the SSI cluster concurrently, using common settings from the identity entry and system-unique settings from the subconfiguration entry.

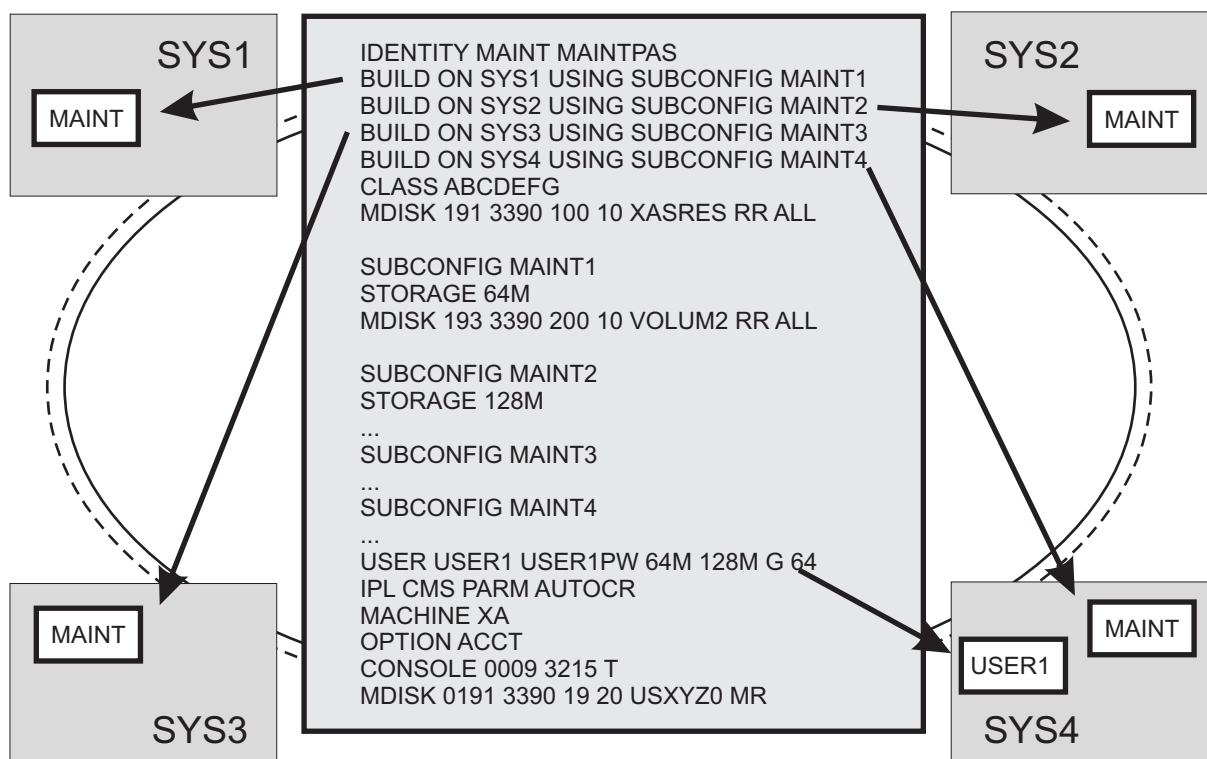


Figure 19. Example single-configuration and multiconfiguration virtual machines

## Source Directory Types

The source directory can be one of the following types:

### Non-SSI

A source directory that does not contain the SSI option on the DIRECTORY statement or any IDENTITY, BUILD, or SUBCONFIG statements.

### SSI-ready

A source directory that can contain single-configuration virtual machine definitions and multiconfiguration virtual machine definitions, but does not have the SSI option on the DIRECTORY statement. In each multiconfiguration virtual machine definition, the identity entry can contain at most one BUILD statement, on which the name of the member of the SSI cluster must be an asterisk (\*). Only one virtual machine instance

can be created from a multiconfiguration virtual machine definition when the object directory is created from this type of source directory.

### SSI-enabled

A source directory that can contain single-configuration virtual machine definitions and multiconfiguration virtual machine definitions and that has the SSI option specified on the DIRECTORY statement. In each multiconfiguration virtual machine definition, the identity entry can have multiple BUILD statements, each of which must specify the name of a member of the SSI cluster. Virtual machine instances can be created on multiple members from a multiconfiguration virtual machine definition when the object directory is created from this type of source directory.

Table 21 shows which directory types are compatible with specific system environments.

*Table 21. Directory Types and System Environments*

| z/VM Release and Environment                                                                                                                                                                                                                                                                                                                                                                 | Object Directory derived from this Source Directory Type |           |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                                              | Non-SSI                                                  | SSI-ready | SSI-enabled   |
| Prior to V6R2                                                                                                                                                                                                                                                                                                                                                                                | Y                                                        | Y         | Not supported |
| V6R2 (or later), no SSI cluster defined                                                                                                                                                                                                                                                                                                                                                      | Y                                                        | Y         | Error         |
| V6R2 (or later) in a single-member SSI cluster                                                                                                                                                                                                                                                                                                                                               | Y                                                        | Y         | Y             |
| V6R2 (or later) in a multiple-member SSI cluster                                                                                                                                                                                                                                                                                                                                             | Error                                                    | Error     | Y             |
| <b>Note:</b><br>1. "Not supported" means this environment is not supported because in older z/VM releases, CP does not know how to use this directory format. In older z/VM releases, CP can bring the directory online but cannot support multiconfiguration virtual machines.<br>2. "Error:" means CP will not bring online object directories derived from this type of source directory. |                                                          |           |               |

## Source Directory File Formats

The source directory can exist in two file formats: monolithic and cluster (not to be confused with an SSI cluster). The monolithic format consists of a single CMS sequential file that contains all of the directory statements. The cluster format consists of an index file that points to one or more definition files that contain all of the directory statements. The index file consists only of LOAD statements that point to the definition file(s). A definition file can be a separate part file that contains one of the following:

- DIRECTORY statement(s)
- A global definitions entry
- A profile entry
- A user entry
- An identity entry
- A subconfiguration entry

## Creating and Updating a User Directory

A definition file could also be a cluster file that contains multiple items from the above list. For details on how to create separate part files or cluster files, see “LOAD Directory Statement” on page 529.

A single cluster format source directory can be made up of an index file and a mixture of separate part definition files and cluster definition files.

Regardless of the file form used for the source directory, the user directory must be processed in the following order:

### **DIRECTORY statement(s)**

Which consists of one or more DIRECTORY statements that define the output object directories.

### **Global definition entry**

Which must begin with the GLOBALDEFS directory statement. The entry also includes directory statements that define global settings to be used by all virtual machine definitions.

### **Profile entries**

Each of which begins with a PROFILE directory statement and consolidates other directory statements that are used in common by many virtual machine definitions.

### **User, identity, and subconfiguration entries**

Each of which begins with a USER, IDENTITY, or SUBCONFIG directory statement. USER begins the entry for an single-configuration virtual machine definition. IDENTITY begins the entry for a multiconfiguration virtual machine definition and includes statements common to virtual machine configurations in that definition. SUBCONFIG begins the entry for a set of directory statements in a multiconfiguration virtual machine definition that is specific for a member of an SSI cluster.

There are rules about the placement of directory statements within an entry. For details on these rules, refer to the individual statement descriptions in this section and to Table 22 on page 457.

## How CP Brings the User Directory Online

During initialization, CP checks for a valid object directory on the system residence volume. If CP finds a valid object directory, it makes that directory the active directory. Otherwise, CP looks for the first valid object directory on the CP-owned volumes brought online during initialization. CP checks the volumes in the order of their appearance in the CP-owned list. If you defined the CP-owned list using CP\_OWNED statements (see “CP\_OWNED Statement” on page 74) in your system configuration file, CP checks the volumes based on the slot number, in increasing order.

If CP does not find a valid object directory, the system comes up with a default user ID of OPERATOR. You can use this virtual machine to create a valid object directory. In this case, you can bring an object directory online by:

- Entering the DIRECTXA utility to install an object directory on an appropriately formatted CP-owned volume
- Attaching a valid object directory volume whose volume ID appears in the CP-owned volume list but which was not brought online during initialization.

After CP has brought an object directory online, the volume on which it resides remains the directory volume for the duration of the IPL. Rewriting an object

directory on a different volume, even one higher in the search order, has no effect. (However, an object directory written higher in the CP-owned volume search order becomes effective when the next hardware or software IPL occurs.)

When DIRECTXA is used to write an object directory on DASD, a pointer to the object directory is written in the volume label for that device. Performing any operation that modifies the volume label, allocation map, or DRCT space on DASD (e.g., CPFMTXA) might result in the object directory not being found when CP tries to bring the directory online.

## Directory Statement Categories

Table 22. Directory Statement Categories

| Category    | Statements                                                                                                                                                                                                                                                                                                                                                                                   | Placement Requirements                                                                                                                                                                                                                                                                                                   |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control     | <ul style="list-style-type: none"> <li>• DIRECTORY</li> <li>• GLOBALDEFS</li> <li>• PROFILE</li> <li>• USER</li> <li>• IDENTITY</li> <li>• SUBCONFIG</li> <li>• SYSAFFIN</li> <li>• LOAD</li> <li>• INCLUDE</li> <li>• BUILD</li> <li>• POOL</li> </ul>                                                                                                                                      | These statements control the structure of the source directory. Refer to each statement description for details on placement of these statements.                                                                                                                                                                        |
| Global      | <ul style="list-style-type: none"> <li>• GLOBALOPTS</li> <li>• POSIXGROUP</li> </ul>                                                                                                                                                                                                                                                                                                         | These statements can appear only in the global definitions entry.                                                                                                                                                                                                                                                        |
| General (1) | <ul style="list-style-type: none"> <li>• COMMAND</li> <li>• CRYPTO*</li> <li>• DATEFORMAT</li> <li>• IPL</li> <li>• LOADDEV</li> <li>• MAXSTORAGE</li> <li>• OPTION CONCEAL, CPUID, LANG, MAXCON, MAXVMCFI, MIH, NOMEASSIST, NOMDCFS, QUICKDSP, SVC76VM, TODENABLE</li> <li>• SCREEN</li> <li>• SHARE</li> <li>• SPOOLFILE</li> <li>• STORAGE</li> <li>• XCONFIG</li> <li>• XSTOR</li> </ul> | <p>These statements are non-authorization statements and are allowed in profile, user, identity, and subconfiguration entries (unless an exception is noted). These statements must appear before any device statements in the entry.</p> <p>* CRYPTO operands other than APVIRT are not allowed in profile entries.</p> |

## Creating and Updating a User Directory

Table 22. Directory Statement Categories (continued)

| Category    | Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Placement Requirements                                                                                                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General (2) | <ul style="list-style-type: none"><li>• ACCOUNT</li><li>• ACIGROUP</li><li>• APPCPASS</li><li>• AUTOLOG</li><li>• CLASS</li><li>• CPU</li><li>• D80NECMD</li><li>• IOPRIORITY</li><li>• IUCV</li><li>• LOGONBY</li><li>• MACHINE</li><li>• NAMESAVE</li><li>• NOPDATA</li><li>• OPTION ACCOUNT, APPLMON, CFVM, CFUSER, CHPID, COMSRV, CRYMEASURE, DEVINFO, DEVMAINT, DIAG88, DIAG98, D84NOPAS, IGNMAXU, LKFAC, LNKEXCL, LNKNOPAS, LNKSTBL, MAINTCCW, NETACCOUNTING, NETROUTER, RMCHINFO, SETORIG, STGEXEMPT, SVMSTAT</li><li>• POSIXGLIST</li><li>• POSIXINFO</li><li>• POSIXOPT</li><li>• STDEVOPT</li><li>• XAUTOLOG</li></ul> | These statements are mainly authorization statements. They are allowed in profile, user, and identity entries, but not in subconfiguration entries. These statements must appear before any device statements in the entry. |
| Device (1)  | <ul style="list-style-type: none"><li>• CONSOLE</li><li>• DASDOPT</li><li>• DEDICATE</li><li>• LINK</li><li>• NICDEF</li><li>• SPECIAL</li><li>• SPOOL</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | These statements are allowed in profile, user, identity, and subconfiguration entries. These statements must appear after all general statements in the entry.                                                              |
| Device (2)  | <ul style="list-style-type: none"><li>• MDISK</li><li>• MINIOPT</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | These statements are allowed in user, identity, and subconfiguration entries. These statements must appear after all general statements in the entry.                                                                       |

Blank lines and lines beginning with an asterisk (\*) can appear. The information on each directory statement must appear in columns 1 through 71.

Some directory statements support mixed-case operands, so care must be taken when editing the directory source file to avoid accidentally altering the case of these operands. Although the example statements in this section are in mixed case, the case is not significant for most of them. They are shown in mixed case only to improve their readability.

## Summary of Directory Statements

Table 23 describes the directory statements. It shows where the statement is described, the statement category, and a brief summary of the statement's function. Although the directory statements are listed in alphabetic order, this is not the order in which they can be coded in the directory.

*Table 23. Summary of User Directory Statements*

| Statement  | Category    | Function                                                                                                                                                                                                                                                                                                                                                               | Location                                     |
|------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| ACCOUNT    | General (2) | Defines the account numbers to which a virtual machine charges its costs. It also defines a distribution code.                                                                                                                                                                                                                                                         | "ACCOUNT Directory Statement" on page 467    |
| ACIGROUP   | General (2) | Specifies the name of a group to which an individual user ID is assigned.                                                                                                                                                                                                                                                                                              | "ACIGROUP Directory Statement" on page 469   |
| APPCPASS   | General (2) | Allows a virtual machine to request an APPC/VM path without supplying security parameters, even when the equivalent of SECURITY (PGM) is indicated on the APPCVM CONNECT request.                                                                                                                                                                                      | "APPCPASS Directory Statement" on page 470   |
| AUTOLOG    | General (2) | A synonym for XAUTOLOG. See XAUTOLOG "XAUTOLOG Directory Statement" on page 617.                                                                                                                                                                                                                                                                                       | "AUTOLOG Directory Statement" on page 472    |
| BUILD      | Control     | Used for the SSI environment; specifies a system name and subconfiguration entry, which in turn specifies the SSI member-specific configuration for a multiconfiguration virtual machine instance.                                                                                                                                                                     | "BUILD Directory Statement" on page 473      |
| CLASS      | General (2) | Specifies the privilege class (or classes) assigned to an individual user.                                                                                                                                                                                                                                                                                             | "CLASS Directory Statement" on page 475      |
| CONSOLE    | Device (1)  | Defines a virtual machine operator's console.                                                                                                                                                                                                                                                                                                                          | "CONSOLE Directory Statement" on page 478    |
| CPU        | General (2) | Specifies a virtual processor that is to be defined automatically when the user logs on to the system.                                                                                                                                                                                                                                                                 | "CPU Directory Statement" on page 481        |
| CRYPTO     | General (1) | Authorizes the user to define virtual cryptographic facilities and provides the guest access to the crypto domains on the cryptographic cards.                                                                                                                                                                                                                         | "CRYPTO Directory Statement" on page 483     |
| DASDOPT    | Device (1)  | An extension to the DEDICATE, LINK, and MDISK statements.                                                                                                                                                                                                                                                                                                              | "DASDOPT Directory Statement" on page 486    |
| DATEFORMAT | General (1) | Specifies a user's default date format for commands that provide multiple date formats.                                                                                                                                                                                                                                                                                | "DATEFORMAT Directory Statement" on page 489 |
| DEDICATE   | Device (1)  | Specifies that a real device is to be used solely by the virtual machine, or that a real tape device is to be shared with other users.                                                                                                                                                                                                                                 | "DEDICATE Directory Statement" on page 491   |
| DIRECTORY  | Control     | Defines the device on which the directory resides and must be the first statement in the directory.                                                                                                                                                                                                                                                                    | "DIRECTORY Directory Statement" on page 494  |
| D8ONECMD   | General (2) | Defines whether a virtual machine can issue multiple CP commands with DIAGNOSE code X'08'.                                                                                                                                                                                                                                                                             | "D8ONECMD Directory Statement" on page 498   |
| GLOBALDEFS | Control     | Signifies the beginning of the global entry.                                                                                                                                                                                                                                                                                                                           | "GLOBALDEFS Directory Statement" on page 500 |
| GLOBALOPTS | Global      | Used to define global settings to be used while processing virtual machine definitions.                                                                                                                                                                                                                                                                                | "GLOBALOPTS Directory Statement" on page 501 |
| IDENTITY   | Control     | Used for the single system image environment:<br>1. Starts a multiconfiguration virtual machine definition<br>2. Defines the multiconfiguration virtual machine's logon identification (user ID) and password<br>3. Defines the multiconfiguration virtual machine's storage size<br>4. Defines the multiconfiguration virtual machine's CP command privilege classes. | "IDENTITY Directory Statement" on page 502   |
| INCLUDE    | Control     | Specifies the name of a profile entry to be invoked as part of the user entry.                                                                                                                                                                                                                                                                                         | "INCLUDE Directory Statement" on page 508    |



## Creating and Updating a User Directory

*Table 23. Summary of User Directory Statements (continued)*

| Statement  | Category       | Function                                                                                                                                                                             | Location                                     |
|------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| IOPRIORITY | General (2)    | Defines a virtual machine's I/O priority queueing range.                                                                                                                             | "IOPRIORITY Directory Statement" on page 510 |
| IPL        | General (1)    | Designates a device number or named saved system that CP automatically loads (IPLs) when the user logs on to the system.                                                             | "IPL Directory Statement" on page 512        |
| IUCV       | General (2)    | Authorizes a virtual machine to create an IUCV communication path with another virtual machine.                                                                                      | "IUCV Directory Statement" on page 515       |
| LINK       | Device (1)     | Accesses another virtual machine's minidisk.                                                                                                                                         | "LINK Directory Statement" on page 524       |
| LOAD       | Control        | Specifies where the directory entry is to be found. The LOAD statement is valid only in a cluster file format directory.                                                             | "LOAD Directory Statement" on page 529       |
| LOADDEV    | General (1)    | Identifies the location of a program to be loaded as a result of an FCP List-Directed IPL. Parameters to be passed to the program can also be defined.                               | "LOADDEV Directory Statement" on page 532    |
| LOGONBY    | General (2)    | Designates up to eight user IDs that can use their own passwords to logon to and use a virtual machine.                                                                              | "LOGONBY Directory Statement" on page 534    |
| MACHINE    | General (2)    | Defines the virtual machine mode (ESA, XA, or XC) and the number of virtual processors a virtual machine can define.                                                                 | "MACHINE Directory Statement" on page 535    |
| MAXSTORAGE | General (1)    | Specifies the virtual storage size for a user.                                                                                                                                       | "MAXSTORAGE Directory Statement" on page 537 |
| MDISK      | Device (2)     | Defines virtual disks (minidisks): permanent minidisks, temporary minidisks, and virtual disks in storage.                                                                           | "MDISK Directory Statement" on page 539      |
| MINIOPT    | Device (2)     | An extension to MDISK used when defining non-full-pack minidisks.                                                                                                                    | "MINIOPT Directory Statement" on page 550    |
| NAMESAVE   | General (2)    | Authorizes a virtual machine to access a restricted named saved system or saved segment and authorizes the virtual machine to obtain an exclusive writeable copy of a saved segment. | "NAMESAVE Directory Statement" on page 554   |
| NICDEF     | Device (1)     | Defines virtual network adapters that are fully simulated by CP.                                                                                                                     | "NICDEF Directory Statement" on page 556     |
| NOPDATA    | General (2)    | Authorizes a virtual machine to use NOP CCWs to transfer data to CP spool files.                                                                                                     | "NOPDATA Directory Statement" on page 560    |
| OPTION     | General (1, 2) | Defines certain options available to the virtual machine.                                                                                                                            | "OPTION Directory Statement" on page 561     |
| POOL       | Control        | Allows a set of virtual machines to be defined with the same configuration or characteristics.                                                                                       | "POOL Directory Statement" on page 570       |
| POSIXGLIST | General (2)    | Specifies all POSIX groups of which the user is a member.                                                                                                                            | "POSIXGLIST Directory Statement" on page 571 |
| POSIXGROUP | Global         | Defines a POSIX group.                                                                                                                                                               | "POSIXGROUP Directory Statement" on page 573 |
| POSIXINFO  | General (2)    | Specifies a user's POSIX information.                                                                                                                                                | "POSIXINFO Directory Statement" on page 575  |
| POSIXOPT   | General (2)    | Specifies option settings related to a user's POSIX capabilities.                                                                                                                    | "POSIXOPT Directory Statement" on page 578   |
| PROFILE    | Control        | Defines the start of a profile entry.                                                                                                                                                | "PROFILE Directory Statement" on page 581    |
| SCREEN     | General (1)    | Defines the extended color and extended highlighting options for the virtual machine console.                                                                                        | "SCREEN Directory Statement" on page 584     |
| SHARE      | General (1)    | Specifies a virtual machine's scheduler share.                                                                                                                                       | "SHARE Directory Statement" on page 587      |
| SPECIAL    | Device (1)     | Defines virtual displays, communication lines, and channel-to-channel adapters that can or cannot be connected to real devices when the user logs on.                                | "SPECIAL Directory Statement" on page 589    |



*Table 23. Summary of User Directory Statements (continued)*

| Statement    | Category    | Function                                                                                                                                                                                                                                                                                                                                         | Location                                     |
|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| SPOOL        | Device (1)  | Defines virtual unit record devices (spooling devices).                                                                                                                                                                                                                                                                                          | "SPOOL Directory Statement" on page 594      |
| SPOOLFILE    | General (1) | Describes virtual machine spool file characteristics.                                                                                                                                                                                                                                                                                            | "SPOOLFILE Directory Statement" on page 597  |
| STDEVOPT     | General (2) | Specifies the optional storage device management functions available to the virtual machine.                                                                                                                                                                                                                                                     | "STDEVOPT Directory Statement" on page 599   |
| STORAGE      | General (1) | Specifies the virtual storage size for a user.                                                                                                                                                                                                                                                                                                   | "STORAGE Directory Statement" on page 601    |
| SUBCONFIG    | Control     | Used in the single system image environment; begins the entry for an SSI member-specific configuration for a multiconfiguration virtual machine instance.                                                                                                                                                                                        | "SUBCONFIG Directory Statement" on page 603  |
| SYSAFFIN     | Control     | Defines how, and to which systems of a multiple-system complex, the subsequent statements apply.                                                                                                                                                                                                                                                 | "SYSAFFIN Directory Statement" on page 606   |
| USER         | Control     | <ol style="list-style-type: none"> <li>1. Starts the entry for a single-configuration virtual machine definition</li> <li>2. Defines the virtual machine's logon identification (user ID) and password</li> <li>3. Defines the virtual machine's storage size</li> <li>4. Defines the virtual machine's CP command privilege classes.</li> </ol> | "USER Directory Statement" on page 609       |
| VMRELOCATE   | General (2) | Controls relocation capability of specified user.                                                                                                                                                                                                                                                                                                | "VMRELOCATE Directory Statement" on page 615 |
| XAUTOLOG     | General (2) | Designates user IDs that can enter an XAUTOLOG command for the virtual machine.                                                                                                                                                                                                                                                                  | "XAUTOLOG Directory Statement" on page 617   |
| XCONFIG      | General (1) | Specifies control parameters for the extended-configuration facilities provided in the ESA/XC virtual machine architecture: access lists and data spaces.                                                                                                                                                                                        | "XCONFIG Directory Statement" on page 619    |
| XSTORE       | General (1) | Authorizes a virtual machine for sole use of the Expanded Storage facility.                                                                                                                                                                                                                                                                      | "XSTORE Directory Statement" on page 624     |
| Blank Line   |             | Can appear anywhere in the directory control file. When the DIRECTXA utility processes the directory control file, it ignores blank lines.                                                                                                                                                                                                       |                                              |
| Asterisk (*) |             | Any line in the source directory file that begins with an asterisk (*) is a comment. When the DIRECTXA utility processes the directory control file, it ignores comment statements.                                                                                                                                                              |                                              |

## Continued Directory Statements

Certain directory statements are permitted to continue across multiple records in the directory file. These statements continue from one record to the next when the record's last nonblank character in columns 1-71 is a comma (,). The statement is continued beginning in column 1 of the next noncomment, nonblank record. That is, since comment records and blank records are ignored by DIRECTXA, they do not terminate a continued statement.

When DIRECTXA is processing a record that ends in a continuation comma, it effectively deletes the continuation comma and concatenates the prior portion of this record with the next noncomment, nonblank record, with one intervening blank (see "Quoted String Operands" on page 462 for the syntax rules for very long strings). This process is repeated until a noncontinued, noncomment, nonblank record is encountered. The statement is then parsed according to its normal rules. Statement names and keywords cannot be split across multiple records.

## Creating and Updating a User Directory

Some statements that support continuation can have additional rules for continuing certain operands, such as quoted string operands, across multiple records. These rules are described in the documentation for these operands.

A continued statement can be no longer than 6144 characters. All characters, including blanks and the continuation comma count towards this limit. On the final record of a continued statement, all characters, including blanks, from column 1 up to and including the last nonblank character count towards the limit.

The following are some examples of directory statements continued across multiple records.

```
POSIXINFO IWDIR /home,
 IUPGM /myself ,
* This is a comment among records of a continued statement.
* The POSIXINFO statement above continues on the next record
FSROOT VMBFS:FPOOL1:FSPACE1

* The following statement has 63 characters that count towards the
* 6144-character limit: 26 on the first record and 37 on the
* next.
POSIXGLIST GIDS 5402 450 ,
 GNAMEs all DeptG63 DeptG30
```

---

## Quoted String Operands

Certain operands on certain directory statements are permitted to be specified as *quoted string operands*, which consist of one or more *quoted strings*. Quoted strings are useful if an operand must be permitted to contain imbedded blanks, single quotation marks, or double quotation marks. If the statement is permitted to be continued through multiple records of the directory file, a quoted string operand, with or without imbedded blanks, can continue through multiple records.

Quoted strings and quoted string operands must obey the following rules:

1. A *quoted string operand* consists of one or more quoted strings.
2. A character string can be surrounded by single or double quotation marks. This string, along with its surrounding quotation marks, is referred to as a *quoted string*. A string which is to contain blanks, single or double quotation marks must be surrounded by quotation marks (single or double). It is permissible to include other characters inside the quotation marks.
3. To include a single quotation mark inside a quoted string surrounded by single quotation marks, two consecutive single quotation marks are required inside the string. Likewise, to include a double quotation mark inside a quoted string surrounded by double quotation marks, two consecutive double quotation marks are required inside the string.
4. To include a single quotation mark inside a quoted string surrounded by double quotation marks, the single quotation mark need not be duplicated. To include a double quotation mark inside a quoted string surrounded by single quotation marks, the double quotation mark need not be duplicated.
5. The final result string of a quoted string is formed as follows: any duplicated single or double quotation marks are reduced to one single or double quotation mark, respectively, then the surrounding quotation marks are removed.
6. The final result string of a quoted string operand is formed as follows: the result string from adjacent quoted strings are concatenated with *no intervening blank*. Note that this concatenation happens even if a continued record ends with a quoted string and the next record begins with a quoted string.

7. A quoted string cannot continue to the next record. It must begin and end on the same record, just as statement names and keywords. A quoted string operand, however, can continue through multiple records by splitting it into quoted strings and splitting the statement between quoted strings.
8. A quoted string cannot be imbedded in or concatenated with another quoted string or a nonquoted string. For example, 'AB'"C" and ABC'DEF' are not valid quoted strings.

The following are some examples of directory statements with valid quoted string operands.

```
POSIXINFO IWDIR '/home'
POSIXINFO IWDIR 'This is Larry's',
 '"Initial Work' ,
 'ing Directory"' ,
IUPGM 'The latest "Init' ,
 "ial User Program"""
```

---

## Creating the User Directory

To create a user directory, you must:

1. Create a CMS file (or edit an existing CMS file) that contains a virtual machine definition for each virtual machine that will run on z/VM.
2. Use the DIRECTXA utility to run the user directory creation program.

IBM provides a sample directory in a CMS file named USER DIRECT. You can edit the USER DIRECT file to tailor your system's user directory.

If you choose not to use the USER DIRECT file, you can create your own CMS file and code directory statements in it.

Finally, to update the directory, your virtual machine must have write access to the volume that contains the directory (by convention, the virtual machine with user ID MAINT or your chosen installation user ID usually has write access to the proper minidisk).

---

## Running the User Directory Program

As previously mentioned, you must use the DIRECTXA utility to run the user directory creation program. The general format of the command to execute the DIRECTXA utility is:

```
directxa
```

*fn ft*

*fn* is the file name of your directory. The default is USER.

*ft* is the file type of your directory. The default is DIRECT.

For example, to bring online the new version of a directory named USER DIRECT, enter:

```
directxa
```

To bring online the new version of a directory named SPECIAL DIRECT, enter:

```
directxa special
```

To bring online the new version of a directory named SECRET DRCT, enter:

## Creating and Updating a User Directory

```
directxa secret drct
```

### Notes:

1. By default, the DIRECTXA utility is located on the cross release utilities disk (PMAINT 551). This disk must be accessed to run the DIRECTXA utility.
2. To update the directory your installation is currently using, you must have privilege class A, B, or C (by convention, MAINT or your chosen installation user ID usually has the appropriate class).
3. The system does not check for overlapping extents in the directory. Therefore, while changing the directory source file, you should check your new virtual machine definitions to ensure that the new MDISK allocations you are defining do not overlap existing MDISK allocations. If an overlap occurs, one virtual machine user could unknowingly destroy data belonging to another.

For more information on the DIRECTXA command, see *z/VM: CP Commands and Utilities Reference*.

---

## Changing the Directory

To change your directory, you must:

1. Edit the file that contains the source directory
2. Add, delete, or change virtual machine definitions as required
3. Bring your modified directory online by entering the command to start the DIRECTXA utility.

As an alternative method of modifying specific pieces of information in the online directory, you can run an application program that uses DIAGNOSE code X'84' on a class B virtual machine. (DirMaint, the Directory Maintenance licensed program, is one such application. Use of DIAGNOSE code X'84' allows DirMaint to make certain changes in the online directory without reprocessing the source directory.)

When used by an application such as DirMaint, DIAGNOSE X'84' improves the turnaround time needed to make the changes active and minimizes the need to totally reprocess the source directory. The DIAGNOSE code cannot, however, delete existing entries nor alter directory entries in the source directory, but can only replace existing online directory data.

For more information on this DIAGNOSE code, refer to *z/VM: CP Programming Services*.

---

## Checking a Directory for Errors

Before you bring a directory online, if you want to check the directory for errors, use the EDIT option of the DIRECTXA utility. For example, to check a directory named MYDIRECT DIRECT for errors, enter:

```
directxa mydirect (edit
```

In response, DIRECTXA checks MYDIRECT DIRECT for errors but does not bring it online (even if there are no errors).

To check USER DIRECT for errors, enter:

```
directxa (edit
```

---

## Creating Directory Profiles

If certain directory statements are repeated for several users, you can make use of directory profiles (*profile entries*) to save space in the directory. Using profile entries is similar to creating a user or identity entry. To create profile entries:

1. Determine which directory statements are commonly repeated for a designated set of user entries.
2. Create a profile entry that contains those directory statements on the source directory using the PROFILE statement (see “PROFILE Directory Statement” on page 581).
3. Insert an INCLUDE statement (see “INCLUDE Directory Statement” on page 508) immediately after the USER statement for those entries that will reference the profile.
4. Remove the existing directory statements in the user or identity entries that reference a profile except for those directory statements that are unique to those entries.
5. Run DIRECTXA in EDIT mode to ensure that there are no errors. Any error conditions result in appropriate messages to your console.
6. Correct any errors and run DIRECTXA again to install the newly created directory.

---

## Creating Multiconfiguration Virtual Machine Definitions

A multiconfiguration virtual machine definition allows the virtual machine being defined to logon to multiple members of an SSI cluster concurrently. To create a multiconfiguration virtual machine definition, do the following steps:

1. Add an IDENTITY statement to the source directory file to identify the user ID of the virtual machine.
2. Add directory statements that are common to all members in the SSI cluster to the identity entry.
3. If there are directory statements that are unique to individual members in the SSI cluster, then add a BUILD statement to the identity entry for each system in the SSI cluster.
4. For each BUILD statement in the identity entry, add a corresponding SUBCONFIG statement.
5. Add directory statements that are unique to each system in the subconfiguration entry.
6. Run DIRECTXA in EDIT mode to ensure that there are no errors. Any error conditions result in appropriate messages to your console.
7. Correct any errors and run DIRECTXA again to install the newly created directory.

### Notes:

1. If you have an identity entry with no BUILD statements, then the user ID specified on the IDENTITY statement is allowed to log on to all members in the SSI cluster concurrently. The configuration of each virtual machine instance as defined by the user directory is identical on all members in SSI cluster.
2. If you have an identity entry with at least one BUILD statement, there should be a BUILD statement for each member in the SSI cluster. Otherwise, the user ID specified on the IDENTITY statement is allowed to log on only to members that are identified on one of the BUILD statements. The user ID is treated as NOLOG on members that are not specified on any of its BUILD statements.

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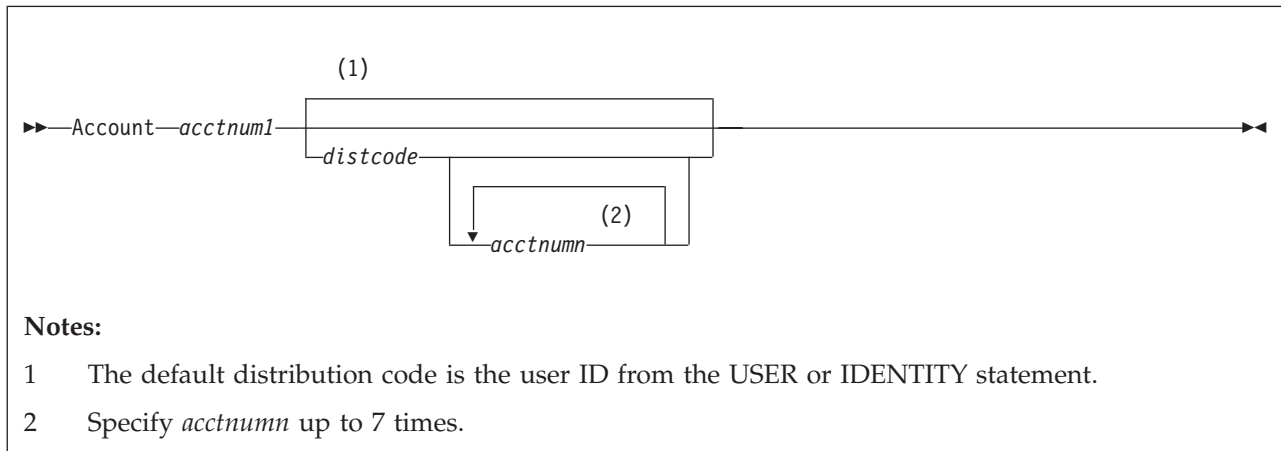
The configuration of the virtual machine at logon time is defined by the directory statements in the identity entry, any included profile entry, and the associated subconfiguration entry. The directory statements in the subconfiguration entry allow for the virtual machine configuration to be different on each system of the SSI cluster.

---

## Determining How Much Space the Directory Needs

The directory requires a minimum of four cylinders of CKD/ECKD space or 600 pages of FBA DASD space. (If you do not allocate enough space for your directory, the DIRECTXA program sends you a message to this effect.) For additional information on determining the space required for the directory, refer to “Directory Space” on page 650.

## ACCOUNT Directory Statement



### Purpose

The ACCOUNT statement specifies an account number to which a virtual machine may charge its costs. It also includes the distribution code, a code that has no meaning to CP but may be used by your installation as it needs it (for example, to designate where printed output is to go).

### How to Specify

The ACCOUNT statement is allowed in profile, user, and identity entries. If specified, the ACCOUNT statement must go before any device statements in an entry. (For a list of device statements, see Table 22 on page 457.) ACCOUNT statements in the profile entry are used only if no ACCOUNT statements are in the user or identity entry.

### Operands

*acctnum1*

defines the primary account number. An account number can be 1- to 8-characters long.

*distcode*

defines the distribution code for printed and punched output. If you specify *acctnum1* and do not specify *distcode*, the distribution code is the user ID from the USER or IDENTITY statement. If you are defining alternative account numbers, you must specify *distcode*. See the usage notes and examples.

*acctnumn*

defines up to seven alternative account numbers.

### Usage Notes

1. You can code multiple ACCOUNT statements in the same directory entry. The total number of account numbers you code for that entry cannot be more than eight, whether you code one ACCOUNT statement or many.
2. If you code several ACCOUNT statements, *distcode* must appear on the first statement only, immediately after the primary account number.
3. When logging on, a user has the option of specifying an alternative account number on the LOGON command. If the specified alternative account number

## ACCOUNT

is in the virtual machine definition, CP charges that alternate account number. If a user logs on without specifying an alternative account number on the LOGON command, CP charges the primary account number.

4. If a virtual machine has several account numbers, the user can switch account numbers using the SET ACCOUNT command. For more information about the SET ACCOUNT command, see the *z/VM: CP Commands and Utilities Reference*.

### Examples

1. To specify JOB101 as a virtual machine's account number, use the following statement in the virtual machine's definition:

```
Account job101
```

2. To specify JOB101 as a virtual machine's account number and BIN-99Z as a virtual machine's distribution code, use the following statement in the virtual machine's definition:

```
Account job101 bin-99z
```

3. To specify:

- JOB101 as a virtual machine's account number,
- BIN-99Z as a virtual machine's distribution code, and
- JOB102, JOB103, and PLAY999 as a virtual machine's alternative account numbers

use the following statement in the virtual machine's definition:

```
Account job101 bin-99Z job102 job103 play999
```



## ACIGROUP Directory Statement

►► ACIgroup *groupname* ◀◀

### Purpose

The ACIGROUP statement is an optional statement used to specify the name of the group to which this user (user ID) is assigned. To assign Access Control Interface (ACI) group names to users, you must include the ACIGROUP statement in the virtual machine definitions of all users you are specifying as members of groups. You cannot assign more than one ACI group name to each user in the directory, nor can you specify more than one ACIGROUP statement per directory entry.

### How to Specify

The ACIGROUP statement is allowed in profile, user, and identity entries. If specified, the ACCOUNT statement must go before any device statements in the entry. (For a list of device statements, see Table 22 on page 457.) One ACIGROUP statement is allowed in a profile entry, but is used only if no ACIGROUP statement exists in the user or identity entry.

### Operands

#### *groupname*

specifies the name of the ACI group to which this user is assigned. The variable *groupname* may consist of any 1 to 8 characters. However, the application programs that use this value (for example, IBM licensed program RACF) may place their own restrictions on the character set that can be used. Therefore, it may be necessary to review the ACI group names, specified if any applications reference them. Only one ACIGROUP statement may be specified per virtual machine definition.

### Examples

To specify that user ID JONES belongs to group MUNDANE, use the following directory statements:

```
User jones ww11qq 8m 16m *
.
.
.
ACIgroup mundane
```

## APPCPASS Directory Statement

►►—APPCpass—*gate\_lu*—*gate\_known\_lu*—*userid*—*password*—◄◄

### Purpose

The APPCPASS directory statement allows a virtual machine to request an APPC/VM path without supplying security parameters (user ID and password), even though the equivalent of SECURITY (PGM) is indicated on the APPCVM CONNECT request. Each APPCPASS statement for a virtual machine identifies a possible target of APPCVM CONNECT requests that indicate SECURITY (PGM), and provides the user ID and password needed for security authorization to complete the connection. When a CONNECT request that requires user ID and password includes only user ID, CP searches for a corresponding APPCPASS statement in the originating virtual machine's definition to obtain the password. If the CONNECT request requires user ID and password, but includes neither, CP searches for a corresponding APPCPASS directory statement to obtain both.

### How to Specify

The APPCPASS statement is allowed in profile, user, and identity entries. If specified, the APPCPASS statement must go before any device statements in the entry. (For a list of device statements, see Table 22 on page 457.) APPCPASS statements found in a profile entry are added to those found in the including user or identity entry with no duplicate checking performed. A statement that appears within a user or identity entry is processed before a statement that appears within an included profile entry.

### Operands

*gate\_lu*

specifies the 8 character GATEWAY\_LU\_NAME that is the first part of the locally-known LU name. A shorter name must be padded on the right with blanks to a length of 8 characters.

*gate\_known\_lu*

specifies the 8 character GATEWAY\_KNOWN\_LU\_NAME that is the second part of the locally-known LU name, which determines the target for which security parameters are being specified. When the GATEWAY\_LU\_NAME is \*IDENT, the GATEWAY\_KNOWN\_LU\_NAME must be 8 bytes of binary zeros (X'0000000000000000').

*userid*

specifies the 1- to 8-character user ID.

*password*

specifies the 1- to 8-character password that corresponds to the user ID value at the target identified by the locally-known LU name.

### Usage Notes

1. Multiple APPCPASS statements can be specified for a single virtual machine.

2. The same *gate\_lu* and *gate\_known\_lu* values may be on multiple APPCPASS statements for a single virtual machine. Each of these APPCPASS statements can have a different user ID value. In this manner, a virtual machine can use multiple user ID and password pairs to gain access to the target. If two or more such statements also have the same user ID value, only the first statement is used to obtain security parameters for the designated target.
3. APPCPASS statements are an alternative to specifying security parameters for APPCVM CONNECT requests from CMS applications in the CMS file that supports the Systems Application Architecture® (SAA) Common Programming Interface for Communications (CPIC).

## Examples

The following APPCPASS statements in the virtual machine definition of JOEUSER's virtual machine define a list of LUs and their security parameters with which JOEUSER's virtual machine can establish communications. This is not a definitive list. Programs running in JOEUSER's virtual machine could develop and pass the required LU and security information dynamically. The APPCPASS statements simply provide default security parameters for the identified LUs for cases when they are not dynamically supplied.

|          |          |          |          |          |
|----------|----------|----------|----------|----------|
| APPCpass | Regional | SalesOff | Outlet01 | pass01   |
| APPCpass | HomeOffc | Invntory | Outlet01 | pass02   |
| APPCpass | HomeOffc | Reports  | SalesMgr | passmgr  |
| APPCpass | HomeOffc | MailBox  | MailMan  | passmm   |
| APPCpass | HomeOffc | MailBox  | JoeUser  | passpers |

With the first statement, JOEUSER could establish a connection with the LU named REGIONAL SALESOFF and be known as user OUTLET01 with password PASS01. With the second, JOEUSER could establish a connection with the LU named HOMEOFFC INVNTORY and also be known as OUTLET01 but with another password of PASS02. With the third, JOEUSER could establish a connection with the LU named HOMEOFFC REPORTS and be known as SALESMGR with a password of PASSMGR. With the fourth, JOEUSER could establish a connection with the LU named HOMEOFFC MAILBOX and be known as MAILMAN with a password of PASSMM. With the last, JOEUSER could establish a connection with the LU named HOMEOFFC MAILBOX to be known as himself, JOEUSER with a password of PASSPERS.

---

### AUTOLOG Directory Statement

#### Purpose

The AUTOLOG statement is a synonym for XAUTOLOG that is available for compatibility reasons. Refer to “XAUTOLOG Directory Statement” on page 617 for the format and for information on coding the XAUTOLOG statement.

#### How to Specify

The AUTOLOG statement is allowed in profile, user, and identity entries. If specified, the AUTOLOG statement must go before any device statements. (For a list of device statements, see Table 22 on page 457.) Multiple AUTOLOG statements are allowed in a profile entry, but are used only if no AUTOLOG or XAUTOLOG statements are in the including user or identity entry.

## BUILD Directory Statement

```
►►—BUILD—ON—sysname—USING—SUBCONFIG—id—◄◄
```

### Purpose

The BUILD statement is used as part of a multiconfiguration virtual machine definition. The BUILD statement specifies a system name of an SSI cluster member and the SUBCONFIG ID of the subconfiguration entry that contains the system-specific directory statements for a multiconfiguration virtual machine instance.

### How to Specify

BUILD statements are allowed only in identity entries. If specified, they must immediately follow an IDENTITY statement, an INCLUDE statement, or another BUILD statement. In an SSI-enabled directory, an identity entry can contain up to 32 BUILD statements. Each of these BUILD statements must have a unique system name identifying one of the members in an SSI cluster. In an SSI-ready directory, an identity entry can have at most one BUILD statement. The system name on this BUILD statement must be \* .

### Operands

#### *sysname*

specifies a 1- to 8-character member system that identifies the SSI member to which the SUBCONFIG definition applies. *sysname* must be an alphanumeric string or a single asterisk (\*).

In an SSI-ready directory, the asterisk character (\*) must be specified for the *sysname*. The asterisk indicates that the member defaults to the IPLed system. In this case, just one BUILD statement can be specified within the identity entry.

In an SSI-enabled directory, an asterisk is not allowed as the *sysname* and each BUILD statement within an identity entry must specify a unique system name.

*id* defines the virtual machine's 1- to 8-character SUBCONFIG ID. Each BUILD statement within the entire directory must specify a unique SUBCONFIG ID. LOGNxxxx, LOGLxxxx, LOGVxxxx, LOGNSYSC, LOGNSYSG, and SYSTEM are reserved for CP use.

### Usage Notes

1. The BUILD statement is used in combination with the IDENTITY and SUBCONFIG statements. See “IDENTITY Directory Statement” on page 502 and “SUBCONFIG Directory Statement” on page 603.
2. A SUBCONFIG statement with an ID matching the ID specified on the BUILD statement must exist in the directory.

### Examples

1. In an SSI cluster, if you want user ID MAINT to be allowed to log on to any member in the SSI cluster by using a combination of common virtual machine

## BUILD

specifications and member-specific virtual machine specifications, create a multiconfiguration virtual machine definition such as:

```
IDENT MAINT MAINTPAS
BUILD ON SYS1 USING SUBCONFIG MAINT1
BUILD ON SYS2 USING SUBCONFIG MAINT2
CLASS ABCDEFG
```

```
SUBCONFIG MAINT1
STORAGE 64M
MDISK 201 3390 100 10 MNTVL1 RR
```

```
SUBCONFIG MAINT2
STORAGE 128M
MDISK 202 3390 100 10 MNTVL2 RR
```

## CLASS Directory Statement

►►—Class—*classes*—◄◄

### Purpose

The CLASS statement specifies the privilege class or classes assigned to an individual user.

### How to Specify

The CLASS statement is allowed in profile, user, and identity entries. If specified, the CLASS statement must go before any device statements. (For a list of device statements, see Table 22 on page 457.) One CLASS statement is allowed in a profile entry if the CLASS field on each of the USER or IDENTITY statements of the including directory entries is blank or contains only an asterisk (\*). The CLASS statement in a user or identity entry overrides a class statement in an included profile entry.

### Operands

*classes*

specifies up to 32 privilege classes of CP commands a user can enter. Command classes are A through Z, and 1 through 6. Each character represents a single privilege class, and may appear in any order, without duplication, and cannot be separated by blanks. See Chapter 16, “Redefining Command Privilege Classes,” on page 443 for information on how to redefine your command privilege classes if you want them to be different from the IBM-defined default classes A, B, C, D, E, F, and G.

### Usage Notes

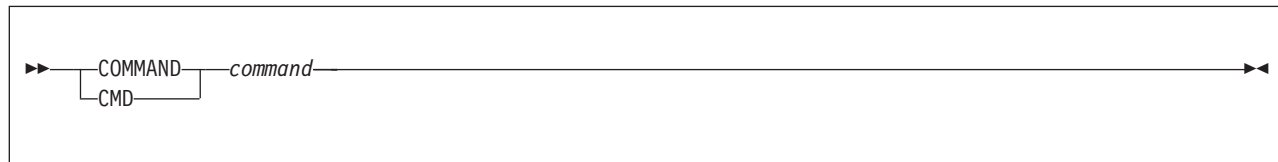
1. If you do not specify a CLASS statement and you specify the class field of the USER or IDENTITY statement as either a blank or an asterisk (\*), CP uses the default class or classes specified on the PRIV\_CLASSES statement in your system configuration file.
2. If the CLASS field of the USER or IDENTITY statement is not blank and is not an asterisk (\*), the CLASS statement is not allowed.
3. If you change the privilege classes for any DIAGNOSE codes, be aware that the change can affect the user's ability to enter commands, because some CMS commands invoke DIAGNOSE codes (for example, DUMPVIEW and GENIMAGE).

### Examples

To specify that user ID BONES can enter commands with privilege classes Z, 1, 6, A, X, C, B, 2, 5, and G, use the following directory statements:

```
User Bones ww11qq 8m 16m *
Class z16axcb25g
```

## COMMAND Directory Statement



### Purpose

The COMMAND statement specifies a command to be executed after the virtual machine is logged on, and before the virtual machine is IPLed. A COMMAND statement may be continued and multiple COMMAND statements are allowed.

### How to Specify

COMMAND statements are allowed in profile, user, identity, and subconfiguration entries. If specified, they must go before any device statements. (For a list of device statements, see Table 22 on page 457.)

COMMAND statements in a profile entry are merged with any COMMAND statements in the user, identity, or subconfiguration entries. The result of the merging is that commands on COMMAND statements in the profile entry are executed before those in the user or identity entry. Commands from the subconfiguration entry follow those in the identity entry.

The COMMAND statement may be continued across multiple records in the source directory file. For detailed information about continued statement rules, see “Continued Directory Statements” on page 461.

### Operands

#### *command*

specifies the command to be executed. It may not exceed 220 characters in length. (See also Usage Note 1 below.) To substitute the virtual machine user ID into the command, specify the token &USERID.

### Usage Notes

1. Besides the 220-character length restriction, please be aware that any command operands should be specified in upper case. (The one exception to this is a command operand not parsed by CP, such as the message text for a MESSAGE command, which can use mixed case.) Specify the command only (i.e. do not begin the string with CP or #CP), and do not use the '#' character to put multiple commands on one line.
2. Each command uses the command length + 1 of command buffer space. The maximum command buffer length cannot exceed 3071 characters per virtual machine. For example, the following directory statements would result in PAVUSER requiring 120 bytes of command buffer space:

```

PROFILE PAVPROF
COMMAND DEFINE HYPERPAVALIAS 5000 FOR BASE 2000
COMMAND DEFINE HYPERPAVALIAS 5001 FOR BASE 2001
USER PAVUSER
INCLUDE PAVPROF
COMMAND DEFINE HYPERPAVALIAS 3000 FOR BASE 1000

```



3. Any form of a command may be invoked using this mechanism, regardless of the command privilege class of the virtual machine. That is, the command is executed as if the virtual machine is authorized for all privilege classes. The syntax used for the command must take this into account.
4. An asynchronous command may be issued using this mechanism, but in this case, subsequent commands may not depend on its results. An option to execute such commands synchronously, if available, or a SLEEP command may be used to provide more deterministic behavior.

## Examples

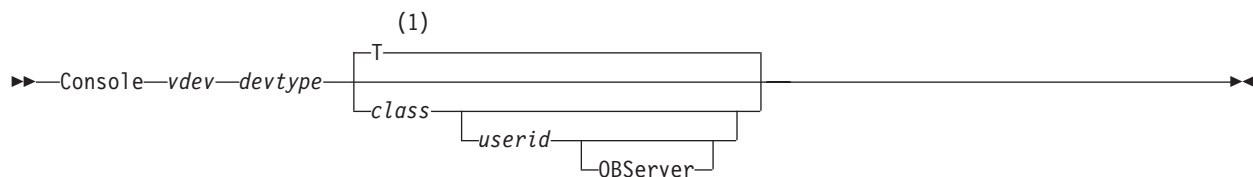
1. To vary a device online and attach it to a user, add the following directory statements in the virtual machine definition:

```
COMMAND VARY ON 1234
COMMAND ATTACH 1234 TO &USERID AS 4567
```

2. To display the status of a virtual device, use the following statement:

```
COMMAND QUERY VIRTUAL 4567
```

## CONSOLE Directory Statement



### Notes:

- 1 The default is no secondary user or observer.

## Purpose

The CONSOLE statement defines the virtual machine console.

This statement also allows the definition of a secondary user or observer:

- The secondary user can control this virtual machine (the primary user) when it is disconnected. The secondary user will receive console output for the primary user and can use the SEND command to send input to the primary user and initiate actions on its behalf. The secondary console function is provided by the single console image facility (SCIF).
- The observer will receive console output for this virtual machine (regardless of whether it is disconnected or connected) but cannot initiate actions on its behalf.

## How to Specify

The CONSOLE statement is allowed in profile, user, identity, and subconfiguration entries. If specified, the CONSOLE statement must go after any general statements. (For a list of general statements, see Table 22 on page 457.) Only one CONSOLE statement is allowed in each entry. If you define a CONSOLE statement in both a user entry and its included profile entry, at logon time two requests to define a console are presented to the system; the request from the user entry is presented first.

A CONSOLE statement in a subconfiguration entry must completely override one specified in the identity entry, including both the secondary user and observer parameters. Because the secondary user must not specify the user ID of the user logged on when the CONSOLE is created, a CONSOLE statement is not allowed to specify the IDENTITY user ID when the CONSOLE statement is contained in a subconfiguration or identity entry. If a CONSOLE statement is contained in the subconfiguration entry, the statement is the one created even if there is a CONSOLE statement in the identity or profile entry.

When processing the CONSOLE statement, DIRECTXA checks for a maximum of five tokens: virtual device number, device type, spooling class, a secondary user ID or observer, in that order. If you specify more than five tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

## Operands

*vdev*

is the virtual device number for the virtual console.

*devtype*

is the device type. Valid device types are 3215 and 3270.

*class*

is a 1-character spooling class. With spooling classes, your installation can govern the printing of the real spooled output. The class can be any single alphanumeric character from A to Z or from 0 to 9. If you omit *class*, the default is T.

*userid*

is the 1- to 8-character secondary user ID whose console is to be used when the primary user disconnects. If *userid* is specified, *class* must also be specified.

**OBServer**

indicates that the specified user is in an observer rather than a secondary user for the virtual machine whose console is being defined.

## Usage Notes

1. A virtual machine can have a maximum of one console. Once logged on, users can change the definition of their console to meet their needs. You can use the following commands to change the definition of your console:

| Command          | Function                                                                                                                                     |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| DEFINE           | <ul style="list-style-type: none"> <li>• Changes the console address.</li> <li>• Creates a console if one does not already exist.</li> </ul> |
| DETACH           | Deletes the console.                                                                                                                         |
| SET OBSERVER     | Changes the observer.                                                                                                                        |
| SET SECUSER      | Changes the secondary user.                                                                                                                  |
| SPOOL            | Changes the spooling class.                                                                                                                  |
| TERMINAL CONMODE | Changes the device type.                                                                                                                     |

2. To define a virtual machine console with a console mode (CONMODE) of 3270, the real terminal must be a graphics device. In addition, if the real terminal is an SNA/CCS terminal, the VTAM service machine (VSM) that controls the terminal must support CONMODE 3270. VTAM service machines that use releases of ACF/VTAM earlier than version 3 release 1.1 support only CONMODE 3215. If either condition is violated, an informational message is issued during logon processing and the console mode defaults to 3215.
3. A virtual machine cannot have both a secondary user and an observer defined by any combination of the CONSOLE statement and the SET SECUSER and SET OBSERVER commands.
4. If the designated secondary user or observer is currently unable to function in that capacity (for example, not logged on, or disconnected with no connection to \*MSG or \*MSGALL), the setting is nevertheless accepted by CP, and the relationship is established when the specified user ID meets the necessary criteria.
5. In an SSI cluster, the secondary user or observer and the primary or observed user can be logged on to different member systems.  
If either user is a multiconfiguration virtual machine:

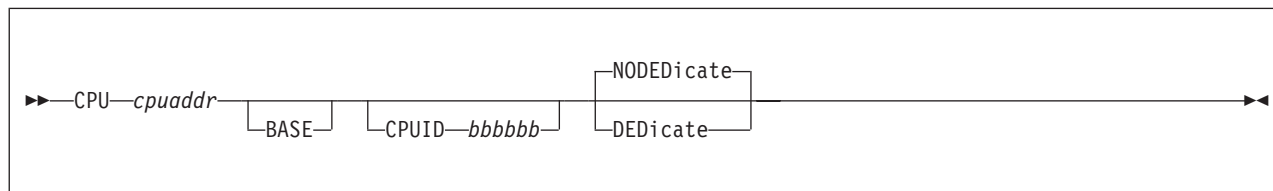
## CONSOLE

- The secondary user or observer will function in that capacity only when it is local (logged on to the same member as the primary or observed user). If the primary or observed user is a multiconfiguration virtual machine, the secondary user or observer must be logged on to the same member as the instance of the primary or observed user for which the secondary user or observer setting is established:
  - If the setting is established by a CONSOLE statement in the identity entry in the primary or observed user's virtual machine definition, a potential secondary user or observer relationship exists for every member instance of the primary or observed user.
  - If the setting is established by a CONSOLE statement in a subconfiguration entry in the primary or observed user's virtual machine definition, a potential secondary user or observer relationship exists for that member instance of the primary or observed user.
- If the secondary user is remote:
  - The secondary user can issue SEND commands to the primary user. The AT *sysname* operands are required if the primary user is a multiconfiguration virtual machine instance.
  - The secondary user will not receive responses to SEND commands or any other output from the primary user.

### Examples

1. To define a 3215 console at address 009 that produces class T spooled output (the default value), use the following statement in the virtual machine definition:  
`Console 009 3215`
2. To define a 3270 console at address 0A9 that produces class Y spooled output, use the following statement in the virtual machine definition:  
`Console 0a9 3270 y`
3. To define a 3215 console at address 01F that produces class T spooled output and the user ID whose console is to be used when this user ID is disconnected is ALJONES, use the following statement in the virtual machine definition:  
`Console 01f 3215 t aljones`

## CPU Directory Statement



### Purpose

The CPU statement specifies a virtual processor that is to be defined automatically for the virtual machine at LOGON time.

### How to Specify

The CPU statement is allowed in profile, user, and identity entries. If specified, the CPU statement must appear before any device statements. (For a list of device statements, see Table 22 on page 457.) The maximum number of CPU statements allowed in the virtual machine definition is controlled by the *mcpu* operand of the user's MACHINE statement, if specified.

The DEFINE CPU command provides additional parameters not supported on the CPU directory statement. The COMMAND directory statement can be used to specify the DEFINE CPU command and access these additional parameters.

Multiple CPU statements are allowed within an entry. If you specify CPU statements with the same processor address (*cpuaddr*) in a user or identity entry and in a profile entry, the statement in the user or identity entry overrides the one in the profile entry. Otherwise, the CPU statements in the user or identity entry and profile entry are additive.

If a BASE CPU is defined in both a profile and user or identity entry, the CPU statement in the user or identity entry overrides the CPU statement in the profile.

If you do not specify a CPU statement in a virtual machine definition, the address of the base virtual processor is X'00' by default.

### Operands

#### *cpuaddr*

defines a virtual processor at the specified address. The address can be any 2-digit hexadecimal number from X'00' to X'3F'.

#### BASE

tells CP that this CPU statement defines the base virtual processor. You can only specify BASE on one CPU statement. If you do not specify BASE on any CPU statement, CP defines the base virtual processor as the CPU statement with the lowest virtual processor address (*cpuaddr*).

#### CPUID *bbbbbb*

provides the processor identification number to be stored in bits 8 through 31 of the CPU ID that is returned in response to the store processor ID (STIDP) instruction. If the guest is relocated, these bits do not change as a result of the relocation, even if the FORCE ARCHITECTURE or FORCE DOMAIN options were used on the VMRELOCATE command.

The variable *bbbbbb* is a 6-digit hexadecimal number. (No checking is done to ensure that this number is unique in the virtual configuration.) For base processors, this option overrides the CPUID operand on the OPTION statement. For nonbase processors, it overrides the CPU ID of the base CPU. For more information about the CPUID operand, see “OPTION Directory Statement” on page 561.

### **DEDicate**

### **NODEDicate**

specifies whether this virtual processor is to be dedicated at LOGON time to a real processor.

If NODEDICATION is specified, this virtual processor is not to be dedicated to a real processor. It has the same effect as entering the UNDEDICATION command for this virtual CPU. NODEDICATION is the default.

### **Usage Notes**

1. The protected application environment is supported only for virtual machines running a single processor. If this virtual machine is running a multiprocessor configuration, the SET CONCEAL ON command is rejected.
2. Although the CRYPTO operand is not shown in the syntax for this statement, it is accepted for compatibility but provides no function.
3. The CPU directory statement cannot be used to define virtual CPUs of different processor types. To create these virtual CPUs, use the CP DEFINE CPU command in a COMMAND directory statement. For additional information on defining virtual machines with specialty processors, see the Specialty Engine Support section in *z/VM: Running Guest Operating Systems*.

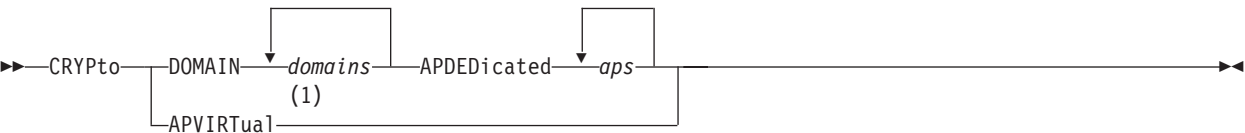
### **Examples**

To define a base CPU at address X'DE', with a CPU ID of X'0000DE', use the following CPU statement:

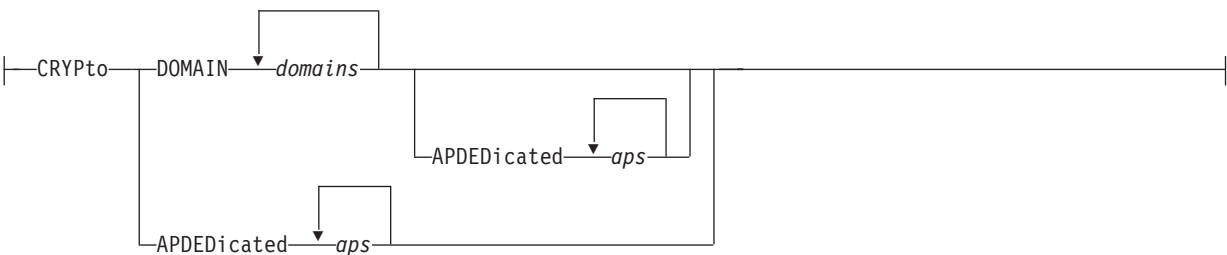
```
CPU de base CPUid 0000de
```

# CRYPTO Directory Statement

**First (or only) CRYPTO statement:**



**Subsequent CRYPTO statements:**



**Notes:**

- 1 APVIRTUAL can only be specified once in the virtual machine definition.

## Purpose

The CRYPTO statement authorizes the user to define virtual cryptographic facilities and provides the guest access to the crypto domains on the cryptographic cards.

## How to Specify

The CRYPTO statement is allowed in user, identity, and subconfiguration entries. If specified, it must appear before any device statements. (For a list of device statements, see Table 22 on page 457.)

A CRYPTO APVIRTUAL statement in a profile is allowed as long as APVIRTUAL is not specified on CRYPTO statements in the user or identity entry. In this case, the APVIRTUAL specified in the profile is added to the CRYPTO definition in the user or identity entry. However, when a subconfiguration entry includes CRYPTO statements, the CRYPTO APVIRTUAL statement in the profile is ignored and does not modify the CRYPTO definition in the subconfiguration entry.

A CRYPTO statement in a subconfiguration entry completely overrides one in the identity entry.

You can specify as many CRYPTO statements as you need to assign domains or APs to the virtual machine. Once the DOMAIN operand is specified, the DOMAIN or APDEDICATED operands can be specified again on additional CRYPTO statements followed by the additional domains or APs to be assigned. Note, however, that the APVIRTUAL operand can only be specified once.

## Operands

### **DOMAIN** *domains*

specifies up to 16 domains the virtual machine may use. Domains are 0 through 15, specified in decimal. They can appear in any order, without duplication. Domain is synonymous with queue. If crypto domains are available, and the APDEDICATED operand is specified, the virtual machine can use the crypto domains corresponding to the domains specified. The DOMAIN operand can be specified more than once on additional CRYPTO statements, but the DOMAIN operand must be specified before APDEDICATED is specified.

### **APVIRTUAL**

tells CP that this virtual machine may share access with other virtual machines to the clear-key functions of the Adjunct Processor (AP) cryptographic facility. The APVIRTUAL operand cannot be specified if the APDEDICATED operand is specified. It is not necessary to specify the DOMAIN operand when specifying the APVIRTUAL operand.

### **APDEDICATED** *aps*

specifies up to 64 APs the virtual machine may use for dedicated access to the Adjunct Processor (AP) cryptographic facility. APs are 0 through 63, specified in decimal. They may appear in any order, without duplication. The DOMAIN operand also must be specified to indicate the crypto domains to access. The crypto domains equivalent to the domains specified by all of the DOMAIN operands will be assigned to the guest for each AP specified on the APDEDICATED operand on all CRYPTO statements. The APDEDICATED operand cannot be specified if the APVIRTUAL operand is specified. The APDEDICATED operand can be specified more than once on additional CRYPTO statements.

The APs specified must be selected from the set of APs selected on the Cryptographic Online List on the Crypto Image Profile Page for the logical partition in which z/VM is running. The DOMAINS specified must be selected from the set of domains specified on the Usage Domain Index selections on the Crypto Image Profile Page for the Logical Partition. For more information about the Crypto Image Profile Page, see the *Processor Resource/Systems Manager Planning Guide*, SB10-7041.

## Usage Notes

1. Only one virtual machine should be given dedicated access to a specific domain at a time. It might be useful to have more than one user with the same crypto definition in the user directory in order to provide backup configurations. In this case, the first user who logs on receives use of the domains specified. Users who could be logged on at the same time should not be defined with overlapping crypto definitions. If they are, more than one user might have concurrent access to the same crypto domain. The combination of the APDEDICATED number with the DOMAIN number should be unique across all active crypto users in the user directory.
2. It is recommended that multiple CRYPTO statements for a user be specified contiguously in the virtual machine definition.
3. The DOMAIN operand should not be specified alone or with APVIRTUAL, although it is accepted for compatibility but provides no function. The DOMAIN operand should be specified with APDEDICATED.
4. The APs specified must be installed on the real processor. If a specified AP is not installed on the real processor at LOGON time, a message is issued that the AP is not available.



5. If major changes are made to the configuration of the crypto domains by updating the APDEDICATED and APVIRTUAL operands on the CRYPTO statements for users without a subsequent system IPL, it is possible that no domains of the type selected by z/VM will remain for sharing. This is because the type of domains used for sharing is initialized during system IPL and is not updated dynamically. In this case, it might still appear that domains are available for sharing when QUERY CRYPTO DOMAINS USERS is issued. If it is necessary to change the type of domains available for sharing, a system IPL must be performed after the directory changes are made.
6. Although the CSU, KEYENTRY, SPECIAL, and MODIFY operands are not shown in the syntax for this statement, they are accepted for compatibility but provide no function.
7. Only a z/Architecture guest can use a crypto domain on a Crypto Express4S. If the device is not configured as an accelerator or as an IBM Common Cryptographic Architecture (CCA) coprocessor, the crypto domain can be accessed as dedicated only, and the APDEDICATED operand should be used to provide dedicated access for the guest. This is true when the device is configured as an IBM Enterprise Public-Key Cryptography Standards (PKCS) #11 (EP11) coprocessor.
8. In an SSI-enabled directory, CRYPTO APDEDICATED and DOMAIN statements can be specified in a SUBCONFIG entry. When used along with BUILD statements, this allows the specified domains on the specified APs to be attached to the user depending on which member of an SSI cluster the user logs onto. The domains specified for APDEDICATED statements in all SUBCONFIG entries are treated as reserved for dedication on all members of an SSI cluster. Typically, the crypto APs and domains which are available on the processor will be different on each SSI member. However, if more than one member of the SSI cluster has crypto hardware with the same AP and domain numbers that are specified in a SUBCONFIG entry, these members will see these devices as reserved for dedication or dedicated and they will not be used for crypto sharing.

## Examples

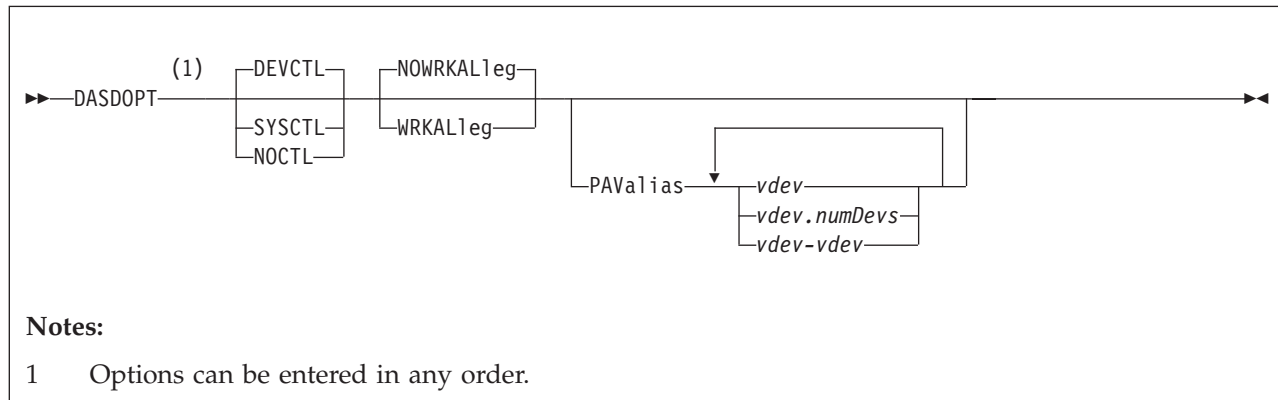
1. To specify that the virtual machine can use the clear-key functions of the Adjunct Processor (AP) cryptographic facility, use the following CRYPTO statement in the virtual machine's definition:  

```
Crypto Apvirt
```
2. To specify that a virtual machine can use crypto domains 3 and 7 on APs 0, 2, and 3, use the following CRYPTO statement in the virtual machine's definition:  

```
Crypto Domain 3 7 Apded 0 2 3
```
3. To specify that a virtual machine can use crypto domains 2, 10, 11, 12, and 13 on AP 4 use the following CRYPTO statement in the virtual machine's definition:  

```
Crypto Domain 2 10 11 12 13 Apded 4
```

## DASDOPT Directory Statement



### Purpose

The DASDOPT statement is an extension to the MDISK, LINK, or DEDICATE statement that immediately precedes it.

### How to Specify

Multiple DASDOPT statements are allowed within a profile, user, identity, or subconfiguration entry. In a profile entry, a DASDOPT statement would immediately follow a DEDICATE and/or a LINK statement that describes a full-pack minidisk. In a user, identity, or subconfiguration entry, a DASDOPT statement would also immediately follow an MDISK statement that describes a full-pack minidisk. (For non-full-pack minidisks, see the MINIOPT statement.) Only one DASDOPT statement is allowed for each DEDICATE, LINK, and MDISK statement. DIRECTXA cannot detect every case when the MDISK preceding the DASDOPT is not a full-pack minidisk and it cannot determine if the volume represented on the LINK statement is a full-pack minidisk. In these situations, the characteristics of the DASDOPT operands are given to the disks and unexpected results can occur.

### Operands

#### DEVCTL

means that the device accepts CCWs that have an effect on resources and functions directly related to the device. See usage note 6 on page 487 for default values.

#### SYSCTL

means that the device accepts CCWs that have a direct global effect on subsystem resources and function, not just those related to the device. See usage note 6 on page 487 for default values.

#### NOCTL

means that the device does not accept any CCWs that can control subsystem resources or functions, regardless of whether they directly relate to the device.

#### WRKALleg

means working allegiance is active on the minidisk. This option is allowed only if DASDOPT is immediately preceded by the MDISK statement.

**NOWRKALleg**

means working allegiance is not active on the minidisk. This option is allowed only if DASDOPT is immediately preceded by the MDISK statement.

**PAValias**

defines one or more alias Parallel Access Volumes for the full-pack minidisk base Parallel Access Volume specified in the preceding LINK or MDISK statement.

*vdev*

*vdev.numDevs*

*vdev-vdev*

is the virtual device address of the alias Parallel Access Volume that you are defining. You can specify a single virtual device (*vdev*), a virtual device combined with a decimal range count (*vdev.numDevs*), a range of virtual devices (*vdev-vdev*), or any combination. The device numbers entered must be hexadecimal numbers between X'0000' and X'FFFF'.

**Usage Notes**

1. If you are dedicating a DASD with logical addresses (for example, a DASD connected to a paging storage director in a 3380 Storage Control Model 11 or 21), the real device number you specify must be the base address for the device, and virtual device number you specify must follow the addressing rules for base addresses.
2. If you are dedicating a device with logical addresses, both the real device number and the virtual device number you specify must be the base address.
3. When the cache status of a device is changed, the hardware presents an asynchronous state change interrupt to every *vdev* associated with that *rdev* that has DASDOPT DEVCTL specified.
4. WRKALLEG must be used when running two or more MVS™ guests as part of a Sysplex configuration using the cross system coupling facility (XCF) component of MVS/ESA. This option must be used for any minidisk containing the XCF couple dataset to maintain cross-system lock integrity (and thereby, data integrity) within the sysplex.
5. WRKALLEG/NOWRKALLEG is valid only when the preceding MDISK statement gives the user write access to the minidisk. If the MDISK statement specifies read-only access, CP rejects the WRKALLEG/NOWRKALLEG statement and issues an error message. Furthermore, working allegiance is simulated only when a guest with write access initiates I/O.
6. Levels of Control (DEVCTL, NOCTL, and SYSCTL):
  - a. The default control level value is normally DEVCTL, unless DASDOPT follows the LINK statement for a full-pack minidisk. In that case, NOCTL is always the default.
  - b. DASDOPT applies only to DASDs on a cached control unit. If you specify DASDOPT for a noncached DASD, the statement is ignored.
  - c. Specifying a level of control (NOCTL, DEVCTL, or SYSCTL) for a DASD connected to a cache storage control unit authorizes CP to accept particular control CCWs.

Table 24 on page 488 shows you the additional control CCWs that CP accepts for a level of control. The DEVCTL column shows the CCWs that CP accepts in addition to those it accepts for the NOCTL level of control. The SYSCTL column shows the CCWs that CP accepts in addition to those it accepts for the DEVCTL and NOCTL levels of control.

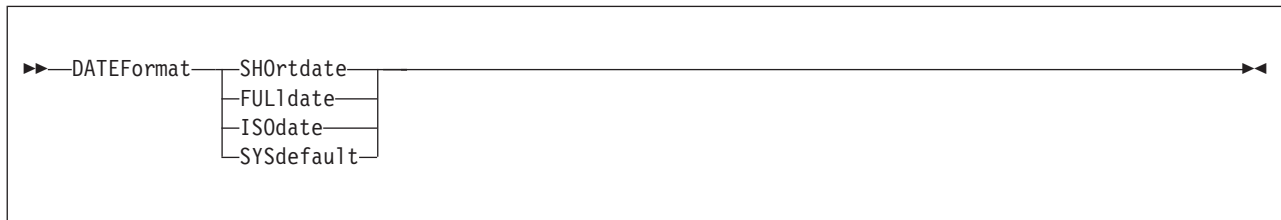
## DASDOPT

Table 24. DASD Control Levels

| Additional Control CCWs Accepted for DEVCTL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Additional Control CCWs Accepted for SYSCTL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Set subsystem mode <ul style="list-style-type: none"> <li>– Activate caching for device</li> <li>– Deactivate caching for device</li> <li>– Activate DASD fast write</li> <li>– Deactivate DASD fast write</li> <li>– Force deactivate DASD fast write</li> </ul> </li> <li>• Perform Subsystem Function <ul style="list-style-type: none"> <li>– Establish Duplex Pair</li> <li>– Terminate Duplex Pair</li> <li>– Suspend Duplex Pair</li> <li>– Direct I/O to One Device of the Duplex Pair</li> <li>– Set Interface ID</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Set subsystem mode <ul style="list-style-type: none"> <li>– Make cache available</li> <li>– Make cache unavailable</li> <li>– Force cache unavailable</li> <li>– Make NVS available</li> <li>– Make NVS unavailable</li> <li>– Activate cache fast write</li> <li>– Deactivate cache fast write</li> </ul> </li> <li>• Perform Subsystem Function <ul style="list-style-type: none"> <li>– Destage Modified Tracks</li> <li>– Set Cache Allocation Parameters</li> <li>– Suspend/Resume Function</li> </ul> </li> </ul> |

7. When using the PAValias parameter, the number of virtual alias Parallel Access Volumes that can be associated with a particular virtual base Parallel Access Volume cannot exceed the number of real alias Parallel Access Volumes that are associated with the real base Parallel Access Volume on which the virtual base is defined.
8. The PAValias keyword is only allowed on DASDOPT statements that follow LINK or MDISK statements. PAVALIAS is not allowed on a DASDOPT statement that follows a DEDICATE statement.
9. The DASDOPT statement may be continued onto additional lines using the rules documented in “Continued Directory Statements” on page 461.
10. For information about the WRKALLEG restrictions when linking, see the LINK command in *z/VM: CP Commands and Utilities Reference*.

## DATEFORMAT Directory Statement



### Purpose

The DATEFORMAT statement specifies a user's default date format for commands that provide multiple date formats.

### How to Specify

One DATEFORMAT statement is allowed in a profile, user, identity, or subconfiguration entry. If you specify the DATEFORMAT statement, it must precede any device statements in an entry. (For a list of device statements, see Table 22 on page 457.) A DATEFORMAT statement in a user or identity entry overrides a DATEFORMAT specification in a profile entry. A DATEFORMAT statement in the subconfiguration entry overrides one in the identity entry.

### Operands

#### SHOrtdate

specifies that dates in command responses be displayed in mm/dd/yy, mm/dd, or yy/mm/dd format, where mm is the month, dd is the day of the month, and yy is the 2-digit year.

#### FULldate

specifies that dates in command responses be displayed in mm/dd/yyyy or yyyy/mm/dd format, where mm is the month, dd is the day of the month, and yyyy is the 4-digit year.

#### IS0date

specifies that dates in command responses be displayed in yyyy-mm-dd format, where yyyy is the 4-digit year, mm is the month, and dd is the day of the month.

#### SYSdefault

specifies that the default date format for this user be set to the system-wide default. The system-wide default date format may be set in the system configuration file with the SYSTEM\_DATEFORMAT statement, or with the CP SET DATEFORMAT command. Refer to “SYSTEM\_DATEFORMAT Statement” on page 267 for a description of the SYSTEM\_DATEFORMAT configuration statement, and the *z/VM: CP Commands and Utilities Reference* for a description of the SET DATEFORMAT command.

### Usage Notes

1. The format of the dates, such as mm/dd/yy, mm/dd, and yy/mm/dd, are dependent upon the command or routine that displays or generates the date.

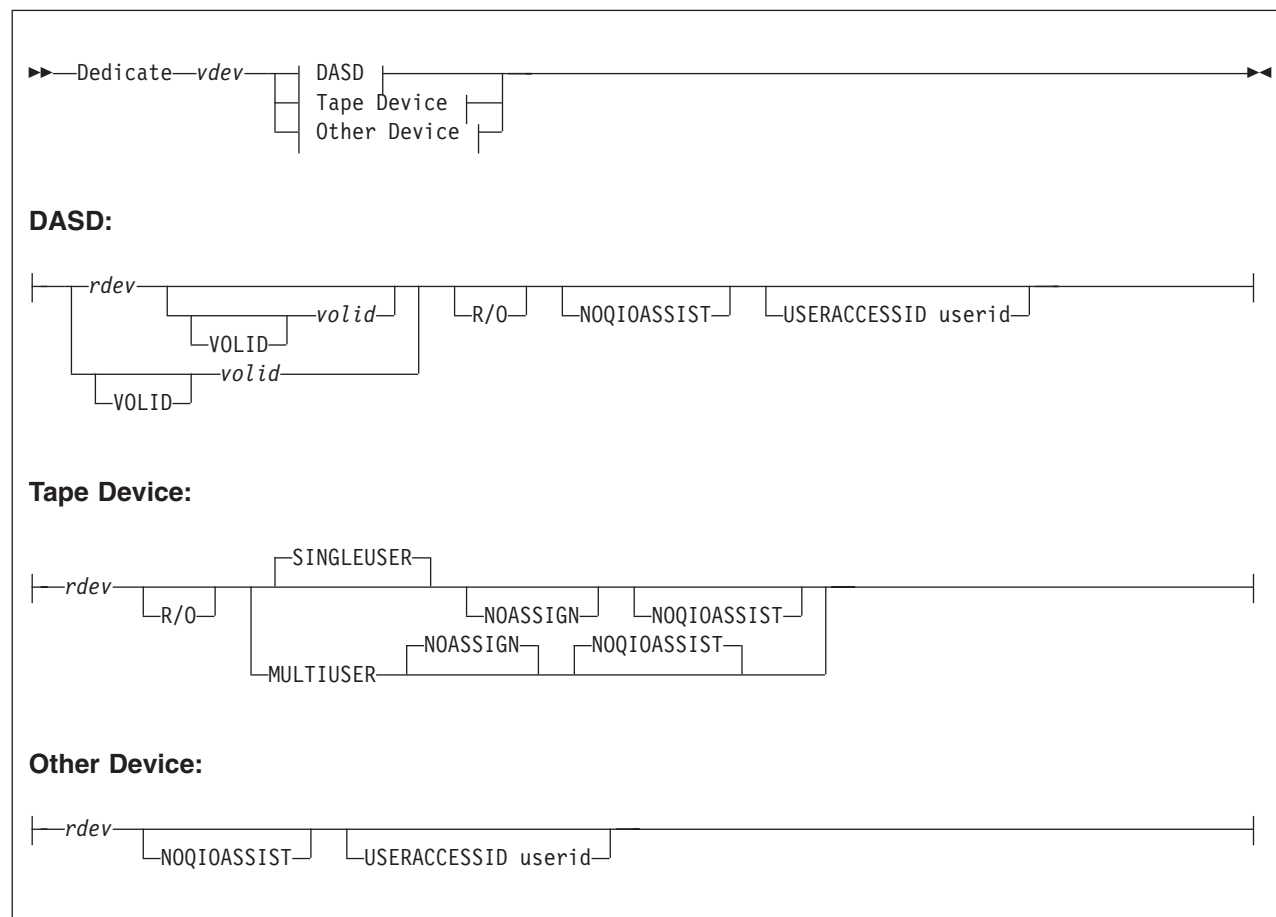
## DATEFORMAT

2. If you omit the DATEFORMAT statement when you code a virtual machine definition, the default format for that user will be the system-wide default (SYSdefault). The user may change their default date format with the CP SET DATEFORMAT command.
3. If the user's default date format is set to SYSDEFAULT, the system-wide default date format that is in effect at logon time will be used until the user logs off or issues the SET DATEFORMAT command. If the system-wide default date format is changed, the user must logoff and log back on or issue the SET DATEFORMAT SYSDEFAULT command to switch to the new system-wide default

### Examples

1. To specify the user's default date format as SHORTDATE, use the following DATEFORMAT statement in the virtual machine definition:  
DATEFORMAT SHORTDATE
2. To specify the user's default date format as FULLDATE, use the following DATEFORMAT statement in the virtual machine definition:  
DATEFORMAT FULLDATE
3. To specify the user's default date format as ISODATE, use the following DATEFORMAT statement in the virtual machine definition:  
DATEFORMAT ISODATE
4. To specify that the user's default date format should be the same as the system-wide default date format, use the following DATEFORMAT statement in the virtual machine definition:  
DATEFORMAT SYSDEFAULT

## DEDICATE Directory Statement



### Purpose

The DEDICATE statement specifies that a virtual machine has sole use of a real device or is serially sharing a real tape device with other users. The DASDOPT statement is an extension to this statement. For more information about the DASDOPT statement, see “DASDOPT Directory Statement” on page 486.

### How to Specify

The DEDICATE statement is allowed in profile, user, identity, and subconfiguration entries. If you specify DEDICATE statements, they must follow any general statements in a directory entry. (For a list of general statements, see Table 22 on page 457.)

Place DEDICATE statements before any SPOOL, LINK, or SPECIAL directory statements. This helps CP assign the correct subchannel number to any virtual devices to which you want to dedicate a real device. For example, you should make sure the virtual subchannel number is the same as the real subchannel number. You would do this by placing the DEDICATE statements before the LINK and SPOOL statements.

## DEDICATE

A DEDICATE request from a subconfiguration entry is presented to the system before DEDICATE requests from the identity entry. DEDICATE requests from the profile entry are presented to the system after requests from the user or identity entry. If the subchannel assignment is important for virtual devices added using DEDICATE statements, then the placement in the directory is important.

DEDICATE statements are allowed within a profile entry if no duplicate virtual device numbers are on DEDICATE statements within the profile. Any virtual device number in a profile that duplicates a virtual device number within a user, identity, or subconfiguration entry is resolved at logon time.

### Operands

*vdev*

is the virtual device number.

*rdev*

*rdev* is the real device number.

**VOLID** *valid*

is the volume serial number of a disk pack mounted on a real disk storage device. The variable *valid* must be a 1- to 6-character string. If *valid* is less than five characters, VOLID is a required keyword; otherwise VOLID is optional.

**R/O**

specifies that the virtual device is to be in read-only mode.

**SINGLEUSER**

dedicates a real tape device to a single user. This is the default for a tape device.

**MULTIUSER**

attaches a real tape device to be serially shared with other users. See Usage Note 3 on page 493.

**NOASSIGN**

indicates that the ATTACH process should not issue an ASSIGN channel command for this user. This lets the ATTACH work, even if the specified real device is assigned to another processor. For more information about the ATTACH command, see the *z/VM: CP Commands and Utilities Reference*.

**NOQIOASSIST**

indicates the device is not eligible for Queued-I/O Assist.

**USERACCESSID** *userid*

to allow a user (guest) the ability to give FCP LUN access to the specified *userid*. In z/VM, authority to LUNs in a Fabric is normally set up by entries in an Access Control Table (ACT). See Linux documentation for details on the ACT configuration tool. z/VM stores the *userid* into the subchannel when an FCP subchannel is attached or reset. The adapter uses the stored *userid* names to correlate I/O requests with the rules in the ACT and allows access to the LUNs based on those rules. The USERACCESSID option provides a proxy method to accessing a LUN. The *userid* specified with the option will be stored in the subchannel, rather than the invoker's *userid*, when an FCP subchannel is attached or reset. It is assumed that the *userid* specified with USERACCESSID is already in the ACT.

### Usage Notes

1. You may dedicate a real device to only one virtual machine at a time. If more than one virtual machine has a DEDICATE statement for a given real device,



only the first virtual machine that logs on receives control of the device. The only exception is when the MULTIUSER operand is specified, which allows serial sharing of an attached tape device.

2. The DEDICATE directory statement defaults to DEVCTL if no DASDOPT is present.
3. The MULTIUSER function is intended for guest operating systems that manage their own assignment of tape devices. It is not intended for CMS unless some external means of managing assignments or serializing access to the tape device among the sharing users is explicitly implemented. Third party assignment and multiple system assignment (Control Access CCW) are not supported.

To share a tape device, the virtual machine definition for that user must contain a DEDICATE statement for the device that includes the MULTIUSER operand, or the user must specify the MULTIUSER option when using the CP ATTACH command to attach the device. If the first user to log on has a DEDICATE statement for the device that does not include MULTIUSER, or issues the ATTACH command for the device without specifying MULTIUSER, the device becomes dedicated to that user. The device then cannot be attached as MULTIUSER by any user until it is detached by the user to whom it is dedicated.

The MULTIUSER function is valid only for 3480, 3490, and 3590 tape devices.

4. When the ENFORCE\_BY\_VOLID ON statement is specified in the configuration file, only DEDICATE statements that specify the VOLID of the target device will be accepted.

## Examples

1. To dedicate the real device at real device number 100 to the virtual device at virtual device number 100, use the following statement in the virtual machine definition:

```
Dedicate 100 100
```

2. To dedicate the real disk at real device number 200 (volume serial number XA9999) to the virtual device at virtual device number 220, use the following statement in the virtual machine definition:

```
Dedicate 220 200 volid xa9999
```

3. To dedicate in read-only mode the real disk at real device number 1300 (volume serial number XB9999) to the virtual device at virtual device number 330, use the following statement in the virtual machine definition:

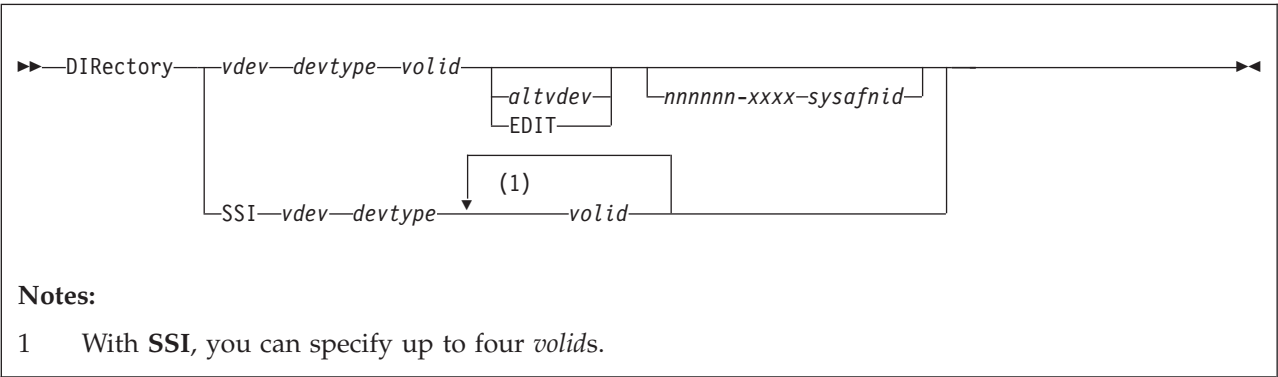
```
Dedicate 330 1300 volid xb9999 r/o
```

4. To share the real tape device at real device number 500 and attach it to the virtual machine as virtual device number 181, use the following statement in the virtual machine definition:

```
Dedicate 181 500 multiuser
```

5. The USERACCESSID option applies only to first-level and second-level guests. If it is attempted on a third-level or higher virtual machine, the request is translated into corresponding first-level and second-level information only.

DIRECTORY Directory Statement



Purpose

The `DIRECTORY` statement defines to CP the device on which you have allocated space for the directory. This device must be a CP-owned volume.

How to Specify

The `DIRECTORY` statements must be the first statements in your source directory or control `DIRMPART` file (cluster format directory).

If you are sharing a single source directory with multiple member systems of an SSI cluster, then the **SSI** operand must be specified with up to four different *valid*s (one for each system). If the **SSI** operand is specified, only one `DIRECTORY` statement is allowed.

If you are sharing a single source directory among several systems that are *not* members of an SSI cluster, a `DIRECTORY` statement with the processor ID (*nnnnnn-xxx*) and *sysafnid* is required for each logical system. This is allowed only in a non-SSI source directory.

In an SSI-ready source directory, `DIRECTXA` checks for a maximum of three tokens: virtual device number, device type, and volume serial number. If you specify more than three tokens, `DIRECTXA` produces an error message and the directory will not be updated.

In an SSI-enabled source directory, `DIRECTXA` checks for up to seven tokens: the **SSI** operand, virtual device number, device type, and up to four volume serial numbers. If you specify more than seven tokens, `DIRECTXA` produces an error message and the directory will not be updated.

In a non-SSI source directory, `DIRECTXA` checks for a maximum of six tokens: virtual device number, device type, volume serial number, alternate device number or the `EDIT` operand, processor ID, and *sysafnid*, in that order. If you specify more than six tokens, `DIRECTXA` ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

Operands

*vdev*  
is the virtual device number of the device that is to contain the object directory.

*devtype*

is the device type. Valid device types are:

3380  
3390  
9336  
FB-512

FB-512 is a generic value which can be used in place of specific FBA device types. A 3390 in 3380 track compatibility mode must be coded as 3380. If multiple DIRECTORY statements are used, the device types do not have to be the same.

*valid*

is the volume serial number of the directory volume. The variable *valid* is a 1- to 6-character alphanumeric string.

*altvdev*

is an alternative virtual device number, on which to write the directory if the primary virtual device number is unavailable.

The *altvdev* operand is not allowed in an SSI-ready or SSI-enabled source directory.

**EDIT**

(Supported for compatibility with VM/SP HPO) defines a special work volume to be used by the VM/SP HPO DIRECT command when it is entered with the EDIT operand. DIRECTXA validates the syntax of this statement but ignores its contents.

If you specify the EDIT operand on a DIRECTORY statement, that statement must:

- Be the last DIRECTORY statement in the source directory
- Immediately follow another DIRECTORY statement
- Be the only DIRECTORY statement with an EDIT operand in the source directory.

The EDIT operand is not allowed in an SSI-ready or SSI-enabled source directory.

*nnnnnn-xxxx*

is the processor ID of the system to which the DIRECTORY statement applies. Use the QUERY CPUID command to get the values for *nnnnnn* and *xxxx*, where *nnnnnn* is the processor identification number, and *xxxx* is the model number of the real machine. For more information about the QUERY CPUID command, see the *z/VM: CP Commands and Utilities Reference*.

If your system is an *n*-way processor operating in single-image mode, you can specify the processor ID as *\*nnnnn-xxxx*. This allows you to use one DIRECTORY statement to define all CPUIDs. See “Usage Notes” on page 496 for more information about defining processor IDs with one DIRECTORY statement.

No processor ID can be specified in an SSI-ready or SSI-enabled source directory.

*sysafnid*

is a 1- to 8-character alphanumeric string that identifies the system whose object directory is affected by the SYSAFFIN statements (see “SYSAFFIN Directory Statement” on page 606).

System affinity is not allowed in an SSI-ready or SSI-enabled source directory.

### SSI

specifies that this directory is to be shared among all members in a single system image cluster. The *altdev*, **EDIT**, *nnnnnn-xxx*, and *sysafnid* operands are not allowed when **SSI** is specified.

### Usage Notes

1. CP dynamically updates the active z/VM directory if your virtual machine has the proper privilege class and one of the following is true:
  - The volume serial number specified is the one on which the directory was found during initialization.
  - No directory has yet been found, and the volume serial number specified is currently owned by CP (as specified using the CP\_OWNED statement in the system configuration file. For more information about the CP\_OWNED statement, see “CP\_OWNED Statement” on page 74.
2. An asterisk (\*) in the first position of the processor ID, *\*nnnnn-xxxx*, lets you use one DIRECTORY statement to define all of the processor IDs of an *n*-way processor operating in single-image mode. Nevertheless, if a four-way processor is partitioned into two logical two-way processors, you must create a DIRECTORY statement for each processor that specifies all 11 digits of the processor ID (*nnnnnn-xxxx*) for each logical processor. This is because the processor ID of the two logical systems would differ only in the first character of the processor ID.
3. When multiple DIRECTORY statements contain the same system affinity ID, the device information (device number, device type, and volume serial number) on all of the statements must be identical.

The maximum number of 16 unique system affinity IDs can be specified on multiple DIRECTORY statements.
4. System affinity is not supported in SSI-ready or SSI-enabled source directories. If **SSI** is specified on the DIRECTORY statement, or if there are any **IDENTITY**, **BUILD**, or **SUBCONFIG** statements in the directory, then no processor id (*nnnnnn-xxxx*) or *sysafnid* can be specified.

### Examples

The following examples show the various ways of coding the DIRECTORY statement:

1. Code the following DIRECTORY statement to specify that:
  - The FBA volume labeled XA0001, at virtual device number 0123, is to contain the new directory
  - The volume at virtual device number 0223 should be used if CP encounters an error while trying to access the directory on virtual device number 0123

```
Directory 0123 fb-512 xa0001 0223
```
2. Code the following DIRECTORY statements to specify:
  - A multiple system definition where a 2064 two-way processor is partitioned into two uniprocessors, SYSTEMA (serial 012345) and SYSTEMB (serial 112345)
  - A 3380 EDIT work volume with a virtual device number of 0243 and a volume serial number of DRM19F

```
Directory 0123 3380 xa0001 0223 012345-2064 systema
Directory 0223 3380 xa0002 0233 112345-2064 systemb
Directory 0243 3380 drm19f edit
```

3. To specify a 2064 four-way processor configured as a single-image processor so that the system can be IPLed on any of the four processors, use the following DIRECTORY statements:

```
Directory 0b64 3380 vmaipl 015211-2064 vma
Directory 0b64 3380 vmaipl 115211-2064 vma
Directory 0b64 3380 vmaipl 215211-2064 vma
Directory 0b64 3380 vmaipl 315211-2064 vma
Directory 0243 3380 drml9f edit
```

Or you can use:

```
Directory 0b64 3380 vmaipl *15211-2064 vma
Directory 0243 3380 drml9f edit
```

4. To specify a 2064 partitioned into two 2-way images, you must use two pairs of DIRECTORY statements, one pair for each image. Each statement in a pair differs only in the first character of the processor ID:

```
Directory 0b64 3390 vmaipl 020893-2064 vma
Directory 0b64 3390 vmaipl 220893-2064 vma
Directory 0784 3380 vmbipl 120893-2064 vmb
Directory 0784 3380 vmbipl 320893-2064 vmb
Directory 0243 3390 drml9f edit
```

5. To specify an *n*-way processor, such as a 2064, that is to be treated as a single image within a complex, use a DIRECTORY statement with an asterisk (\*) in the first character of the processor ID. This ensures that the DIRECTXA command can be entered on any processor in the complex.

```
Directory 0b64 3390 vmaipl *20893-2064 vma
```

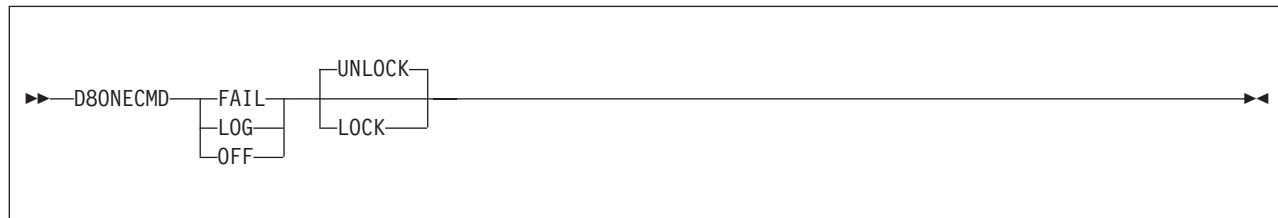
6. To specify a multiple system environment where four 2064 processors share a single directory, use the following DIRECTORY statements:

```
Directory 0123 9336 fba001 0223 012345-2064 fbasysa
Directory 0223 9336 fba002 0223 012355-2064 fbasysb
Directory 0323 9336 fba003 0223 012445-2064 fbasysc
Directory 0423 9336 fba004 0223 013345-2064 fbasysd
```

7. The following is an example of a DIRECTORY statement for an SSI cluster with three member systems:

```
Directory SSI 0123 3390 DIRVOL DIRVOL2 DIRVOL3
```

## D8ONECMD Directory Statement



### Purpose

The D8ONECMD statement is an optional statement that defines whether a virtual machine can issue multiple CP commands using DIAGNOSE code X'08' and separating the commands with X'15's. This statement also tells CP whether to log the commands to the system operator's console.

### How to Specify

The D8ONECMD statement is allowed in profile, user, and identity entries. If specified, it must come before any device statements. (For a list of device statements, see Table 22 on page 457.) You can have only one D8ONECMD statement in an entry. If you specify more than one, you receive an error message. A D8ONECMD statement in a user or identity entry overrides a D8ONECMD statement in an included profile entry.

If you do not specify a D8ONECMD statement, CP does not prevent users from issuing multiple commands with DIAGNOSE code X'08' and allows users to change their D8ONECMD setting.

### Operands

#### OFF

tells CP that this virtual machine can issue multiple commands with DIAGNOSE code X'08' without any logging.

#### FAIL

tells CP to prevent this virtual machine from issuing multiple commands with DIAGNOSE code X'08'. If the virtual machine tries to issue more than one command with DIAGNOSE code X'08', CP will log each command to the system operator's console, process the first command, and reject any subsequent commands in the sequence.

#### LOG

tells CP that this virtual machine can issue multiple commands with DIAGNOSE code X'08' and tells CP to log the multiple commands to the system operator's console.

#### LOCK

tells CP to lock the D8ONECMD setting for a specific virtual machine definition. This prevents users from changing the D8ONECMD setting for their virtual machine.

#### UNLOCK

tells CP not to lock the D8ONECMD setting for a specific virtual machine definition. This allows user to change the D8ONECMD setting for their virtual machine.

## Usage Notes

1. If you omit the D8ONECMD for any virtual machine definition, CP uses the defaults: OFF and UNLOCK. This means everything continues as you expected it to in previous releases of VM. If you want to use the D8ONECMD statement but you are afraid to have CP start rejecting commands, we suggest you use the LOG operand. Using the LOG operand does not cause CP to reject any commands and it provides you with a list of all the commands by logging them to the system operator's console. You can then monitor any multiple command activity until you feel comfortable in switching to the FAIL operand.
2. If you are running an earlier level of CMS and D8ONECMD is set to FAIL, some CMS commands (such as SENDFILE, NETDATA, DISK LOAD, and READCARD) may not work properly. Also an earlier level of the programmable operator facility will not initialize if D8ONECMD is set to FAIL.

## Examples

1. If you wanted to:
  - Prevent a user from issuing more than one command using DIAGNOSE code X'08' and X'15's,
  - Log each of the commands to the system operator's console, and
  - Prevent that user from changing the D8ONECMD setting
 use the following D8ONECMD statement:
 

```
D80neCmd Fail Lock
```
2. If you wanted to:
  - Allow a user to issue multiple commands using DIAGNOSE code X'08' and X'15's,
  - Record each command, and
  - Allow that user to change the D8ONECMD setting
 use the following D8ONECMD statement:
 

```
D80neCmd Log UnLock
```

---

### GLOBALDEFS Directory Statement

►► GLOBALDefs ◄◄

#### Purpose

The GLOBALDEFS statement denotes the start of the global definitions entry. If no global settings are specified, this statement is optional.

#### How to Specify

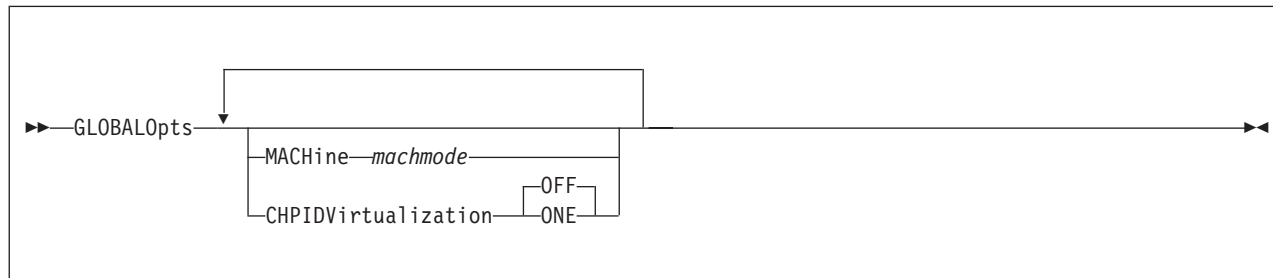
The GLOBALDEFS statement, if specified, must directly follow the DIRECTORY statement(s) and precede all profile, user, identity, and subconfiguration entries. At most one GLOBALDEFS statement can appear in the user directory.

#### Examples

To see an example of the use of this statement, see “GLOBALOPTS Directory Statement” on page 501.



## GLOBALOPTS Directory Statement



### Purpose

The GLOBALOPTS statement is used to define global settings that will be used during user processing.

### How to Specify

The GLOBALOPTS statement, if specified, must be within the global definition entry of the source directory.

### Operands

#### **MACHINE** *machmode*

specifies the virtual machine mode for any virtual machine definition that does not contain a MACHINE directory statement. The valid values that may be used for the virtual machine mode are ESA, XA, and XC.

#### **CHPIDVirtualization** *setting*

specifies the CHPIDVirtualization setting for any virtual machine definition that does not contain an OPTION directory statement with CHPIDVirtualization specified. The valid values for *setting* are ONE and OFF. If this operand is not specified, the default is OFF. GLOBALDEF CHPIDV can only be specified once. If it is specified more than once, an error message is issued.

### Examples

In the examples that follow, assume this multisystem complex definition:

```

Directory 07a4 3380 vmaipl *01234-2064 vma
Directory 0b64 3380 vmbipl 104567-2064 vmb
Directory 0cF4 3380 vmcipl *15211-2064 vmc
Directory 0664 3380 vmdipl *00012-2064 vmd

```

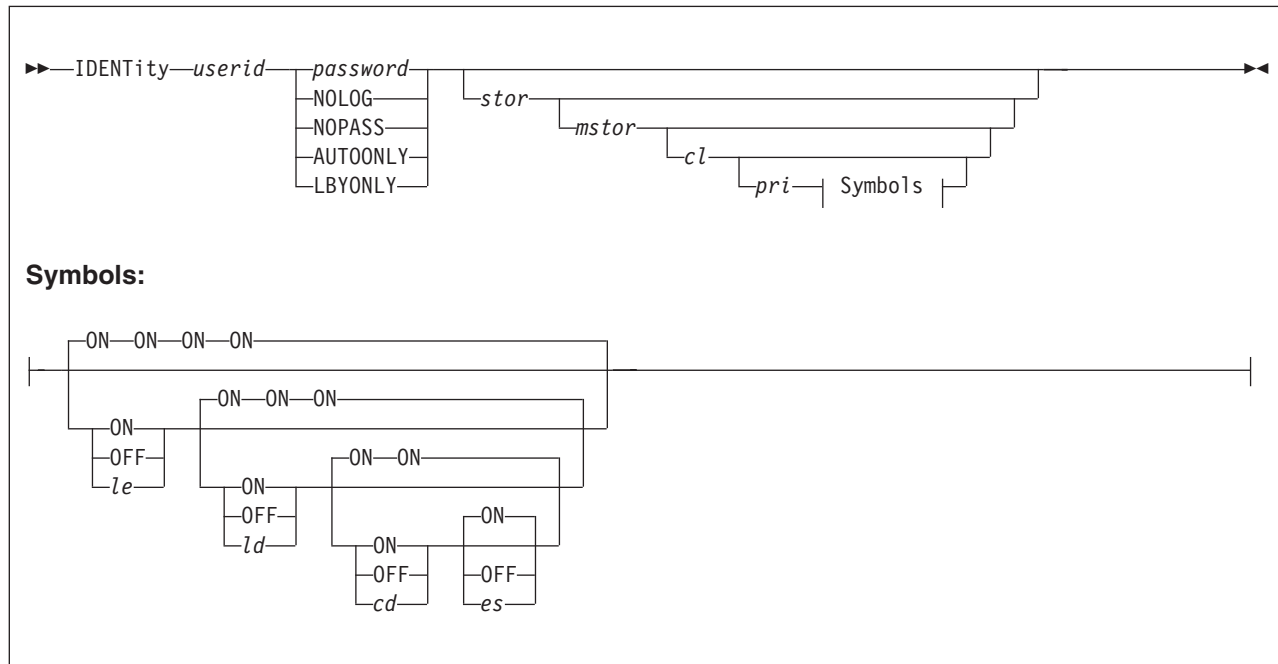
The following global definition entry would define a default machine mode of XA on system vma and a default machine mode of ESA on system vmb.

```

Globaldefs
 Sysaffin vma
 Globalopts machine xa
 Sysaffin vmb
 Globalopts machine esa

```

## IDENTITY Directory Statement



### Purpose

The `IDENTITY` statement is used in combination with the `BUILD` and `SUBCONFIG` statements to create a multiconfiguration virtual machine for use in a single system image (SSI) cluster. The `IDENTITY` statement starts a multiconfiguration virtual machine definition, which consists of an identity entry, any included profile entry, and all associated subconfiguration entries. In an SSI-enabled source directory, this virtual machine definition allows multiple virtual machine instances to be defined, which enables the user ID to be logged on concurrently to multiple members of the SSI cluster. Each of these virtual machine instances can have a different configuration from the others.

### How to Specify

If specified, an `IDENTITY` statement must appear after the `DIRECTORY` statement, global entry, and all profile entries.

When processing the `IDENTITY` statement, `DIRECTXA` checks for a maximum of ten tokens: `userid`, `password`, logon storage size, maximum storage size, privilege class, a placeholder for compatibility with VM/SP, line-end symbol, line-delete symbol, character-delete symbol, and escape character, in that order. If you specify more than ten tokens, `DIRECTXA` ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

#### *userid*

defines the multiconfiguration virtual machine's 1- to 8-character user ID.

`LOGNxxxx`, `LOGLxxxx`, `LOGVxxxx`, `SYSTEM`, and `SYSTEMMP` are reserved for CP use. The `xxxx` can be any character, number, or symbol.

The user ID cannot be the same as a user ID specified on a USER statement or an ID specified on a SUBCONFIG statement.

You should not assign user IDs that are system keywords (such as command names, command operands, or 1- to 4-digit user IDs that could be spool IDs). Assigning system keywords as user IDs can cause unpredictable results. For a list of restricted user IDs, see *z/VM: CP Commands and Utilities Reference*.

You should not assign user IDs that contain colons (:), periods (.), semicolons (;), or slashes (/). These characters are used, or might be used in the future, as delimiters in several CP commands that also take a user ID as a parameter. Results are unpredictable when these commands are entered with a user ID containing any of these delimiter characters.

The characters that you can use for user IDs are restricted by translation test tables in HCPTBL to:

**alphabetics**

A through Z

**numerics**

0 through 9

**others** @ # \$ \_ (underscore) - (hyphen)

**Note:** It is recommended that the characters @, #, ¢, and " not be used in the *userid* because the system, by default, assigns these characters as logical line editing symbols. For a discussion of the system defaults settings for logical line editing symbols, see Appendix B in *z/VM: CP Commands and Utilities Reference*.

You can override the translation tables in HCPTBL. See "TRANSLATE\_TABLE Statement" on page 287.

*password*

specifies a 1- to 8-character password that a user enters during the logon procedure.

**Note:** If DELETEUSER is specified as the password of a user when the DELTA option of the DIRECTXA utility is in effect, the user is marked for deletion in its user index entry. For more information, see the description of DIRECTXA in *z/VM: CP Commands and Utilities Reference*.

**NOLOG**

specifies that a user cannot log on. You can use the NOLOG option to create virtual machines to which no one can log on. For example, you can place special system DASD areas (allocation, warm-start, and checkpoint areas) on minidisks and then assign the minidisks to virtual machines with NOLOG passwords. This helps you identify areas on a DASD.

Also, you can create minidisks for common user data and then assign the minidisks to virtual machines with NOLOG passwords. Users can then enter a CP LINK command to access those minidisks when they need the data.

**NOPASS**

specifies that a user does not require a password to log on. It also specifies that a virtual machine can be automatically logged on using the XAUTOLOG command without password authorization.

Even though a user ID is defined with the NOPASS operand, LOGON password authorization might be required when an external security manager is installed. For more information, see the documentation provided by your external security manager.

## AUTOONLY

specifies that a user can be autologged, but not logged on at a terminal.

## LBYONLY

specifies that:

- Logging on to this virtual machine with the LOGON command requires use of the BY option
- This user ID cannot be used to log on to any virtual machine with the BY option.

Furthermore, this user ID might not be able to perform functions that require password validation, because LBYONLY is not accepted as a valid password.

CP allows an external security manager (ESM) to override these restrictions, so they are effective only when no ESM is installed or when the ESM defers to CP's processing. See the ESM documentation for more information.

## stor

specifies the virtual machine's primary address space size at logon. Specify *stor* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 25).

This operand can contain an asterisk (\*) as a placeholder. If the operand is omitted or specified as an asterisk, this indicates that the storage size is defined by a STORAGE statement in either the identity entry or a profile entry.

Table 25. Maximum Input Values for Storage Units

| Storage unit suffix ( <i>u</i> ) | Maximum input value ( <i>n</i> ) |
|----------------------------------|----------------------------------|
| K - kilobytes                    | 9999999                          |
| M - megabytes                    | 9999999                          |
| G - gigabytes                    | 9999999                          |
| T - terabytes                    | 9999999                          |
| P - petabytes                    | 16384                            |
| E - exabytes                     | 16                               |

## Notes:

1. A K specification is rounded up to an M value.
2. The maximum input value of 9999999 for the K, M, G, or T suffix is not a size limit but the physical limit of the operand (7 digits plus suffix). If the maximum input value for one of these suffixes does not allow you to define the amount of storage you want, you need to use a larger storage unit.
3. The maximum size you can specify is 16E or 16384P, although the actual maximum size supported might be restricted by the model of the server where the directory is used.
4. An XC virtual machine can address up to 2047M of storage in its base address space.
5. Allowing many virtual machine instances to have large storage sizes might affect real storage availability. See usage note 1 on page 506.

## mstor

specifies the maximum size of the virtual machine's primary address space. Specify *mstor* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 25). The default is 1M (1 MB).

This operand can contain an asterisk (\*) as a placeholder. If the operand is omitted or specified as an asterisk, this indicates that the maximum storage size is defined by a MAXSTORAGE statement in either the identity entry or a profile entry.

- cl* specifies the privilege class or classes of CP commands a user can enter. Command classes are A through Z, and 1 through 6. You can specify up to 32 classes (if they fit). Each character represents a single privilege class and can appear in any order, without duplication, and must not be separated by blanks. The class field can also contain an asterisk (\*) as a placeholder. If the field is not specified, or if it contains an asterisk (\*) and there is no CLASS statement, CP uses the default class or classes assigned by the PRIV\_CLASSES statement in the system configuration file (see “PRIV\_CLASSES Statement” on page 212).

**Note:** If you have not changed your classes from the IBM-defined defaults, only classes A through G are valid. For information on defining your own user class structure, see Chapter 16, “Redefining Command Privilege Classes,” on page 443. For a description of the different command classes, see *z/VM: CP Commands and Utilities Reference*.

*pri*

is for VM/SP compatibility and serves no z/VM function. It must be a number from 1 to 99. If the *pri* specification is not entered, the line-end (*le*), line-delete (*ld*), character-delete (*cd*), and escape (*es*) characters default to ON.

*le*

**ON**

**OFF**

*le* is a 1-character line-end symbol or a 2-digit hexadecimal equivalent of the symbol. Input following a line-end symbol begins a new logical line. ON means that the virtual machine instance uses the system value. OFF means that CP does not recognize line-end symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the line-end symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

*ld*

**ON**

**OFF**

*ld* is a 1-character line-delete symbol or a 2-digit hexadecimal equivalent of the symbol. A line-delete symbol causes the previous logical line input to be ignored. ON means that the virtual machine instance uses the system value. OFF means that CP does not recognize line-delete symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the line-delete symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

*cd*

**ON**

**OFF**

*cd* is a 1-character delete symbol or a 2-digit hexadecimal equivalent of the symbol. A character-delete symbol causes the previous character input to be

ignored. ON means the virtual machine instance uses the system value. OFF means that CP does not recognize character-delete symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the character-delete symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

*es*

**ON**

**OFF**

*es* is a 1-character escape symbol or a 2-digit hexadecimal equivalent of the symbol. The escape symbol causes CP to treat the following character literally, without consideration as an *le*, *ld*, or *cd* character. ON means that the virtual machine instance uses the system value. OFF means that CP does not recognize escape symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the escape symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

### Usage Notes

1. Allowing many virtual machines to have large storage sizes might affect real storage availability. For each virtual machine, CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables, segment tables, and higher level (region) tables.  
CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; as such, their impact on real storage depends on how frequently the MBs of storage they reference are used.  
Segment tables and region tables are allocated from host real storage and are not pageable:
  - To reference the page tables for a primary address space or data space up to 2 GB, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.
  - For a primary address space larger than 2 GB, multiple segment tables are created, plus one or more region tables to reference the segment tables. Each region table occupies 1 - 4 contiguous frames. If needed, multiple levels of region tables are created.
2. The IDENTITY statement is used in combination with the BUILD and SUBCONFIG statements to create a multiconfiguration virtual machine definition. A multiconfiguration virtual machine is used in an SSI cluster. See “BUILD Directory Statement” on page 473 and “SUBCONFIG Directory Statement” on page 603.
3. If there are no BUILD statements in the identity entry, the user ID specified on the IDENTITY statement can log on to any member in the SSI cluster. In this case, the multiconfiguration virtual machine instance is logged on using only the settings from the identity entry.
4. If BUILD statements (even if only one) are contained in the identity entry, the user ID specified on the IDENTITY statement can log on only to members that are identified on those BUILD statements. In this case, the multiconfiguration

virtual machine instance is logged on using the common settings from the identity entry and the member-specific settings from the subconfiguration entry.

5. In general, if duplicate specifications exist in an identity entry and its subconfiguration entry, the subconfiguration specification overrides the identity specification, unless noted otherwise in the statement definition. For details on override rules, see the description for each directory statement.

## Examples

1. In an SSI cluster, if you want user ID MAINT to be allowed to log on to any member in the SSI cluster by using a combination of common virtual machine specifications and member-specific virtual machine specifications, create a multiconfiguration virtual machine definition such as:

```
IDENT MAINT MAINTPAS
BUILD ON SYS1 USING SUBCONFIG MAINT1
BUILD ON SYS2 USING SUBCONFIG MAINT2
CLASS ABCDEFG
MDISK 191 3390 100 10 XASRES RR ALL
```

```
SUBCONFIG MAINT1
STORAGE 64M
MDISK 193 3390 200 10 VOLUM2 RR ALL
```

```
SUBCONFIG MAINT2
STORAGE 128M
```

The MAINT multiconfiguration virtual machine definition allows MAINT to log on to SYS1 or SYS2 (or both) using MAINTPAS as a password. MAINT has privilege classes A, B, C, D, E, F, and G on both SSI members. A 191 disk is defined that is global to all MAINT user IDs that log on to SYS1 or SYS2.

On SYS1, MAINT's virtual machine instance storage size at logon is 64M. In addition to the global 191 disk, a 193 disk is defined that is local to MAINT on SYS1.

On SYS2, MAINT's virtual machine instance storage size at logon is 128M. This MAINT virtual machine instance has access to the global 191 disk. The 193 disk defined in the MAINT1 subconfiguration is not defined for MAINT2.

2. In an SSI cluster, if you want user ID WORK to be allowed to log on to only one member in the SSI cluster by using a combination of common virtual machine specifications and member-specific virtual machine specifications, create a multiconfiguration virtual machine definition such as:

```
IDENT WORK WORKPASS
BUILD ON SYS1 USING SUBCONFIG WORK1
```

```
SUBCONFIG WORK1
STORAGE 64M
```

The WORK multiconfiguration virtual machine definition allows WORK to log on to SYS1 only. Since no other BUILD statements are specified, WORK is not allowed to log on to any other member in the SSI cluster.

3. In an SSI cluster, if you want user ID ALLSYS to be allowed to log on to any member in the SSI cluster by using only common virtual machine specifications, create a multiconfiguration virtual machine definition such as:

```
IDENT ALLSYS WORKPASS
STORAGE 64M
```

The ALLSYS multiconfiguration virtual machine definition has no BUILD statements, so ALLSYS is allowed to log on to any member in the SSI cluster.

## INCLUDE Directory Statement

```
►►—INclude—profilename—◄◄
```

### Purpose

The INCLUDE statement specifies the name of a profile entry to be invoked as part of the user or identity entry (see “USER Directory Statement” on page 609 or “IDENTITY Directory Statement” on page 502).

### How to Specify

If you specify an INCLUDE statement, it must directly follow the USER or IDENTITY statement. Normally, you can specify only one INCLUDE statement in a directory entry. However, in a non-SSI multisystem complex sharing a single source directory, you could have multiple INCLUDE statements separated by system affinity records, only one of which can apply to a given system.

### Operands

*profilename*

specifies the name assigned to the profile entry and is used to reference the profile. The variable *profilename* is a 1- to 8-character alphanumeric string. Only one profile name may be specified on an INCLUDE statement.

### Usage Notes

1. DIRECTXA tries to locate the profile name coded on an INCLUDE statement by searching the list of PROFILE entries already processed and being held in free storage buffers. The PROFILE is then processed (included) into the virtual machine definition and analyzed with respect to the rest of the user's definition data.
2. In a non-SSI multisystem complex sharing a single source directory, it is possible to tailor the user's PROFILE definition by system. This is accomplished by selective inclusion of the PROFILE using the internal form of the SYSAFFIN statement.

### Examples

1. To specify PROFILE1 as a profile entry to be invoked as part of the USER statement, use the following statements:
 

```
User example ...
Include profile1
.
.
.
```
2. To tailor a user's profile selection by system in a non-SSI multisystem complex, use the following statements:
 

```
User example ...
Sysaffin vma
Include d123vma
Sysaffin vmb
```



```
Include d123vmb
```

```
.
.
.
```

## IOPRIORITY Directory Statement



### Purpose

The IOPRIORITY statement defines a virtual machine's I/O priority queueing range.

### How to Specify

One IOPRIORITY statement is allowed in a user, identity, or profile entry. An IOPRIORITY statement in a user or identity entry overrides an IOPRIORITY statement in a profile entry.

If you specify the IOPRIORITY statement, it must precede any device statements that you specify in a profile, user, or identity entry. (For a list of device statements, see Table 22 on page 457.)

### Operands

#### ABSolute

indicates the type of I/O priority range. If the LPAR I/O Priority Facility is enabled, the I/O priority range must fit onto the range available to CP. If the range specified falls outside of the range available to CP, an informational message is displayed during LOGON processing, and the requested range is clipped to fall within the range available to CP.

If LPAR I/O Priority Facility is not enabled or not installed, CP simulates an I/O priority range from 0 to 255.

#### RELative

indicates the type of I/O priority range. The maximum I/O priority range is 0 to 255. If LPAR I/O Priority Facility is installed and enabled, the maximum I/O priority range maps proportionately onto the range available to CP, with the highest I/O priority mapping directly to the highest value available to CP. The requested RELATIVE I/O priority range is used to calculate a percentage of the maximum I/O priority range, and the user's effective I/O priority range is the corresponding percentage of the I/O priority range available to CP.

If LPAR I/O Priority Facility is not enabled or not installed, CP simulates an I/O priority range from 0 to 255. Thus, the maximum I/O priority range maps directly onto the range simulated by CP.

#### low

is the low value of the I/O priority range. It must be a number from 0 to 255.

#### high

is the high value of the I/O priority range. It must be a number from 0 to 255 and greater than or equal to the low value. If not specified, the high value is equal to the low value.

## Usage Notes

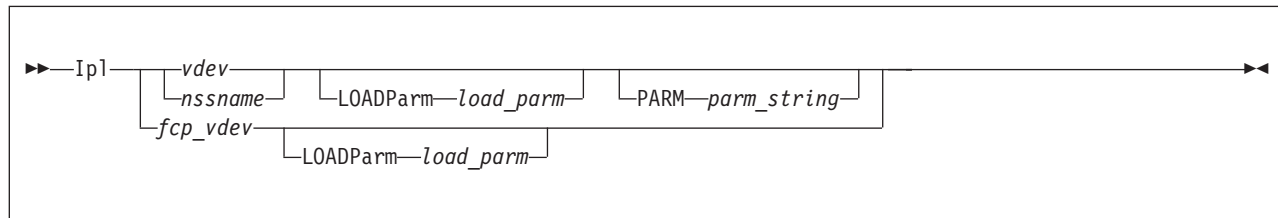
1. If an IOPRIORITY statement is not found, LOGON processing requests RELATIVE I/O priority range with a low value of 0 and a high value of 0.
2. For more information on IOPRIORITY ranges, refer to the CP SET IOPRIORITY command in the *z/VM: CP Commands and Utilities Reference*.

## Examples

1. To assign a RELATIVE range of 8 values, use the following IOPRIORITY statement in a virtual machine definition:

```
ioprior rel 0 7
```

## IPL Directory Statement



### Purpose

The IPL statement designates a named saved system or the device number of a device that CP automatically loads (IPLs) when the user logs on the virtual machine.

### How to Specify

The IPL statement is allowed in profile, user, identity, and subconfiguration entries. An IPL statement in a user or identity entry overrides one in a profile entry. An IPL statement in a subconfiguration entry overrides one in an identity entry.

If you specify the IPL statement, it must precede any device statements in a directory entry. (For a list of device statements, see Table 22 on page 457.)

### Operands

#### *vdev*

is the virtual device number of the device CP is to automatically IPL when the user logs on. The variable *vdev* is any hexadecimal number from X'0000' to X'FFFF'.

#### *nssname*

is the 1- to 8-character alphanumeric name of a named saved system.

#### *fcv\_vdev*

If the specified virtual device is an FCP-attached device, a guest IPL from SCSI disk will be initiated. This feature requires that parameters have previously been defined with the LOADDEV directory statement.

#### **PARM** *parm\_string*

specifies a parameter string to pass to the user's virtual machine in general-purpose registers at the completion of the IPL. When you specify PARM, all characters that follow the statement are considered part of the parameter string. Therefore, you must code the PARM option last on the IPL statement. Although the IPL command allows for 64 bytes of parameters, the string on the directory statement is limited to the number of characters that can be specified in the first 71 positions of the statement. The string begins with the first nonblank character in the statement. (This differs from the IPL command, where trailing blanks are included.)

If you specify an IPL statement using a virtual device number, the parameter string is inserted into the virtual machine registers, 4 bytes per register, starting with register 0. One byte of binary 0's is inserted after the string. If PARM is specified without a parameter string (only blanks), byte 0 of register 0 contains binary 0's. If you omit PARM, the virtual machine's registers remain unchanged.

If you specify an IPL statement using a named saved system that was defined with the `PARMREGS=m-n` operand of the CP `DEFSYS` command, the parameter string is inserted into the virtual machine registers *m* through *n* that are first initialized to binary 0's. (For more information on the CP `DEFSYS` command, see the *z/VM: CP Commands and Utilities Reference*.) If you enter a string larger than can fit in the designated registers, an error message is issued during LOGON and the IPL command is rejected. If you omit `PARM` or specify it with no parameter string, the virtual machine registers contain all 0's.

If you specify an IPL statement using a named saved system that was defined with the `PARMREG=NONE` operand on the CP `DEFSYS` command, any parameter string causes an error message to be issued and the command to be rejected.

If you specify an IPL statement using a named saved system that was defined without the `PARMREGS=m-n` operand on the CP `DEFSYS` command, the parameter string is inserted into virtual machine registers 0 through 15. The registers are not initialized first to binary 0's. If you omit `PARM` or specify it with no parameter string, the virtual machine's registers remain unchanged.

#### **LOADParm** *load\_parm*

specifies a 1- to 8-character load parameter that is used by the IPL'd system. It may be necessary to enclose the load parameter in single quotes. The load parameter may be retrieved by the guest operating system during its IPL sequence. It is preserved until a system-reset-clear operation is performed on the virtual machine; this operation resets it to 8 EBCDIC blanks.

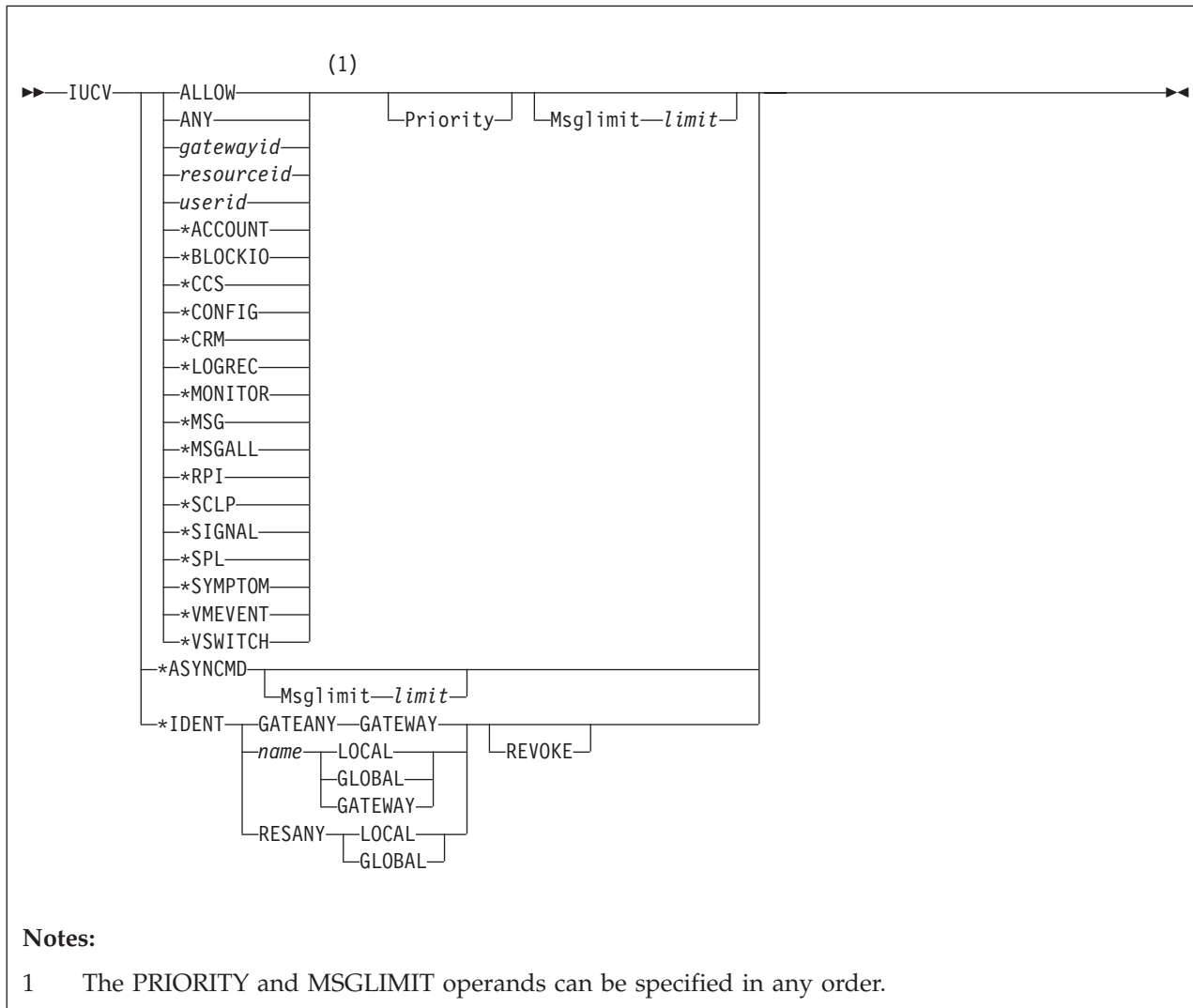
### **Usage Notes**

1. Although the CP IPL command allows up to 64 characters on the `PARM` option, the directory restricts each statement to a single card image. This restriction limits the number of characters that you can enter on the IPL statement in the directory.
2. If a user IPLs a named saved system that was created with the `VMGROUP` option on the CP `DEFSYS` command, that user's virtual machine becomes a member of the virtual machine group known by the NSS name. Members of a virtual machine group can connect to the signal system service to provide signalling within the group, including awareness messages (signal-in and signal-out) about members joining the group or leaving it.
3. A user whose virtual machine is a member of a virtual machine group and has the appropriate privilege class may authorize trace data recording to a system data file for the group.
4. See the *z/VM: CP Commands and Utilities Reference* for detailed information on the IPL command (including information about the `LOADPARM` and `PARM` options).
5. The IPL action may not be completed if the user does not have certain privilege classes. For example, if IPL CMS is coded in a nonclass G virtual machine definition, the IPL fails because CMS issues class G CP commands using DIAGNOSE code X'08'.
6. Specifying the load parameter in single quotation marks gives you leading blanks, embedded blanks, or single quotation marks. Remember that any single quotation mark that is a part of the load parameter must be doubled. For example, use 'BETSY"S' to specify BETSY'S as a load parameter.
7. You may specify both the `LOADPARM` and `PARM` options when IPLing by either *vdev* or *nssname*. The `PARM` option must be the last option on the IPL statement.

### Examples

1. To specify that CP is to automatically IPL virtual device number 490 for a virtual machine, use the following IPL statement in the virtual machine definition:  
`Ipl 490`
2. To specify that CP is to automatically IPL a named saved system called CMS for a virtual machine, use the following IPL statement in the virtual machine definition:  
`Ipl cms`
3. To specify that CP is to automatically IPL virtual device number 490 for a virtual machine and pass parameters XYZ to that virtual machine, use the following IPL statement in the virtual machine definition:  
`Ipl 490 Parm xyz`
4. To specify that CP is to automatically IPL virtual device number 490 for a virtual machine and pass parameters XYZ to the virtual machine and load parm data of BETSY'S, code the following statement in the virtual machine definition:  
`Ipl 490 LOADParm 'betsy''s' Parm xyz`

## IUCV Directory Statement



### Purpose

The IUCV statement authorizes a virtual machine to create an inter-user communications vehicle (IUCV) communication path with another virtual machine or CP system service, or to create APPC/VM communication paths. (To communicate with itself, a virtual machine does not need an IUCV statement in its virtual machine definition.) For CP system services which do not require authorization, this statement can be used to define the message limit.

You can pass information between virtual machines with IUCV. IUCV allows virtual machines to send and receive any amount of data to and from other virtual machines. To use IUCV, you must specify the IUCV statement for the virtual machines that use IUCV. For more information on IUCV, see the *z/VM: Connectivity* book.

## How to Specify

The IUCV statement is allowed in profile, user, and identity entries. If you specify the IUCV statement, it must precede any device statements in an entry. (For a list of device statements, see Table 22 on page 457.)

You can specify multiple IUCV statements within each entry. Any IUCV statements within a profile entry are added to those in the including user entry with no duplicate checking performed.

## Operands

### ALLOW

specifies that any other virtual machine can establish a communication path with this virtual machine. No further authorization is required in the virtual machine that initiates the communication.

### ANY

is a general authorization indicating that a communications path can be established with any other virtual machine, local resource, system resource, global resource, or gateway residing on this VM/ESA system. This option does *not* indicate that a communication path can be established with a CP system service.

### *gatewayid*

is a 1-character to 8-character gateway name used to connect to the resources in the SNA network rather than to a specified virtual machine. The first byte of the gateway name must be alphanumeric. (IBM reserves the names beginning with non-alphanumeric characters for its own use.)

Be sure that the gateway name you specify is not the same as a user ID or resource name on the system, ALLOW, ANY, or SYSTEM.

### *resourceid*

is a 1-character to 8-character resource identifier used to connect to a resource manager rather than to a specified virtual machine. The first byte of the name must be alphanumeric. (IBM reserves names beginning with the remaining characters for its own use.)

Be sure you do *not* specify the same name as a user ID or gateway on the system; or as ALLOW, ANY, or SYSTEM.

Specifying IUCV *resourceid* does not give authority to connect by user ID to the virtual machine that owns the specified resource. At the same time, specifying IUCV *userid* does not give authority to connect by *resourceid* to the specified virtual machine.

When you explicitly authorize each virtual machine (with IUCV *name* or IUCV ANY), you should also give explicit directory authorization to the TSAF virtual machine residing on the same system as the name (with IUCV *name* or IUCV ANY).

### *userid*

is the z/VM user ID of the virtual machine to which an IUCV communication path is authorized.

### \*ACCOUNT

is the Accounting system service, which handles sending accounting records to authorized virtual machines. For further information, see the Account System Service (\*ACCOUNT) in the z/VM: CP Programming Services book.



**\*ASYNCMD**

is the Asynchronous CP Command Response system service, which handles capturing CP command responses as a result of issuing the FOR command. For further information, see the FOR command in the *z/VM: CP Commands and Utilities Reference* book and the Asynchronous CP Command Response System Service (\*ASYNCMD) in the *z/VM: CP Programming Services* book.

**\*BLOCKIO**

is the DASD Block I/O system service, which provides a virtual machine with device-independent, asynchronous access to its CMS-formatted virtual disk devices. For further information, see the DASD Block I/O System Service (\*BLOCKIO) in the *z/VM: CP Programming Services* book.

**\*CCS**

is the Console Communications Services system service. The VTAM service machine (VSM) must be authorized for this system service to use IUCV communication with SNA/CCS. For information on VSM and SNA/CCS, see Chapter 9, "Planning for SNA Console Communication Services (SNA/CCS)," on page 369. This function is reserved for IBM use.

**\*CONFIG**

is the system service used by a virtual machine running the Enterprise Systems Connection Manager (ESCM) licensed program. The function is reserved for IBM use.

**\*CRM**

is the Collection Resource Management system service. This function is reserved for IBM use.

**\*LOGREC**

is the Error Logging system service, which handles sending error log records to authorized virtual machines. For further information, see the Error Logging System Service (\*LOGREC) in the *z/VM: CP Programming Services* book.

**\*MONITOR**

is the Monitor system service, which notifies connected virtual machines when records are created by the z/VM monitor. For further information see the *z/VM: Performance* book.

**\*MSG**

is the Message system service, which allows a virtual machine read messages and responses that come from CP, rather than display them on the terminal. For further information, see Message System Service (\*MSG) in the *z/VM: CP Programming Services* book.

**\*MSGALL**

is the Message All system service, which acts as an alternative to the Message system service, where it will collect all terminal messages and responses. For further information, see the Message All System Service (\*MSGALL) in the *z/VM: CP Programming Services* book.

**\*RPI**

is the Access Verification system service, which handles IUCV communications between the CP access control interface (ACI) and an external security manager (ESM) service virtual machine. For further information, see the Access Verification System Service (\*RPI) in the *z/VM: CP Programming Services* book.

**\*SCLP**

is the SCLP system service, which provides an IUCV communication interface between CP and virtual machines for IBM Hardware Management Console

(HMC) event management. For further information, see “SCLP System Service (\*SCLP)” in *z/VM: CP Programming Services*.

**\*SIGNAL**

is the Signal system service, which allows a virtual machines in a virtual machine group to signal each other. For further information, see the Signal System Service (\*SIGNAL) in the *z/VM: CP Programming Services* book.

**\*SPL**

is the Spool system service, which provides a communication interface using IUCV between CP and virtual machines for print services, reader services, and reader notification. For further information, see the Spool System Service (\*SPL) in the *z/VM: CP Programming Services* book.

**\*SYMPTOM**

is the Symptom system service, which handles sending symptom records to authorized virtual machines. For further information, see the Symptom System Service (\*SYMPTOM) in the *z/VM: CP Programming Services* book.

**\*VMEVENT**

is the VM Event system service, which provides an IUCV communication interface between CP and virtual machines for event notification. For further information, see “VM Event System Service (\*VMEVENT)” in *z/VM: CP Programming Services*.

**\*VSWITCH**

is the virtual switch system service, which allows communication between CP and the TCP/IP for z/VM stack in order to provide device status and other information. This function is reserved for IBM use.

**Priority**

indicates that a communication path with the specified virtual machine can handle priority IUCV communications and IUCV communications that have no priority. If you do not specify PRIORITY, paths authorized by this entry cannot handle priority messages. PRIORITY does not apply to APPC/VM paths. For any communication path routed through ISFC, PRIORITY status is determined by the IUCV directory statement for the initial invoker of the IUCV CONNECT.

**Note:** PRIORITY is ignored for the \*MSG, \*MSGALL, and \*ASYNCMD system services because the virtual machine(s) will only receive messages.

**Msglimit limit**

defines the maximum number of outstanding messages allowed on any path authorized by this entry. If you omit MSGLIMIT or if the IUCV CONNECT and ACCEPT functions specify a lower message limit, the message limit is taken from the CONNECT or ACCEPT parameter list. If you omit MSGLIMIT and the IUCV CONNECT and ACCEPT functions do not specify a message limit, the default value is 10. The maximum allowed value for MSGLIMIT is 65,535. MSGLIMIT does not apply to APPC/VM paths.

For further information on message limits, see the *z/VM: CP Programming Services* book.

**\*IDENT**

allows the virtual machine to connect to the Identify System Service to identify a resource or gateway LU. For further information, see Identify System Service (\*IDENT) in the *z/VM: CP Programming Services* book.

**GATEANY**

allows the virtual machine to identify any gateway LU name.

**Note:** Be careful when you assign names and when you give authorization for GATEANY. A virtual machine that has authority for GATEANY can identify a gateway LU name as *gateany*. Also, this virtual machine would be authorized to identify any other gateway LU name.

#### *name*

is a 1- to 8-character resource or gateway LU name that the virtual machine is authorized to identify. The first byte of the name should be alphanumeric. (IBM reserves names beginning with the remaining characters for its own use.)

Be sure that the name you specify is not the same as a user ID on the system. Also, do not specify the name as any of the following: ALLOW, ANY, or SYSTEM.

Specify LOCAL or GLOBAL for the next operand if the name corresponds to a resource managed by the virtual machine. Specify GATEWAY as the next parameter if the name corresponds to a gateway LU provided by the virtual machine.

#### **RESANY**

allows the virtual machine to identify any resource name.

**Note:** Be careful when you assign names and when you give authorization for RESANY. A virtual machine that has authority for RESANY can identify a resource name as *resany*. Also, this virtual machine would be authorized to identify any other resource name.

#### **LOCAL**

authorizes the virtual machine to identify the resource as a local resource known only to the local system. If you specify LOCAL with RESANY, the virtual machine can identify any resource as a local resource.

#### **GLOBAL**

authorizes the virtual machine to identify the resource as a global resource known to all systems in the collection. This operand allows the virtual machine to identify the resource as local also. If you specify GLOBAL with RESANY, the virtual machine can identify any number of local or global resources.

#### **GATEWAY**

authorizes the virtual machine to identify the gateway LU. If you specify GATEANY as the system gateway name, the virtual machine can identify any gateway LU in the collection.

#### **REVOKE**

authorizes the virtual machine to revoke the specified resource or gateway LU name without owning it. A resource manager can always revoke ownership of resource that it owns by severing its session with the \*IDENT system service. A virtual machine that can revoke resources or gateway LUs can also identify them.

If you specify REVOKE with:

- LOCAL, the virtual machine can revoke and identify the specified resource only on this z/VM system.
- GLOBAL, the virtual machine can revoke and identify:
  - The specified global resource
  - A local or system resource on this z/VM system that has the same name as the global resource.

A virtual machine cannot revoke a global and local resource at the same time. The virtual machine must specify which resource to revoke when the connection is made to \*IDENT.

- GATEWAY, the virtual machine can revoke and identify the gateway LU anywhere within the collection.
- GATEANY, the virtual machine can revoke and identify any gateway LU in the collection. Since gateway LUs are always known throughout the collection, there is no need for the LOCAL or GLOBAL authority keywords.
- RESANY and LOCAL, the virtual machine can revoke and identify any local resource.
- RESANY and GLOBAL, the virtual machine can revoke and identify any resource, local or global.

Because the TSAF virtual machines do not keep track of the local resources, a virtual machine cannot revoke a local resource on another system.

## Usage Notes

1. When a virtual machine invokes the IUCV CONNECT function, IUCV searches virtual machine definitions in the following order:
  - a. The invoker's IUCV statements for the target's user ID
  - b. The invoker's IUCV statements for an ANY virtual machine definitions
  - c. The target's IUCV statements for an ALLOW virtual machine definitions.

Connections invoked from CP system code do not need directory authorization. Priority status and message limit are taken from the CONNECT parameter list.
2. For information on how to specify the maximum number of IUCV connections a virtual machine can make, see the OPTION statement on page “OPTION Directory Statement” on page 561.
3. For information on how to code IUCV programs, see the *z/VM: CP Programming Services* book.
4. Authorization using an IUCV statement is required in order to communicate with certain system services. Table 26 indicates which system services require authorization.

*Table 26. System services requiring authorization*

| System Service                                  | Authorization Required |
|-------------------------------------------------|------------------------|
| *ACCOUNT (Accounting)                           | Yes                    |
| *ASYNCMD (Asynchronous CP Command Response)     | No                     |
| *BLOCKIO (DASD Block I/O)                       | No                     |
| *CCS (Console Communication Services)           | Yes                    |
| *CONFIG (Enterprise Systems Connection Manager) | Yes                    |
| *CRM (Collection Resource Management)           | Yes                    |
| *IDENT (Identify)                               | Yes                    |
| *LOGREC (Error Recording)                       | Yes                    |
| *MONITOR (MONITOR)                              | Yes                    |
| *MSG (Message)                                  | No                     |
| *MSGALL (Message All)                           | No                     |
| *RPI (Access Verification)                      | Yes                    |
| *SCLP                                           | Yes                    |

Table 26. System services requiring authorization (continued)

| System Service            | Authorization Required |
|---------------------------|------------------------|
| *SIGNAL (Signal)          | No                     |
| *SPL (Spool)              | Yes                    |
| *SYMPTOM (Symptom)        | Yes                    |
| *VMEVENT                  | Yes                    |
| *VSWITCH (Virtual Switch) | Yes                    |

**Notes:**

- a. Authorization using an IUCV \*CCS statement is required for a virtual machine running the Enterprise Systems Connection Manager (ESCM) licensed program and when communicating using SNA/CCS.
- b. Authorization using an IUCV \*MONITOR statement is required for a virtual machine to receive information concerning the location of monitor records in a saved segment for monitor. Without \*MONITOR on the IUCV statement, a user cannot issue IUCV CONNECT to \*MONITOR.  
 After a virtual machine is connected, it receives notifications from IUCV SEND commands whenever data is in the monitor saved segment. The IPARML points to the guest real addresses in the saved segment where the monitor control area lies. The control area points to each data area.  
 More than one virtual machine can have an IUCV \*MONITOR statement. If so, every virtual machine with an IUCV \*MONITOR statement can connect concurrently to \*MONITOR.
- c. Before communications can be established with the \*RPI system service, an external security manager must be installed on the system.
5. When the virtual machine definition associated with a resource manager user ID contains \*IDENT authority to identify or revoke any resources or gateway LUs, this information is saved in storage and checked in place of a subsequent directory search. This reduces the number of directory searches required when a resource manager virtual machine identifies or revokes resources (thereby improving performance). This means that if \*IDENT authority is updated, it is not recognized until the resource manager stops using IUCV support and restarts.
6. If a virtual machine must identify more than one resource, you can specify more than one IUCV statement for \*IDENT in the virtual machine definition. To check whether a virtual machine is authorized to identify or revoke the resource or gateway LU named in the IUCV CONNECT request presented to \*IDENT, the Identify System Service searches the virtual machine definition for IUCV statements in the following order:
  - a. The first \*IDENT entry that has either the resource name RESANY or the gateway LU name GATEANY (depending on the type of name). If \*IDENT finds a match, it checks whether the LOCAL or GLOBAL (for resources) and REVOKE operands have enough authority to do the requested function.
  - b. If it does not find a match, or if the other operands are not enough authority, \*IDENT searches for the first \*IDENT entry that has the same resource name or gateway LU name as specified on the CONNECT request.
  - c. If \*IDENT does not find a match, or if it finds a match but authorization for the LOCAL or GLOBAL (for resources) and REVOKE operands does not

correspond to that specified in the CONNECT parameter list, \*IDENT severs the requested connection, and the resource or gateway LU is not identified.

## Examples

1. To indicate that a virtual machine can establish an IUCV communication path to SOURCE, use the following statement in the virtual machine definition:

```
Iucv source
```

2. To indicate that a virtual machine can establish both of the following:
  - a. An IUCV communication path to SOURCE
  - b. A priority IUCV communication path with a message limit of 100 to TARGET

use the following statements in the virtual machine definition:

```
Iucv source
Iucv target Priority MsgLimit 100
```

3. To indicate that a virtual machine can establish:
  - a. A priority IUCV communication path with a message limit of 100 to TARGET
  - b. IUCV communication paths with any other virtual machine

use the following statements in the virtual machine definition:

```
Iucv target Priority MsgLimit 100
Iucv Any
```

4. To indicate that any virtual machine can establish a path to the virtual machine whose virtual machine definition you are creating, use the following statement:

```
Iucv Allow
```

5. The following examples show how to use multiple IUCV statements for \*IDENT.

- a. A resource manager, RESMGR1, has the following IUCV statements:

```
Iucv *Ident ResAny Global
Iucv *Ident residx Local Revoke
```

The first IUCV statement authorizes RESMGR1 to identify any resource (RESANY) as a local or global resource (GLOBAL). This includes the local resource, RESIDX. The second IUCV statement authorizes RESMGR1 to revoke (REVOKE) the resource RESIDX, if it is defined on the local system as a local resource (LOCAL).

- b. A resource manager, RESMGR2, has the following IUCV statements:

```
Iucv *Ident Gateany Gateway
Iucv *Ident gatewayx Gateway Revoke
```

The first IUCV statement authorizes RESMGR2 to identify any gateway LU. This includes the gateway LU, GATEWAYX. The second IUCV statement authorizes RESMGR2 to revoke the gateway LU GATEWAYX, but no other gateway LUs.

Because gateway LUs are always known throughout the collection, no keyword is needed to authorize a user to identify a gateway LU that can be accessed only by users on the local system.

- c. A resource manager, RESMGR3, has the following IUCV statements:

```
Iucv *Ident residx Global
Iucv *Ident residy Global
Iucv *Ident ResAny Local Revoke
```

RESMGR3 can identify the resources, RESIDX and RESIDY, as local and global resources. RESMGR3 is not authorized to revoke any global resources. Because of the last IUCV statement, RESMGR3 can identify any resource as a local resource. Also, RESMGR3 can revoke any resource known on the local system as a local resource.

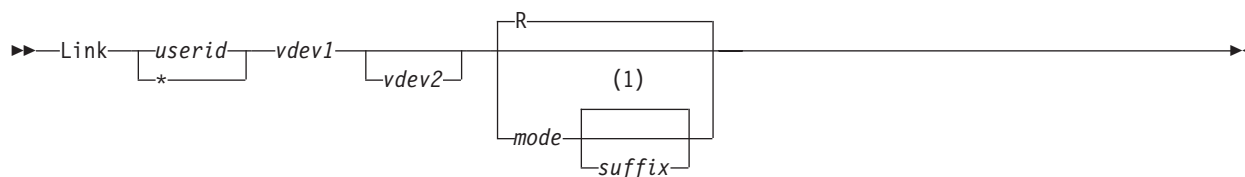
- d. A resource manager, RESMGR4, has the following IUCV statements:

```
Iucv *Ident residx Local
Iucv *Ident residy Global
Iucv *Ident residx Global Revoke
```

RESMGR4 can identify the resource RESIDX as a local resource and the resource RESIDY as either a local or global resource. RESMGR4 cannot revoke any resources, because \*IDENT searches for the first entry that matches the resource name specified on the CONNECT. If RESMGR4 tries to connect to \*IDENT to identify or revoke the GLOBAL resource, RESIDX, \*IDENT severs the connection. In this case, if you want RESMGR4 to identify and revoke the global resource, RESIDX, you must delete the first IUCV statement.



## LINK Directory Statement



### Notes:

- 1 The default is a blank.

## Purpose

The LINK statement gets access to another user's minidisk. The target minidisk must be defined by an MDISK statement in the target virtual machine definition (see "MDISK Directory Statement" on page 539). The DASDOPT statement is an extension to the LINK statement. If no DASDOPT statement follows it, the LINK directory statement defaults to NOCTL (which behaves like the LINK command). For more information on the DASDOPT statement, see "DASDOPT Directory Statement" on page 486.

## How to Specify

The LINK statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the LINK statement, it must follow any general statements you specify in a directory entry. (For a list of general statements, see Table 22 on page 457.)

Multiple LINK statements are allowed within an entry. Any LINK statements in a subconfiguration entry are processed first at logon time, followed by LINK statements in a user or identity entry, followed by LINK statements in a profile entry. LINK statements with duplicate virtual device numbers within an entry are errors. No user/identity-to-profile or identity-to-subconfiguration duplicate virtual device number checking is performed.

When processing the LINK statement, DIRECTXA checks for a maximum of five tokens: target user ID, virtual device number (or address) of the target minidisk, virtual device number (or address) for the linking virtual machine, access mode, and a suffix of S or E. If you specify more than five tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

## Operands

*userid*

is the virtual machine user ID of the target minidisk owner.

\* indicates that the user being processed owns the minidisk.

*vdev1*

is the virtual device number or virtual address of the target minidisk.



*vdev2*

is the virtual device number or virtual address that the linking virtual machine uses for the target minidisk. If you omit *vdev2*, the definition of *vdev1* is used.

*mode*

is the access mode for the minidisk. The first letter in the access mode is the primary access mode (read-only, write, or multiple-write); the second letter (optional) is the alternate access (read-only or write). A suffix letter, S or E, may be added to any of the one or two letter modes to provide this user specific authorization for use of stable or exclusive link modes when linking the specified minidisk using the LINK command, the CMS VMLINK command, or DIAGNOSE code X'E4'.

The access modes are:

- R** Read-only access. Read access is established, unless another user holds a write or an exclusive mode (ER, EW) access to the disk. If you omit the mode, R is the default.
- RR** Read-only access. Read access is established, unless another user holds an exclusive mode (ER, EW) access.
- W** Write access. Write access is established, unless another user holds access (any mode) to the disk.
- WR** Write access. Write access is established unless another user holds access (any mode) to the disk. If write access is denied, read access is established unless another user holds an exclusive (ER, EW) mode access for the disk.
- M** Multiple-write access. Write access is established unless another user holds a write, a stable (SR, SW, SM) or an exclusive (ER, EW) mode access to the disk.
- MR** Multiple-write access. Write access is established unless another user has a write, stable mode (SR, SW, SM) or exclusive mode (ER, EW) access to the disk. In the case of a previous write or stable access, read-only access is established. In the case of an exclusive mode access existing, read access is also denied.
- MW** Multiple-write access. Write access is established in all cases except when another user holds either a stable (SR, SW, SM) or an exclusive mode (ER, EW) access to the disk.

*suffix*

The optional suffix letters authorize virtual reserve/release and the use of the stable and exclusive (data integrity) access modes of the LINK command and DIAGNOSE code X'E4'. The specification on the LINK statement allows the user to enter a LINK command with the specified type of access mode, stable or exclusive, against the specified user's minidisk. For more information about stable and exclusive access modes, see the *z/VM: CP Commands and Utilities Reference*.

The suffix letters can be combined as follows (note that CP requires they be specified in this order):

1. S, E, or null (S and E are mutually exclusive), plus
2. D or null.

Therefore, the only valid combinations are: S, E, D, SD, or ED. This suffix is in turn concatenated with the mode, with no intervening blanks. For example, RS, RRE, and MRSD are all valid.

## LINK

- S** Authorizes the virtual machine to use the LINK command stable access modes (SR, SW, SM) against the specified user's minidisk.
- E** Authorizes the virtual machine to use the LINK command exclusive and stable access modes (ER, EW, SR, SW, SM) against the specified user's minidisk.
- D** Tells CP that the device should not be defined when the virtual machine initially logs on or is autologged, but to defer doing so until an explicit LINK command is issued for that device.

### Usage Notes

1. It is the responsibility of the operating system running in each virtual machine to keep data from being destroyed or altered on shared disks.
2. CMS allows many virtual machines to have read access to the same minidisk; however, CMS does not supervise virtual machines that have write access to the same minidisk. If two or more CMS virtual machines have write access to the same disk, all data on the disk may be destroyed.

Also note that CP does not prevent a virtual machine with an MW access to another virtual machine's minidisk from formatting that minidisk.

3. The use of the stable (SR, SW, and SM) and exclusive (ER and EW) link modes can be authorized in two different ways:
  - Globally, using the OPTION statement values, LNKSTABL and LNKEXCLU (see "OPTION Directory Statement" on page 561).
  - Specifically, using the mode suffix letters (S or E) on the LINK or MDISK statements (see "MDISK Directory Statement" on page 539).
4. Do not add LINK statements to the z/VM directory shared file system file pool minidisks. Shared file system file pool server machines link to the file pool minidisks when needed.
5. Use the LINK statement to give a user direct access to another user's minidisk, or indirect access by linking to a third user's LINK or MDISK statement. You can have up to 50 of these *indirect* links (LINK indirections). For example:

```
USER0
 MDISK 393 3390 1 10 USRVOL ALL ALL ALL
USER1
 LINK USER0 393 393 RR
USER2
 LINK USER1 393 393 RR
USER3
 LINK USER2 393 393 RR
```

Since USER1 has had to first access the 393 minidisk through a direct link to USER0, USER2's link to the 393 minidisk is considered an indirect link. USER3's link to the 393 minidisk through USER2 is thus also an indirect link. Up to 50 of these indirect links are allowed before the following message is issued:

#### HCP109E

*userid vdev* not linked; excessive LINK indirections

**Note:** This limit of 50 indirect links includes the original link. (In the example, USER1 to USER0.)

6. If the target minidisk is a virtual disk in storage that is defined in the specified virtual machine definition but currently does not exist, the virtual disk in storage is created to satisfy the request, as long its creation does not

exceed the system limit on the storage available for virtual disks in storage. Note that a new virtual disk in storage must be formatted before it can be used.

7. If a minidisk is defined as virtual device number 192 in the linking virtual machine, the following special rules apply when that virtual machine IPLs CMS:
  - If 192 is an unformatted virtual disk in storage, CMS formats it and accessed it as file mode D.
  - If 192 is a CP-formatted virtual disk in storage, CMS reformats it for CMS use and accesses it as file mode D.
  - If 192 is a CMS-formatted virtual disk in storage or permanent minidisk that is accessed as a file mode other than D, CMS reaccesses it as file mode D.
  - If 192 is an unformatted or CP-formatted permanent minidisk, CMS does not automatically format, reformat, access, or reaccess it.

When CMS accesses a 192 minidisk as file mode D, any minidisk or SFS directory already accessed as D is released.

8. If the directory definition of a permanent minidisk is changed while users are linked to it, existing links are unchanged, but any new links are made using the new definition of the minidisk. Unpredictable results may occur.
9. If the directory definition of a virtual disk in storage is changed while users are linked to it, existing links are unchanged, and any new links are made to the existing virtual disk in storage. The existing virtual disk in storage is used until the last user detaches it or logs off, at which time the virtual disk in storage is destroyed. After that, any new links use the new definition of the virtual disk in storage.
10. If you are linking a minidisk where the MDISK statement has been defined with the V mode suffix or WRKALLEG has been specified on the MINIOPT or DASDOPT extension of the MDISK, see the LINK command in *z/VM: CP Commands and Utilities Reference* for restrictions when linking.

## Examples

1. To link in read-only mode LINKMAN's 191 disk to a virtual machine as a 192 disk, use the following LINK statement in the virtual machine definition:

```
Link linkman 191 192 rr
```

2. To link in write mode LINKMAN's 291 disk to a virtual machine as a 292 disk, use the following LINK statement in the virtual machine definition:

```
Link linkman 291 292 wr
```

WR indicates that write access is given only if no one else is linked to the disk; if someone else is linked to the disk, read access is given.

3. To authorize a specific user the ability to enter the LINK command with one of the stable access modes, use the following LINK statement in the virtual machine definition:

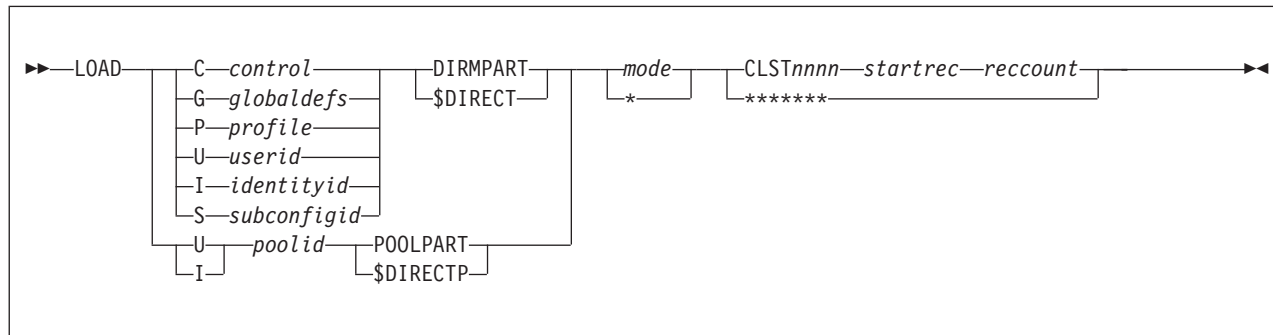
```
Link linkman 191 291 rrs
```

RRS ensures the virtual machine a default logon access of read to the specified disk and permits this virtual machine to issue the LINK command with one of the stable modes at a later time. If the virtual machine issues the LINK command specifying the issuer's own directory and the stable read access mode

## LINK

of SR, password-level authorization will not be necessary. However, if a higher level of access (such as SW or SM) is requested, password-level authorization would be required.

## LOAD Directory Statement



### Purpose

The LOAD statement tells DIRECTXA where the specified directory definition entry is located in a separate file or in a cluster file.

### How to Specify

Use this statement only if the entire directory is being maintained in cluster-file format. If it is, this is the only record type found in the USER DIRECT file.

When processing the LOAD statement, DIRECTXA checks for a maximum of five tokens when a separate part file is specified or seven tokens when a cluster file is specified. If you specify more tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

C  
G  
P  
U  
I  
S

**S** specifies the type of definition to be loaded; C for CONTROL, G for Global definitions, P for PROFILE, U for USER, I for IDENTITY, and S for SUBCONFIG.

#### *control*

specifies the file name of the file if the control definition (consisting only of DIRECTORY statements) is in a separate file. Otherwise, this operand is ignored.

#### *globaldefs*

specifies the file name of the file containing the global definitions. If the global definitions are not in a separate file, this operand is ignored.

#### *profile*

specifies the name of the profile. If the profile definition is in a separate part file, *profile* is also the file name of the file.

#### *userid*

specifies the user ID. If the user definition is in a separate part file, *userid* is also the file name of the file.

*identityid*

specifies the IDENTITY user ID. If the IDENTITY definition is in a separate part file, *identityid* is also the file name of the file. For a description of the IDENTITY user ID, see “IDENTITY Directory Statement” on page 502.

*subconfigid*

specifies the SUBCONFIG ID. If the SUBCONFIG definition is in a separate part file, *subconfigid* is also the file name of the file. For a description of the SUBCONFIG ID, see “SUBCONFIG Directory Statement” on page 603.

*poolid*

specifies the pool ID (the 1- to 3-character user ID used to define the pool). If the pool definition is in a separate part file, *poolid* is also the file name of the file.

**DIRMPART****\$DIRECT**

specifies the file type of the file if the directory definition is in a separate part file; otherwise, this operand is ignored.

**POOLPART****\$DIRECTP**

specifies that the directory definition is for a pool of users. If the directory definition is in a separate part file, the file type of the file must be DIRMPART or \$DIRECT (DIRMPART if POOLPART is specified; \$DIRECT if \$DIRECTP is specified).

**mode**

- \* specifies the alphabetic portion of the file mode of the separate part file or of the cluster file that contains the directory definition. If the mode is an asterisk (\*), CP uses the CMS search order to locate the files.

**CLSTnnnn****\*\*\*\*\***

specifies whether the directory definition entry is located in a separate part file or in a cluster file. If this operand is specified as **\*\*\*\*\***, the directory is located in a separate part file. Otherwise, the directory definition is located in the cluster file identified by CLSTnnnn CLUSTER *mode*, where *nnnn* is a decimal number from 0000 to 9999.

*startrec*

specifies the starting record number of the directory definition in the specified cluster file. The number must be greater than 0 and in decimal format.

*reccount*

specifies the record count of the specified directory definition in the cluster file. The number must be greater than 0 and in decimal format.

**Usage Notes**

1. The following restrictions apply to cluster format and content:
  - A USER DIRECT file maintained in cluster file format should contain only one type C definition, followed by zero or one type G definitions, followed by zero or more type P definitions, followed by zero or more type U, I, and S definitions. U, I, and S definitions can be intermixed.
  - Each definition in a cluster format source directory should contain only the named definition: the type C should contain only the DIRECTORY statements, the type G should contain only global definition statements, each type P should contain only the named PROFILE definition, each type U

should contain only the named USER definition, each type I should contain only the named IDENTITY definition, and each type S should contain only the named SUBCONFIG definition.

- The first directory statement of each definition should match the definition type. Thus, the first directory statement in a type C definition should be a DIRECTORY statement, the first directory statement in a type G definition should be a GLOBALDEFS statement, the first directory statement in a type P definition should be a PROFILE statement, the first directory statement in a type U definition should be a USER statement, the first directory statement in a type I definition should be an IDENTITY statement, and the first directory statement in a type S definition should be a SUBCONFIG statement. Note also that comments and blank lines cannot be the first line in a definition. (This restriction is due to the relationship between DIRECTXA and DIRMAINT.)
- 2. DIRMPART and \$DIRECT are the only file types recognized for separate part files in a cluster file installation. The file types DIRMPART and \$DIRECT are interchangeable. However, DIRMPART is preferred. \$DIRECT is a temporary file type used by DIRMAINT.
- 3. When you define a pool of users, you must specify POOLPART (or \$DIRECTP). If the definition is in a separate part file, the file type of the separate part file must be DIRMPART (or \$DIRECT).
- 4. When you use the z/VM Directory Maintenance Facility (DIRMAINT) to maintain the source directory, you should leave the creation and maintenance of the LOAD statements strictly to DIRMAINT.
- 5. To migrate a manually created and maintained cluster format source directory to DIRMAINT, it must first be converted to the sequential format.

## Examples

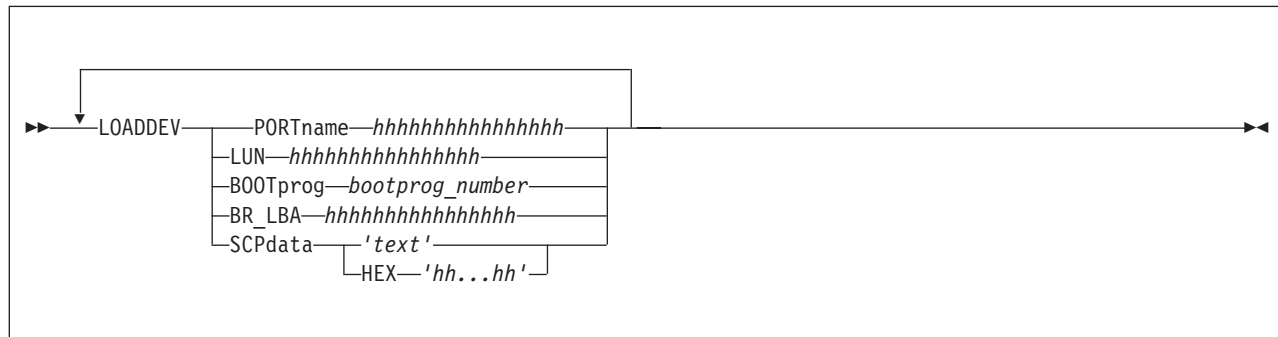
To define a directory in cluster file format with:

- Three POSIXGROUP definitions, GRP0001, GRP0002 and GRP0003, in a separate global definition part file
- Two profiles, DEPT0000 and DEPT0001, where one is in a separate part file and the other is in a cluster file
- Three users, USER0001, USER0002, and USER0003, where two are in a cluster file and the third is in a separate part file
- An IDENTITY and its SUBCONFIGs, for which the IDENTITY and one of the SUBCONFIGs are in separate files but the other SUBCONFIG statement is in the cluster file
- Two pools of users, USR00001 through USR00025, and USR00050 through USR00075, where one is a separate part file and the other is in a cluster file

you might use the following LOAD statements:

```
Load C $directl$ dirmpt e *****
Load G glbdefs dirmpt e *****
Load P dept0000 dirmpt e *****
Load P dept0001 dirmpt e clst0000 1 20
Load S tcpip001 dirmpt e *****
Load U user0001 dirmpt e clst0000 21 5
Load I tcpip dirmpt e *****
Load U user0002 dirmpt e clst0000 26 5
Load U user0003 dirmpt e *****
Load S tcpip002 dirmpt e clst0000 97 4
Load U usr poolpart e *****
Load U usr poolpart e clst0000 31 2
```

## LOADDEV Directory Statement



**Note:** The maximum SCPDATA that can be input is 4,096, whether as a text string in quotation marks or as hex characters.

### Purpose

Use the LOADDEV directory statement to identify the location of a program to be loaded as a result of a guest IPL from SCSI disk. Additionally, information to be passed to the program can also be defined.

### How to Specify

LOADDEV statements are allowed in profile, user, identity and subconfiguration entries. Each LOADDEV statement can specify only one operand and the associated operand value. If you specify additional tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

If you specify the LOADDEV statement, it must precede any device statements you specify in an entry. (For a list of device statements, see Table 22 on page 457.) Multiple LOADDEV statements are allowed within an entry. Each operand can be specified only once within an entry.

Individual operand values on LOADDEV statements in the subconfiguration entry override the corresponding operand values in the identity entry. Values for operands specified in the identity entry but not in the subconfiguration entry retain their value. The result is that the LOADDEV is a merging of all settings, with operand values in the subconfiguration entry overriding the corresponding values in the user or identity entry and operand values in the user or identity entry overriding the corresponding values in the profile entry.

### Operands

#### PORTname

The hexadecimal digits designating the one- to eight-byte fibre channel port name of the FCP-I/O device. It must be a value from X'0-FFFFFFFFFFFFFFFF'. There is no default.

#### LUN

The hexadecimal digits representing the one- to eight-byte logical unit number of the FCP-I/O device. It must be a value from X'0-FFFFFFFFFFFFFFFF'. The default is 0.



**BOOTprog**

The decimal value between 0 and 30 representing the script to IPL from.

**BR\_LBA**

The hexadecimal digits designating the logical-block address of the boot record of the FCP-I/O device. It must be a value from X'0-FFFFFFFFFFFFFFFF'. The default is 0.

**SCPDATA**

Designates information to be passed to the program which was loaded during guest IPL. If the program does not require any information, then this operand is optional. Up to 4096 (4 KB) characters of data (text or hex) may be entered for SCPDATA. The actual number of input characters could be less depending on the translation to UTF-8. Because two hex characters are required to represent each UTF-8 data byte, the maximum number of UTF-8 data bytes that can be defined using the HEX option is 2048 (1/2 of the 4 KB character input limit). The hex string must be an even number of digits. There is no default.

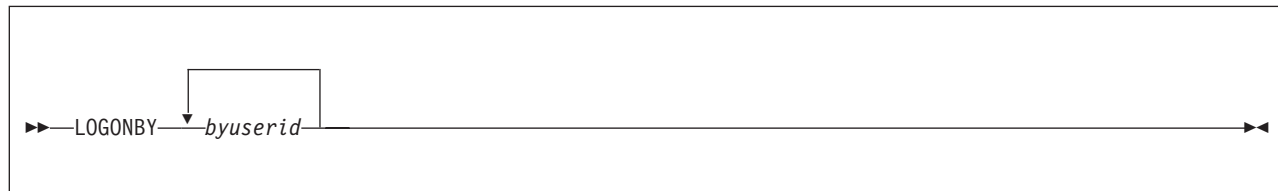
**HEX**

Indicates that the operand value that follows is UTF-8 encoded hex (characters 0-F). If not specified, the value is assumed to be EBCDIC text (codepage 924).

**'text'**

The text string in quotation marks is assumed to be in codepage 924.

## LOGONBY Directory Statement



### Purpose

The LOGONBY statement designates up to eight user IDs that can use their own passwords to log on to and use the virtual machine.

### How to Specify

The LOGONBY statement is allowed in profile, user, and identity entries. The LOGONBY statement must precede any device statements in an entry. (For a list of device statements, see Table 22 on page 457.) An entry can contain several LOGONBY statements, and more than one LOGONBY user ID can be specified on each statement, but the maximum total of LOGONBY user IDs that can be specified in a user, identity, or profile entry is eight.

### Operands

*byuserid*

is a 1- to 8-character user ID that is to log on to this virtual machine with the BY operand. Up to eight user IDs can be specified.

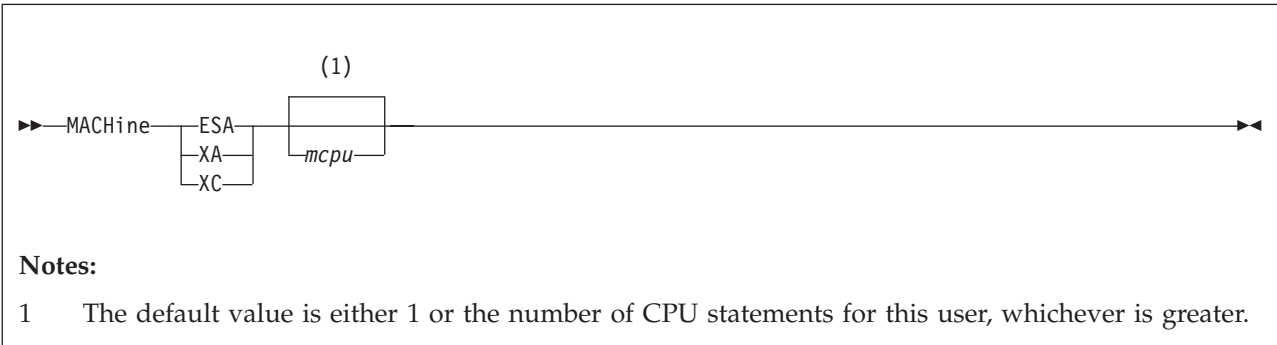
### Usage Notes

1. When an External Security Manager (ESM) such as RACF is installed, the authorization provided by the LOGONBY statement may be overridden. Also, RACF support has been added to perform authorization checks for attempts to log on to shared user IDs. Refer to documentation provided by your ESM for further details.
2. When a user logs on with the BY operand, that user's ID is the by-user ID for the virtual machine.
3. The password of the by-user ID is used for LOGON authorization checking. See the *z/VM: CP Commands and Utilities Reference* for information about the BY operand of the CP LOGON command.
4. The current by-user ID for a virtual machine can be queried by using the CP QUERY BYUSER command, DIAGNOSE X'260' subcode 4, or DIAGNOSE X'26C' subcode 4.

### Examples

1. To authorize user ID LARRY to log on to a virtual machine with the BY operand, put this LOGONBY statement in the virtual machine definition:  
LOGONBY larry
2. To authorize user IDs OPER1, OPER2, OPER3, and JONES to log on to a virtual machine with the BY operand, put this LOGONBY statement in the virtual machine definition: LOGONBY oper1 oper2 oper3 jones

# MACHINE Directory Statement



## Purpose

The MACHINE statement specifies the virtual machine architecture.

## How to Specify

The MACHINE statement is allowed in profile, user, and identity entries. Only one MACHINE statement is allowed in each entry. If you specify the MACHINE statement, it must precede any device statements you specify in an entry. (For a list of device statements, see Table 22 on page 457.) A MACHINE statement in a user or identity entry overrides a machine statement in an included profile entry.

When processing the MACHINE statement, DIRECTXA checks for a maximum of two tokens: architecture type and maximum virtual processors, in that order. If you specify more than two tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

## Operands

- ESA**  
designates an ESA virtual machine, which simulates ESA/390 architecture.  
A guest operating system may have the capability to issue an instruction to switch the virtual machine to z/Architecture mode.
- XA** designates an XA virtual machine, which is functionally equivalent to an ESA virtual machine.
- XC** designates an XC virtual machine, which simulates ESA/XC architecture.
- mcpu*  
defines the maximum number of virtual processors the user can define. The number must be between 1 and 64 (decimal). The default value is either 1 or the number of CPU statements for this user, whichever is greater.

## Usage Notes

1. If you omit the MACHINE statement when you code a virtual machine definition:
  - The user's virtual machine mode is defined by the mode specified by the GLOBALOPTS directory statement. If no mode is specified in the GLOBALOPTS directory statement, the default mode will be ESA.

## MACHINE

- Additionally, if no CPU statements are in the virtual machine definition, the virtual machine has no virtual multiprocessor capabilities. However, if CPU statements are in the virtual machine definition, the number of these statements determines the allowable number of virtual processors.
2. For information on globally changing the default architecture, see “GLOBALOPTS Directory Statement” on page 501.
  3. For information on defining multiple virtual processors for a virtual machine, see *z/VM: Running Guest Operating Systems*.
  4. For compatibility, z/VM continues to accept the designation XA and continues to report XA as the virtual machine mode in response to the QUERY SET and INDICATE USER commands when the virtual machine has been defined using the XA designation. However, whether the virtual machine is defined as XA or ESA makes no difference when running on z/VM. A virtual machine defined as XA has the capabilities of an ESA virtual machine and is considered by CP to be an ESA virtual machine.

### Examples

1. To specify that a virtual machine can simulate ESA/390 architecture, use the following MACHINE statement in the virtual machine definition:  

```
Machine esa
```
2. To specify that a virtual machine can simulate ESA/390 architecture and define a maximum of 12 virtual processors, use the following MACHINE statement in the virtual machine definition:  

```
Machine esa 12
```
3. To specify that a virtual machine can simulate the ESA/XC architecture, use the following MACHINE statement in the virtual machine definition:  

```
Machine xc
```

## MAXSTORAGE Directory Statement

►► MAXSTORAGE *size* ◀◀

### Purpose

The MAXSTORAGE statement specifies the maximum virtual storage size for a user.

### How to Specify

The MAXSTORAGE statement is allowed in profile, user, identity, and subconfiguration entries. If specified, it must appear before any device statements in the entry. (For a list of device statements, see Table 22 on page 457.) A MAXSTORAGE statement is allowed in a profile if the USER or IDENTITY statement maximum storage size field of each of the including directory entries is either omitted or specified as an asterisk (\*). A MAXSTORAGE statement in a user or identity entry overrides one in a profile entry.

If MAXSTORAGE or STORAGE statements are specified in the subconfiguration entry, then those statements override any in the identity entry. If either a STORAGE or MAXSTORAGE statement is specified, but not the other, within a subconfiguration entry, then the default is applied to the other in the subconfiguration entry. The combination of the specified value and the default then override whatever settings were specified in the identity entry.

### Operands

#### *size*

is the maximum storage size of the virtual machine. Specify *size* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 27).

Table 27. Maximum Input Values for Storage Units

| Storage unit suffix ( <i>u</i> ) | Maximum input value ( <i>n</i> ) |
|----------------------------------|----------------------------------|
| K - kilobytes                    | 9999999                          |
| M - megabytes                    | 9999999                          |
| G - gigabytes                    | 9999999                          |
| T - terabytes                    | 9999999                          |
| P - petabytes                    | 16384                            |
| E - exabytes                     | 16                               |

#### Note:

1. A K specification is rounded up to a MB value.
2. The maximum input value of 9999999 for the K, M, G, or T suffix is not a size limit but the physical limit of the operand (7 digits plus suffix). If the

maximum input value for one of these suffixes does not allow you to define the amount of storage you want, you need to use a larger storage unit.

3. The maximum size you can specify is 16E or 16384P, although the actual maximum size supported may be restricted by the model of the server where the directory is used.
4. An XC virtual machine can address up to 2047 MB of storage in its base address space.
5. Allowing many virtual machines to have large storage sizes might affect real storage availability. See usage note 1.

### Usage Notes

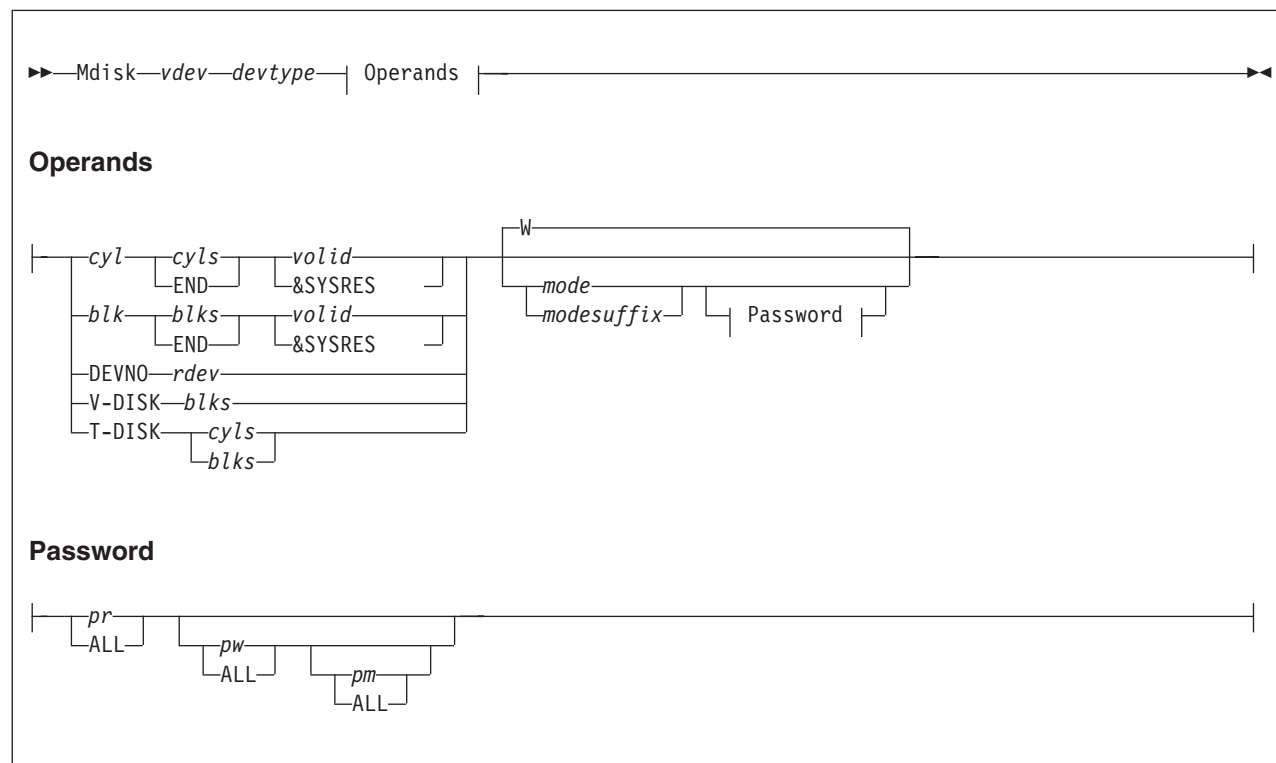
1. Allowing many virtual machines to have large storage sizes might affect real storage availability. For each virtual machine, CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables, segment tables, and higher level (region) tables.

CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; as such, their impact on real storage depends on how frequently the MBs of storage they reference are used.

Segment tables and region tables are allocated from host real storage and are not pageable:

- To reference the page tables for a primary address space or data space up to 2 GB, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.
- For a primary address space larger than 2 GB, multiple segment tables are created, plus one or more region tables to reference the segment tables. Each region table occupies 1 - 4 contiguous frames. If needed, multiple levels of region tables are created.

## MDISK Directory Statement



### Purpose

The MDISK statement defines minidisks (virtual disks) for virtual machines:

- Permanent minidisks
- Temporary minidisks
- Virtual disks in storage

The DASDOPT and MINIOPT statements are extensions to the MDISK statement. The MDISK statement defaults to DEVCTL if no DASDOPT statement follows. For more information about the DASDOPT statement, see “DASDOPT Directory Statement” on page 486. For more information about the MINIOPT statement, see “MINIOPT Directory Statement” on page 550. You can use one DASD to provide several minidisks or you can use one DASD to provide one minidisk (a *full-pack minidisk*).

**Attention:** CP and the directory program do not completely prevent you from defining minidisks that overlap. Overlap defeats the integrity of link access modes and RESERVE/RELEASE. If you define such overlap, you assume responsibility for data integrity.

### How to Specify

MDISK statements are allowed within user, identity, and subconfiguration entries. If you specify the MDISK statement, it must follow any general statements you specify in an entry. (For a list of general statements, see Table 22 on page 457.)

In an SSI cluster, the scope of an MDISK definition can be global (accessible from all members of the cluster) or local (accessible from only one member of the cluster):

- An MDISK definition for a permanent minidisk in a user or identity entry is global. The minidisk can be shared with users on any member of the cluster.
- An MDISK definition for a permanent minidisk in a subconfiguration entry is local. The minidisk can be shared only with users on the member to which the subconfiguration entry applies.
- An MDISK definition for a virtual disk in storage can be included only in a user or subconfiguration entry and is local. The minidisk can be shared only with users on the member where the minidisk is created.
- An MDISK definition for a temporary minidisk is local. The minidisk is created on the member where the user logs on.

MDISK passwords for MDISKs in the subconfiguration entry are encrypted with the user ID from the IDENTITY statement.

DIRECTXA does not check for extra tokens that might be specified at the end of the MDISK statement. If you specify additional tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified extra tokens.

### Operands

*vdev*

is the virtual device number of the minidisk.

*devtype*

is the device type of the minidisk.

- For a permanent minidisk or temporary disk, this is the device type of the real device on which the minidisk resides. Valid device types are:

3380

3390

9336

FB-512

FB-512 is a generic specification for FBA DASD and can be used in lieu of a specific FBA device type (9336). A 3390 in 3380 track-compatibility mode must be coded as a 3380.

- For a virtual disk in storage, which is not mapped to a real DASD, this is the device type of the device that is simulated in host storage. A virtual disk in storage simulates an FBA minidisk; therefore, the device type must be FB-512.

*cyl*

*blk*

is the starting cylinder (ECKD) or block number (FBA) on the real DASD you specify on the *valid* operand.

**DEVNO**

specifies a full-pack minidisk.

**V-DISK**

indicates that the minidisk is a virtual disk in storage. A virtual disk in storage is temporary but shareable. It is created when the first user links to it and destroyed when the last user detaches it or logs off.



The V-DISK operand is not allowed on an MDISK statement in an identity entry.

#### **T-DISK**

indicates that the minidisk is temporary. It is created from a preselected pool of temporary disk space when the virtual machine logs on and is returned to the pool when the virtual machine logs off or the virtual device is detached. Temporary minidisks cannot have passwords and cannot be shared.

*cyls*

*blks*

is the number of cylinders (ECKD) or blocks (FBA) allocated to the minidisk. Table 28 on page 543 shows the number of cylinders or blocks available in each format for each device type on which you can put minidisks.

#### **END**

specifies that the minidisk should be defined with the remaining available cylinders or blocks. This is useful when defining a full-pack minidisk. See usage note 4 on page 544 for more information.

*rdev*

is the real device number.

*valid*

is the volume serial number of the real DASD volume on which the minidisk resides.

#### **&SYSRES**

indicates that the minidisk resides on whichever real DASD is the VM system residence volume. This volume is established when VM is IPLed but can change from one IPL to another.

Use the &SYSRES option of the DIRECTXA command to assign a value to be used to represent the volume serial number of the system residence volume for minidisks defined using the &SYSRES operand on the MDISK statement. The value used on the &SYSRES option of the DIRECTXA command is substituted for &SYSRES on the MDISK statement and used regardless of the actual system residence volume.

This value is used in responses from the VMUDQ LISTMDSK function. If the &SYSRES option is omitted on the DIRECTXA command, a value of +VMRES is used.

**Note:** If the SSI option is added to the DIRECTORY statement, the following are not allowed on the MDISK statement:

- &SYSRES
- +VMRES
- *valids* that match the value supplied by the &SYSRES option of the DIRECTXA command.

*mode*

is the access mode for the minidisk. The first letter in the access mode is the primary access mode (read-only, write, or multiple-write); the second letter (optional) is the alternate access (read-only or write).

The access modes are:

- R** Read-only access. Read access is established, unless another user holds a write or an exclusive mode (ER, EW) access to the disk.

- RR** Read-only access. Read access is established, unless another user holds an exclusive mode (ER, EW) access.
- W** Write access. Write access is established, unless another user holds access (any mode) to the disk. If you do not specify an access mode on the MDISK statement, the default is W.
- WR** Write access. Write access is established unless another user holds access (any mode) to the disk. If write access is denied, read access is established unless another user holds an exclusive (ER, EW) mode access for the disk.
- M** Multiple-write access. Write access is established unless another user holds a write, a stable (SR, SW, SM) or an exclusive (ER, EW) mode access to the disk.
- MR** Multiple-write access. Write access is established unless another user has a write, stable (SR, SW, SM) or exclusive mode (ER, EW) access to the disk. In the case of a previous write or stable (SR, SW, SM) access, read-only access is established. In the case of an exclusive mode access existing, access is denied.
- MW** Multiple-write access. Write access is established in all cases except when another user holds either a stable (SR, SW, SM) or an exclusive mode (ER, EW) access to the disk.

#### *modesuffix*

The optional mode suffix letters authorize virtual reserve/release and the use of the stable and exclusive (data integrity) access modes of the CP LINK command and DIAGNOSE code X'E4'. The specification here on the MDISK statement allows the user to enter a LINK command with the specified type of access mode, stable or exclusive. For more information about stable and exclusive access modes, see the *z/VM: CP Commands and Utilities Reference*.

The suffix letters can be combined as follows (note that CP requires they be specified in this order):

1. V or null, plus
2. S, E, or null (S and E are mutually exclusive), plus
3. D or null.

Therefore, the only valid combinations are: V, S, E, D, VS, VE, VD, VSD, VED, SD, or ED. This suffix is in turn concatenated with the mode, with no intervening blanks. For example, RV, RRS, WVE, and MVSD are all valid.

- V** Tells CP to use its virtual reserve/release support in the I/O operations for the minidisk. For example, MWV means the minidisk functions with write linkage using CP's virtual reserve/release.
- S** Authorizes the virtual machine in whose virtual machine definition this statement appears the ability to use the LINK command stable access modes (SR, SW, SM) against the specified user's minidisk. For more information, see the *z/VM: CP Commands and Utilities Reference*.
- E** Authorizes the virtual machine in whose virtual machine definition this statement appears the ability to use the LINK command exclusive and stable access modes (ER, EW, SR, SW, SM) against the specified user's minidisk. For more information, see the *z/VM: CP Commands and Utilities Reference*.
- D** Tells CP that the device should not be defined when the virtual machine initially logs on or is autologged, but to defer doing so until an explicit LINK command is issued for that device.

*pr***ALL**

is the password that allows sharing the minidisk (by using the CP LINK command) in read mode. The variable *pr* is a 1- to 8-character string. If you specify ALL, a user can link in read mode to this minidisk without using a password.

*pw***ALL**

is the password that allows sharing the minidisk (by using the CP LINK command) in write mode. If you specify ALL, a user can link in write mode to this minidisk without using a password.

*pm***ALL**

is the password that allows sharing the minidisk (by using the CP LINK command) in multiple-write mode. The variable *pm* is a 1- to 8-character string. If you specify ALL, a user can link in multiple-write mode to this minidisk without using a password.

Table 28. Maximum Minidisk Sizes

| Device Type                      | Models                                 | CMS/VSAM, CMS<br>512-Byte, 1 KB, 2 KB, or 4<br>KB Format |
|----------------------------------|----------------------------------------|----------------------------------------------------------|
| 3380                             | A04, AA4, B04, AD4, BD4, AJ4, BJ4, CJ2 | 885 cylinders                                            |
| 3380                             | AE4, BE4                               | 1770 cylinders                                           |
| 3380                             | AK4, BK4                               | 2655 cylinders                                           |
| 3390 <sup>1</sup>                | A14, A18, B14, B18, B1C                | 1113 cylinders                                           |
| 3390 <sup>1</sup>                | A24, A28, B24, B28, B2C                | 2226 cylinders                                           |
| 3390 <sup>1</sup>                | A34, A38, B34, B38, B3C                | 3339 cylinders                                           |
| 3390 <sup>2</sup>                | A98, B9C                               | 10017 cylinders <sup>3, 4, 6</sup>                       |
| 9336                             | 020                                    | 2147483640 blocks <sup>5, 6</sup>                        |
| FB-512 (virtual disk in storage) | (not applicable)                       | 4194296 blocks                                           |

**Notes:**

<sup>1</sup> These capacities apply to 3390 mode and 3380 track compatibility mode.

<sup>2</sup> 3380 track compatibility mode is not supported for these 3390 models.

<sup>3</sup> Minidisks used with VSAM are limited to 64 KB (65,536) tracks (4369 3390 cylinders). This is a limitation of the VSE/VSAM licensed program. This limit applies whether the minidisk is used by a VSE guest or by CMS/VSAM.

<sup>4</sup> Value can be up to the maximum number of cylinders on the DASD (CMS and GCS are limited to 32,767 cylinders).

<sup>5</sup> z/VM supports a SCSI disk, which is emulated as a 9336-020, up to a capacity of 268,435,455 4096-byte pages (1 terabyte minus 1 page). Note, however, that directory, paging, and spooling allocations must reside within the first 16,777,215 pages (64 GB minus 1 page) of a CP-formatted disk.

<sup>6</sup> Because the CMS file system requires file status and control information to reside below 16 MB in virtual storage, there is a practical limitation on the size of CMS minidisks. As a minidisk increases in size, or more files reside on the disk, the amount of virtual storage associated with the disk for CMS file system status and control increases in storage below 16 MB. The current ECKD DASD limitation for CMS is 65520 cylinders for a 3390 disk on an IBM TotalStorage DASD subsystem, or about 45 GB of data. The maximum size for FBA SCSI disks supported for use by CMS or GCS is 381 GB. IBM suggests that customers defining disks for use by CMS should set a practical limit of about 22 GB. If larger disks are defined, they should be limited to contain very few files, or the CMS file system might not be able to obtain enough virtual storage below 16 MB to format or access those disks. For more information, see the ACCESS command in the *z/VM: CMS Commands and Utilities Reference*.

## Usage Notes

1. You must format a temporary minidisk or virtual disk in storage before you use it. If you want to format the disk for CP use, use the Device Support Facility (ICKDSF) program; it is the recommended method of CP volume maintenance. For more information about ICKDSF procedures, see the *Device Support Facilities User's Guide and Reference*, GC35-0033. If you want to format the disk for CMS use, use the CMS FORMAT command as described in the *z/VM: CMS Commands and Utilities Reference*. To format minidisk space for other operating systems, use the commands of the operating system that controls the minidisk.
2. If a user has written sensitive data on temporary disk space, the user should reformat the disk before detaching it from the virtual machine. If the system is configured to clear all temporary disk space, this clearing is done by the system. You can determine whether temporary disk clearing is enabled by entering the QUERY TDISKCLR command. This action removes any risk of security exposure.
3. If for some reason two or more volumes have the same label, CP defines the minidisk on the volume that is attached to the system. (You cannot attach two volumes with the same label to the system at the same time.)
4. To define a full-pack minidisk you must specify that the minidisk is to contain all of a DASD's primary cylinders or blocks. To do this, specify '0' to 'END' on the MDISK statement. Note that:
  - A minidisk beginning with cylinder 1 or block 1 is not a full-pack minidisk.
  - You should use the keyword 'END' so your MDISK statement is not dependant on the size and type of DASD.

You can optionally specify any of the DASD's alternate cylinders or blocks, but those cylinders or blocks, and all others, are accessible to anyone with a full-pack minidisk.

5. Full-pack minidisks that overlap other minidisks are ignored during link access mode checking. However, you should not define any other type of overlap. CP does the overlap checking to ensure the integrity of link access modes. This is not a feature to exploit.  
If you do overlap other minidisks, you might be:
  - Prevented from linking to those minidisks and receive messages HCP104E, HCP105E, and HCP106E, or
  - Linked read only to those minidisks and receive messages HCP101E, HCP102E, and HCP103E.
6. CP volumes will be supported in either 3380 track compatibility mode or 3390 mode of operation on a volume basis except for the 3390 Model 9 which does not support 3380 track compatibility mode.
7. Read Special home address and Write Special home address CCWs are only supported for dedicated and full-pack minidisks for guests with the OPTION statement value MAINTCCW or DEVMAINT.
8. The use of the stable (SR, SW, and SM) and exclusive (ER and EW) link modes can be authorized in two different ways, either globally using the OPTION statement values, LNKSTABL and LNKEXCLU, or specifically, using the mode suffix letter on the MDISK or LINK statements.
9. The DEVNO operand allows the user to define a full-pack minidisk by specifying the real device number of the minidisk. This operand must be used when defining full-pack minidisks where the guest will control the duplexing of the device.

10. The DEVNO operand should be used when defining multiple minidisks with identical volume serial numbers.
11. Refer to the appropriate storage control manuals for additional dual copy information.
12. For information on the use of the MDISK statement for the CMS shared file system, refer to the *z/VM: CMS File Pool Planning, Administration, and Operation* book.
13. If an external security manager (ESM) is installed, you might not be authorized to use the MDISK statement for all minidisks and all access modes. The ESM might downgrade certain requests for write access to read access. For additional information, contact your security administrator.
14. Virtual disks in storage and FBA temporary minidisks are created in 8-block pages. Therefore, the size of the virtual disk in storage or FBA temporary minidisk that is created might be rounded up to the nearest page.
15. If you define a minidisk as virtual device number 192, the following special rules apply when you IPL CMS:
  - If 192 is an unformatted temporary minidisk or virtual disk in storage, CMS formats it and accessed it as file mode D.
  - If 192 is a CP-formatted temporary minidisk or virtual disk in storage, CMS reformats it for CMS use and accesses it as file mode D.
  - If 192 is a CMS-formatted temporary minidisk, virtual disk in storage, or permanent minidisk that is accessed as a file mode other than D, CMS reaccesses it as file mode D.
  - If 192 is an unformatted or CP-formatted permanent minidisk, CMS does not automatically format, reformat, access, or reaccess it.

When CMS accesses a 192 minidisk as file mode D, any minidisk or SFS directory already accessed as D is released.
16. If you change the definition of a permanent minidisk while users are linked to it, existing links are unchanged, but any new links are made using the new definition of the minidisk. Unpredictable results might occur.
17. If you change the definition of a virtual disk in storage while users are linked to it, existing links are unchanged, and any new links are made to the existing virtual disk in storage. The existing virtual disk in storage is used until the last user detaches it or logs off, at which time the virtual disk in storage is destroyed. After that, any new links use the new definition of the virtual disk in storage.
18. Some programs might not support the use of &SYSRES, and require the use of a synonym. The synonym is the value specified on the DIRECTXA command with the &SYSRES operand. If the &SYSRES option is omitted on the DIRECTXA command, a synonym of +VMRES is used. In other words, either &SYSRES or its synonym can be used to define a minidisk on the system residence volume.
19. A minidisk, including a temporary disk, is not eligible for minidisk cache if it has been defined with greater than 32767 cylinders. This does not apply to FBA devices. It applies only to ECKD devices.
20. For information about the V mode suffix restrictions when linking, see the LINK command in *z/VM: CP Commands and Utilities Reference*.
21. In an SSI cluster, if a virtual disk in storage is defined in a user entry, the minidisk can be created on any member of the cluster (when the owner logs on or when the first user links to it), but subsequently can be shared only by other users on that member until the last user detaches it or logs off.

22. If a temporary minidisk is defined in an identity entry, a separate temporary minidisk is created for each logon instance of the virtual machine.

### Examples

1. To define a minidisk that:

- Has the virtual device number 191
- Takes up 5 cylinders beginning at cylinder 100 of the 3380 DASD with volume serial MDDASD
- Is accessible only in read-only mode
- Cannot be linked to in any mode (no passwords are specified)

use the following MDISK statement in the virtual machine definition:

```
Mdisk 191 3380 100 5 mddasd rr
```

2. To define a minidisk that:

- Has the virtual device number 291
- Takes up 10 cylinders beginning at cylinder 105 of the 3380 DASD with volume serial MDDASD
- Is accessible only in read or write mode
- Can be linked to by anyone in read mode (but no other mode)

use the following MDISK statement in the virtual machine definition:

```
Mdisk 291 3380 105 10 mddasd mr all
```

3. To define a minidisk that:

- Has the virtual device number 198
- Takes up 6000 blocks beginning at block 12,000 of a supported FBA DASD with volume serial FBDASD
- Is accessible only in multiple-write (MW) modes
- Can be shared using CP's virtual reserve/release
- Has a read password of 12WE45

use the following MDISK statement in the virtual machine definition:

```
Mdisk 198 9336 12000 6000 fbdasd mwv 12we45
```

4. To define a minidisk that:

- Has the virtual device number 198
- Takes up 6000 blocks beginning at block 12,000 of the 9336 DASD with volume serial FBDASD
- Will have the default access mode of Write when the virtual machine is logged on, but will specifically authorize the user to access it with a stable access mode using the LINK command at a later time.
- Can be shared using CP's virtual reserve/release
- Has a read password of 12WE45

use the following MDISK statement in the virtual machine definition:

```
Mdisk 198 fb-512 12000 6000 fbdasd mvs 12we45
```

5. To define 5 cylinders of temporary 3380 DASD space at virtual device number 391, use the following MDISK statement in the virtual machine definition:

```
Mdisk 391 3380 t-disk 5
```

6. To define 4000 blocks of temporary FBA DASD space at virtual device 392, use the following MDISK statement in the virtual machine definition:

```
Mdisk 392 fb-512 t-disk 4000
```

7. To define a 3380 DASD full-pack minidisk at virtual device number 199, use one of the following MDISK statements in the virtual machine definition:



```
Mdisk 199 3380 000 885 mddasd mr
Mdisk 199 3380 000 end mddasd mr
```

8. To define a pair of full-pack minidisks that are candidates for duplexing and:

- Have virtual device numbers 198 and 199
- Have real device numbers 200 and 201
- Are accessible in read or write mode
- Can be linked to by anyone in read mode

use the following MDISK statements in the virtual machine definition:

```
mdisk 198 3390 devno 200 mr all
mdisk 199 3390 devno 201 mr all
```

9. To define a virtual disk in storage that:

- Has virtual device number 401
- Consists of 8000 blocks
- Is accessible in read or write mode
- Can be shared using CP's virtual reserve/release

use the following MDISK statement in the virtual machine definition:

```
mdisk 401 fb-512 v-disk 8000 mwv
```

10. To define a minidisk using a synonym of VM-RES instead of &SYSRES, use the following MDISK statement:

```
MDISK 123 3390 0 END VM-RES RR
```

and use the following command to place the directory online:

```
DIRECTXA USER DIRECT (&SYSRES VM-RES
```

### Minidisk Restrictions

The following restrictions exist for minidisks:

1. In the following cases, z/VM modifies the cylinder data in user storage at the completion of the channel program:
  - Read Home Address (with the skip bit off)
  - Read Record Zero (with the skip bit off)
  - Sense (with the skip bit off)
  - Read Track (with the skip bit off)
  - Read Device Characteristics.

This is necessary because the addresses must be converted for minidisks. Therefore, the data buffer area cannot be dynamically modified during the I/O operation in these cases.

**Note:** For the Read Record Zero case, the above restriction does not apply to devices that do not provide alternate track recovery.

2. On a minidisk, if a CCW string uses multitrack-search on I/O operations, subsequent operations to that disk must have preceding seeks or continue to use multitrack operations. There is no restriction for dedicated disks.
3. If the user's channel program for a count-key-data minidisk does not perform a seek operation, CP inserts a positioning seek operation into the user's channel program to prevent accidental accessing. Thus, certain channel programs might generate a condition code (CC) of 0 on an SIO instead of the expected CC of 1, which is reflected to a virtual machine. The final status is

reflected to the virtual machine as an interruption. The final states for some channel programs initiated through an SIOF or SSCH might not indicate deferred CC 1.

4. A DASD channel program might give results on dedicated DASD that differ from results on minidisks having nonzero relocation factors if the channel program includes multiple-track operations and depends on a Search ID High or Search ID Equal or High to terminate the program. The record 0 count fields on these devices must contain the real cylinder number of the track on which they reside. Therefore, a Search ID High, for example, based on a low virtual cylinder number, might terminate prematurely if a real record 0 is encountered.

Minidisks with nonzero relocation factors are not usable under OS and OS/VS systems. This is because the locate catalog management function employs a Search ID Equal or High CCW to find the end of the VTOC.

5. The IBCDASDI program cannot assign alternate tracks.

**Notes:**

- a. Device-Support Facilities (ICKDSF) might assign alternate tracks
  - b. Alternate track assignment is permitted for full-pack minidisks only.
6. If the DASD channel programs include a Write Record Zero CCW or a Write Home Address CCW, the results depend on whether the device is dedicated or not dedicated. For a dedicated DASD, a Write Record Zero or a Write Home Address CCW is allowed, but the user must be aware that the track descriptor record might not be valid from one DASD to another. For a DASD that is not dedicated, a Write Record Zero or a Write Home Address CCW is accepted only if the device is a full-pack minidisk. CP rejects the command if the device issuing a Write Record Zero or a Write Home Address CCW on a nondedicated DASD is *not* defined as a full-pack minidisk.
  7. When performing DASD I/O, if the record field of a Search ID Argument is zero when a virtual SIO, SIOF, or SSCH is issued, but the Search ID Argument is dynamically read by the channel program before the Search ID CCW is executed, the real Search ID uses the relocated search argument instead of the argument that was read dynamically. To avoid this problem, the record field of a Search ID Argument should not be set to binary zero if the search argument is to be dynamically read or if the search ID on record 0 is not intended.
  8. The following CCWs are restricted to virtual machines with MAINTCCW authority. You specify this authority by coding the MAINTCCW operand on the OPTION statement in the virtual machine definition.
    - Diagnostic Write Home Address
    - Diagnostic Read Home Address
    - Write Record Zero
    - Diagnostic Load
    - Diagnostic Sense/Reset Allegiance: CP treats the command as a reset allegiance CCW and accepts it as long as it is the first CCW in the channel program.
    - Diagnostic Write
    - Diagnostic Sense/Read
    - Diagnostic Control
  9. Diagnostic Read Home Address and Diagnostic Write Home Address commands are supported only for dedicated and full-pack 3380 and 3390 minidisks.



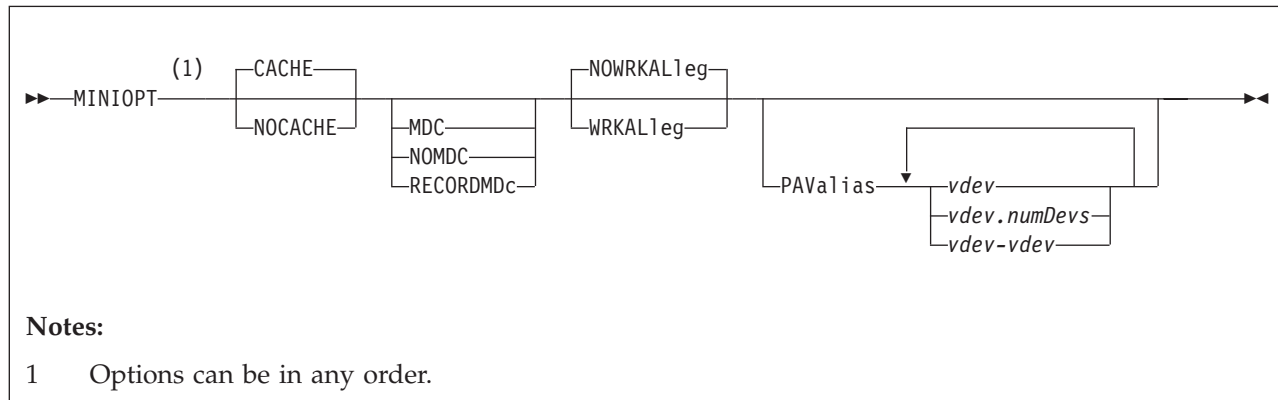
All Diagnostic CCWs are restricted to users with the OPTION statement value MAINTCCW or DEVMAINT.

10. Refer to *OS/VS Device Support Facilities* for procedures to format all supported DASDs for use in an OS/VS operating system running in a virtual machine.
11. The 3390s used for CP volumes are supported in either 3380 track compatibility mode or 3390 mode of operation on a volume basis except for the 3390 Model 9 which does not support 3380 track compatibility mode. The ability to change operating modes is restricted to guests with the OPTION statement value MAINTCCW or DEVMAINT. The use of ICKDSF is the recommended method to change modes.
12. A user should never have an MDISK statement with the DEVNO operand and an MDISK statement with the volume serial number operand for the same volume.
13. Access to cache control units is controlled by the settings of level of control for these units. For more information, see "DASDOPT Directory Statement" on page 486.
14. Minidisks defined on an FBA volume which are not page-aligned will not be eligible for minidisk cache and will therefore not benefit from its performance improvement. Aligning minidisks on page boundaries is highly recommended. Minidisks as well as full-pack minidisk volumes that are not page-aligned might result in residual blocks that are not formatted and utilized. Additional restrictions apply for SFS Filepool minidisks which are not page-aligned. For more information see the *z/VM: CMS File Pool Planning, Administration, and Operation*. If the starting block number is a multiple of eight and the number of blocks is a multiple of eight, then the minidisk is defined to be page-aligned.

**Note:** Under the conditions outlined in the above usage note, residual blocks on FBA devices that have not been ICKDSF formatted can still be defined and used as MDISK space.

15. Minidisks defined on an FBA volume which are not page aligned cannot be mapped to an address space using minidisk mapping.

## MINIOPT Directory Statement



### Purpose

The MINIOPT statement is an extension to the MDISK statement and must immediately follow an MDISK statement that defines a non-full-pack minidisk. If you want to use a full-pack minidisk, you can use a DASDOPT statement with the MDISK statement.

### How to Specify

MINIOPT statements are not allowed within a profile entry.

### Operands

#### CACHE

means that the minidisk has access to the control unit cache. This is the default if neither CACHE or NOCACHE are specified.

#### NOCACHE

means that CP forces I/O for the minidisk to bypass the control unit cache.

#### MDC

specifies that the minidisk will use the full track minidisk cache as long as caching is set to DFLTON or DFLTOFF for the real device. If neither MDC, NOMDC, nor RECORDMDC is specified, then the minidisk will use the full track minidisk cache as long as caching is set to DFLTON for the real device.

#### NOMDC

specifies that the minidisk will not use the full track minidisk cache. If neither MDC, NOMDC, nor RECORDMDC is specified, then the minidisk will use the full track minidisk cache as long as caching is set to DFLTON for the real device.

#### RECORDMDC

specifies that the minidisk will use record level minidisk caching rather than normal full track minidisk caching as long as caching is set to DFLTON or DFLTOFF for the real device. If neither MDC, NOMDC, nor RECORDMDC is specified, then the minidisk will use full track minidisk cache as long as caching is set to DFLTON for the real device.

**Attention:**

Use of this option is a last resort for very special and unusual circumstances. It should only be used as the result of consultation with IBM support personnel who have concluded that no other problem exists. Its use should occur only after trials using the SET MDCACHE MDISK ON command's RECORDMDc option have proven that this truly solves the performance problem. Using this option for any other reason may mask a performance problem which when corrected allows normal full track minidisk cache to perform better than with the RECORDMDc option.

**WRKALleg**

causes working allegiance to be simulated on the minidisk.

**NOWRKALleg**

causes no simulated working allegiance for the minidisk. This is the default.

**PAValias**

defines one or more alias Parallel Access Volumes for the non-full-pack minidisk base Parallel Access Volume specified in the preceding MDISK statement.

*vdev*

*vdev.numDevs*

*vdev-vdev*

is the virtual device address of the alias Parallel Access Volume that you are defining. You can specify a single virtual device (*vdev*), a virtual device combined with a decimal range count (*vdev.numDevs*), a range of virtual devices (*vdev-vdev*), or any combination. The device numbers entered must be hexadecimal numbers between X'0000' and X'FFFF'.

**Usage Notes**

1. IBM recommends that the defaults of both control unit caching and minidisk caching be used. The default double caching of data should not degrade the performance of normal minidisk operation. MINIOPT statements should be used only in cases of shared DASD and specific data/transaction-related performance problems.
2. WRKALLEG must be used when running two or more z/OS guests as part of a Sysplex configuration using the cross system coupling facility (XCF) component of z/OS. This option must be used for any minidisk containing the XCF couple dataset to maintain cross-system lock integrity (and thereby, data integrity) within the sysplex.
3. WRKALLEG is valid only when the preceding MDISK statement gives the user write access to the minidisk. If the MDISK statement specifies read-only access, CP rejects the WRKALLEG statement and issues an error message. Furthermore, working allegiance is simulated only when a guest with write access initiates I/O.
4. Implementation of caching by the system depends on the following:
  - For the control unit if:
    - It is a cached control unit
    - The subsystem is enabled for cache operation
    - The caching function is turned on for the device
  - For minidisk cache if:
    - Minidisk is on a device supported by minidisk cache.
    - Minidisk caching is enabled for the system.

## MINIOPT

- Minidisk caching is set to DFLTON for the real device and either MINIOPT MDC is specified or no minidisk cache option is specified on the MINIOPT statement for the minidisk; or minidisk caching is set to DFLTOFF for the real device and MINIOPT MDC is specified for the minidisk:

| Cache setting for real device | MINIOPT Default | MINIOPT MDC | MINIOPT NOMDC |
|-------------------------------|-----------------|-------------|---------------|
| DFLTON                        | ON              | ON          | OFF           |
| DFLTOFF                       | OFF             | ON          | OFF           |
| OFF                           | OFF             | OFF         | OFF           |

For example:

- If DFLTON and MINIOPT is NOMDC, then caching is off.
  - If DFLTOFF and MINIOPT is MDC, then caching is on.
- For FBA devices, the minidisk is page-aligned
5. Optimization of cache use may be made after an analysis of your production use has been made. This is accomplished by adding MINIOPT statements that cause the I/O subsystem to bypass the use of either or both of the caching techniques.
  6. MINIOPT is not valid for full-pack minidisks. For full-pack minidisks, use the “DASDOPT Directory Statement” on page 486.
  7. MINIOPT is ignored if it follows an MDISK statement that defines a virtual disk in storage.
  8. The RECORDMDc option should only be used when directed to do so by IBM support personnel. RECORDMDc is for use only when DASD cache as well as real storage and expanded storage minidisk cache are all being overwhelmed by excessive unreferenced records being read by the full track cache support.
  9. A minidisk, including a temporary disk, is not eligible for minidisk cache if it has been defined with greater than 32767 cylinders. This does not apply to FBA devices. It applies only to ECKD devices.
  10. When using the PAValias parameter, the number of virtual alias Parallel Access Volumes that can be associated with a particular virtual base Parallel Access Volume cannot exceed the number of real alias Parallel Access Volumes that are associated with the real base Parallel Access Volume on which the virtual base is defined.
  11. This MINIOPT statement may be continued onto additional lines using the rules documented in “Continued Directory Statements” on page 461.
  12. For information about the WRKALLEG restrictions when linking, see the LINK command in *z/VM: CP Commands and Utilities Reference*.

### Examples

1. If the minidisk specified by the MDISK statement is to have access to the control unit cache, use the following MINIOPT statement:  
MiniOpt Cache
2. If the minidisk specified by the MDISK statement will *not* use the minidisk cache, use the following MINIOPT statement:  
MiniOpt NoMdc
3. If the minidisk specified by the MDISK statement will have simulated working allegiance, use the following MINIOPT statement:  
MINIOPT WRKALleg

4. If the minidisk specified by the MDISK statement is a base Parallel Access Volume and you want to define four alias Parallel Access Volumes for it, use the following MINIOPT statement:

```
MINIOPT PAVALIAS 681-684
```

## NAMESAVE Directory Statement



### Notes:

- 1 Specify *sysseg* up to 8 times.

## Purpose

The NAMESAVE statement authorizes a virtual machine to access a restricted named saved system or saved segment. The NAMESAVE statement also authorizes a virtual machine to access and load a private copy of a nonrestricted saved segment, using the load nonshared function of DIAGNOSE code X'64'. If the virtual machine has the appropriate NAMESAVE entry, it can access a private copy of a saved segment (whether or not the saved segment is restricted) for debugging, using the load nonshared function of DIAGNOSE code X'64'. (For more information, see Usage Note 3.)

## How to Specify

The NAMESAVE statement is allowed in profile, user, and identity entries. If you specify the NAMESAVE statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.)

Multiple NAMESAVE statements are allowed within a profile, user, or identity entry. NAMESAVE statements within a profile entry are added to those in the including user or identity entry with no duplicate checking performed.

## Operands

*sysseg*

is the 1- to 8-character alphanumeric name of the named saved system or saved segment that you are authorizing a virtual machine to access. You can specify a maximum of eight names.

**Note:** *sysseg* cannot be a member name. Members are authorized by the segment space they are in.

## Usage Notes

1. Each NAMESAVE statement can specify up to eight named saved systems and eight saved segments.
2. For information on creating named saved systems, see the *z/VM: Virtual Machine Operation* book.
3. If you have the appropriate NAMESAVE entry, you can access a private copy of a saved segment (whether or not the saved segment is restricted) for debugging purposes, using the load nonshared function of DIAGNOSE code X'64'. When you do this, you receive exclusive read/write access to all the page

ranges in the saved segment, regardless of the type of access specified on the CP DEFSEG command when the saved segment was defined.

4. To access a private copy of a named saved system, you must IPL by device number. You cannot specify that a private copy of a named saved system should be loaded.
5. When packing DCSSs you must have the segment space name in a NAMESAVE statement.

## Examples

1. To indicate that a virtual machine can access the restricted named saved systems MVSXA1 and MVSXA2, use the following NAMESAVE statement in the virtual machine definition:

```
NameSave mvsxa1 mvsxa2
```

2. To indicate that a virtual machine can access both of the following:
  - a. The restricted named saved systems MVSXA1 and MVSXA2
  - b. The restricted saved segment XASEG

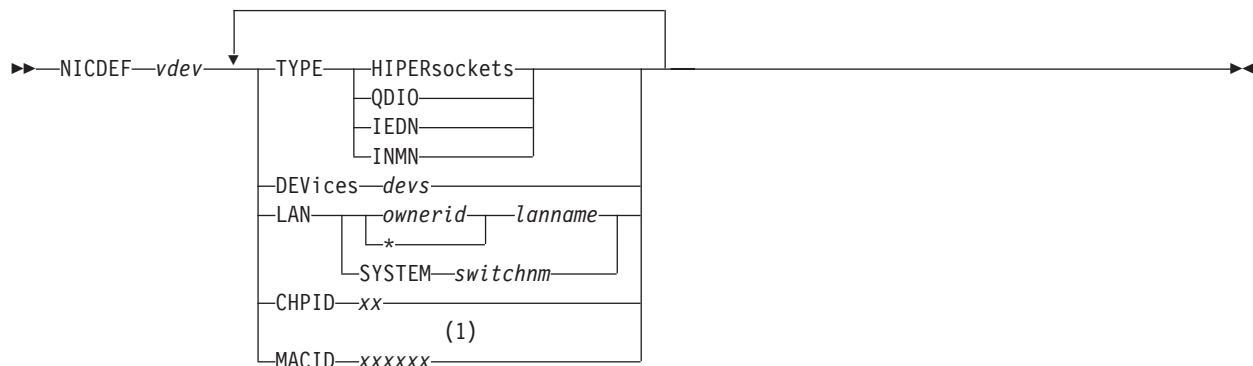
use the following NAMESAVE statement in the virtual machine definition:

```
NameSave mvsxa1 mvsxa2 xaseg
```

3. To indicate that a virtual machine can access a private copy of the nonrestricted saved segment XASEG1, use the following NAMESAVE statement in the virtual machine definition:

```
NameSave xaseg1
```

## NICDEF Directory Statement



### Notes:

- 1 MACID can be specified only for a type QDIO or HiperSockets adapter.

## Purpose

The NICDEF statement defines virtual network adapters that are fully simulated by CP. Use NICDEF to create a specific type of adapter in the virtual machine, and (optionally) connect it to an appropriate guest LAN or virtual switch.

## How to Specify

The NICDEF statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the NICDEF statement, it must follow any general statements you specify in a directory entry. (For a list of general statements, see Table 22 on page 457.)

The SPECIAL statement can also be used to define virtual network adapters in a virtual machine. However, there are additional configuration options available with the NICDEF statement. NICDEF statements are not compatible with the SPECIAL statements for the same *vdev*. You cannot define some attributes on the SPECIAL statement and some attributes on a NICDEF statement.

At logon time, any NICDEF statements in a subconfiguration entry are processed first, followed by NICDEF statements in a user or identity entry, followed by NICDEF statements in a profile entry. Consecutive NICDEF statements with the same virtual device addresses are allowed within an entry and are treated as modifiers of previous NICDEF statements with the same virtual device address.

## Operands

### *vdev*

is the base (or first) device address in a series of virtual I/O devices that belong to the same unit.

### TYPE

specifies the type of NIC adapter to be created, specifically the hardware and protocol that the adapter will emulate. TYPE is a required keyword and it



must be the first keyword specified. If a LAN is identified in this statement, an attempt is made to couple the adapter to the specified *ownerid lanname*.

#### **HIPERsockets**

defines this adapter as a simulated HiperSockets NIC. This adapter will function like the HiperSockets internal adapter (device model 1732-05). A HiperSockets NIC can function without a guest LAN connection, or it can be coupled to a HiperSockets guest LAN.

An error results if you attempt to connect a simulated HiperSockets adapter to a virtual switch.

#### **QDIO**

defines this adapter as a simulated QDIO NIC. This adapter will function like the OSA-Express (QDIO) adapter (device model 1732-01). A QDIO NIC is functional only when it is coupled to a QDIO guest LAN or a QDIO, IEDN or INMN virtual switch. A QDIO adapter can COUPLE to an IEDN or INMN virtual switch only when the owning user ID is authorized by the system administrator by specifying OSDSIM on the SET VSWITCH command.

#### **IEDN**

defines this adapter as a simulated intraensemble data network NIC. This adapter will function like an OSA-Express CHPID type OSX adapter (device model 1732-02) that is managed by the Unified Resource Manager. An IEDN NIC is functional only when it is coupled to an IEDN virtual switch.

#### **INMN**

defines this adapter as a simulated intranode management network NIC. This adapter will function like an OSA-Express CHPID type OSM adapter (device model 1732-03) that is managed by the Unified Resource Manager. An INMN NIC is functional only when it is coupled to an INMN virtual switch.

#### **DEVices *devs***

is the number (decimal) of virtual I/O devices to be created for a simulated network interface card (NIC). This number is evaluated during LOGON processing.

*Table 29. Number (Decimal) of Virtual I/O Devices*

| Adapter TYPE       | Minimum | Maximum | Default |
|--------------------|---------|---------|---------|
| HiperSockets       | 3       | 3072    | 3       |
| QDIO, IEDN or INMN | 3       | 240     | 3       |

#### **LAN [ *ownerid* | \* *lanname* ] [ SYSTEM *switchnm* ]**

identifies a virtual LAN segment for an immediate connection to the network interface card (NIC). When *ownerid* is specified as an asterisk (\*), it is resolved as the user ID of the current virtual machine. When the LAN operand is omitted, the adapter is left in the default (uncoupled) state. When LAN *ownerid lanname* is identified in this statement or another with the same *vdev*, the adapter is connected to the designated virtual LAN segment automatically.

*Ownerid* may be specified as SYSTEM, indicating the virtual LAN segment may be a virtual switch or a system-owned LAN.

**Note:** Ensure that the defined NIC adapter type is compatible with the intended guest LAN or virtual switch.

**CHPID** *xx*

is a 2-digit hexadecimal number that represents the Channel Path ID (CHPID) number to be allocated in the virtual machine I/O configuration for this adapter. If **CHPID** is omitted, an available CHPID is automatically assigned to this adapter. This option is required when a HiperSockets adapter is being created for a z/OS guest because z/OS configurations require a predictable CHPID number. During LOGON, CP attempts to use the specified CHPID number. If the specified CHPID number is already in use, this adapter is not defined. To correct this situation, you must eliminate the conflicting device or select a different CHPID.

**MACID** *xxxxxx*

is a unique identifier (up to 6 hexadecimal digits in the range 000001 - FFFFFFFF) that is to be used as part of the adapter MAC address for a QDIO or HiperSockets type NIC adapter.

A MAC address for a device on an IEDN or INMN network can be assigned only by an ensemble manager. A user-defined MAC address is not allowed on these networks. Specifying a MACID for a type IEDN or INMN adapter prevents the adapter from being added to the virtual I/O configuration of a guest.

During LOGON, the specified MACID (3 bytes) is appended to the system MACPREFIX or USERPREFIX (3 bytes) to form a unique MAC address for this adapter. If MACID is omitted from this definition, CP generates a unique identifier for this adapter using the system MACPREFIX. If the specified MACID is already in use, this adapter is not defined. To correct this situation, you must eliminate the conflicting device or select a different MACID.

If the MACPREFIX and USERPREFIX are set to the identical value, the specified MACID must fall within the USER subset of the MACIDRANGE SYSTEM range defined on the VMLAN configuration statement.

**Usage Notes**

1. When a simulated NIC adapter is defined, the NICDEF statement results in the creation of a series of I/O devices. The base device is validated by directory processing, but the remaining devices in the range are validated during LOGON processing. If another device is found in the range established by *vdev* and *devs*, the simulated NIC cannot be created.
2. It is possible to define a simulated NIC that will be automatically coupled to a guest LAN or virtual switch by adding the optional LAN parameter. However, if the designated guest LAN or virtual switch is not available when this user signs on, the COUPLE function cannot be performed. To make effective use of this feature, you must consider adding a DEFINE LAN or DEFINE VSWITCH statement in the SYSTEM CONFIG file to create the target guest LAN or virtual switch during system initialization.
3. z/VM supports virtual QDIO networking connections comprised of one read control device, one write control device, and up to eight data devices. This provides the ability to configure up to ten virtual devices per host QDIO connection.

**Examples**

1. Define a simulated QDIO adapter using I/O devices 0500 - 0507 (eight devices) which will be coupled to the SYSTEM-owned INEWS LAN during LOGON processing:  

```
NICDEF 500 TYPE QDIO DEV 8 LAN SYSTEM INEWS
```

2. Define a simulated HiperSockets adapter using I/O devices FD20 - FD2F (16 devices) which will be coupled to the user's own HSTEST LAN during LOGON processing:

```
NICDEF FD20 TYPE HIPERS
NICDEF FD20 DEVICES 16 LAN * HSTEST
```

Note that this adapter cannot couple to the designated LAN during LOGON unless it has been defined earlier. This can be accomplished by adding the necessary DEFINE LAN statement to the SYSTEM CONFIG file.

---

## NOPDATA Directory Statement

►►—NOPDATA—◄◄

### Purpose

The NOPDATA statement authorizes a virtual machine to use NOP CCWs to transfer data to CP spool files. (Such data is not printed or punched with the file, and is not visible if the file is later read through a virtual card reader. It can only be accessed using DIAGNOSE code X'14'.)

### How to Specify

The NOPDATA statement is allowed in profile, user, and identity entries. If you specify the NOPDATA statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.)

When processing the NOPDATA statement, DIRECTXA does not check for extra tokens. If you specify anything after the NOPDATA keyword, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Usage Notes

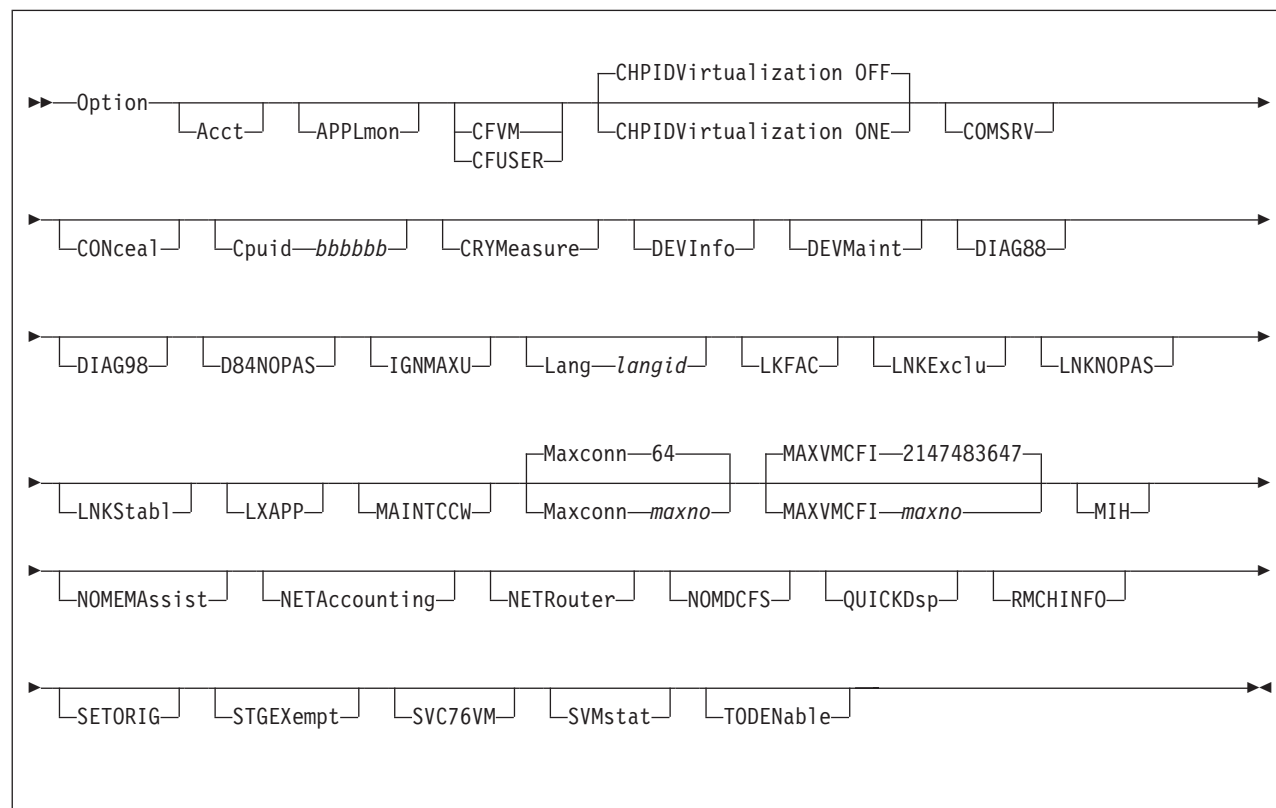
1. The NOPDATA statement should appear in the virtual machine definition of the RSCS virtual machine. For more information, see *z/VM: RSCS Networking Planning and Configuration*.
2. Do not use data chaining with NOP CCWs.

### Examples

To authorize a virtual machine to transfer data to CP spool files using NOP CCWs, use the following NOPDATA statement in the virtual machine definition:

```
NoPData
```

## OPTION Directory Statement



### Purpose

The OPTION statement specifies special characteristics available to the virtual machine.

### How to Specify

The OPTION statement is allowed in profile, user, identity, and subconfiguration entries; however, some operands are not allowed in all entries. See the description of each operand for restrictions. If you specify the OPTION statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.)

Any number of OPTION statements are allowed in each entry and are added to any OPTION statements in other entries that make up the virtual machine instance when the user is logged on. If the option is specified with a value, then a specification in a user or identity entry overrides one in the profile, and a specification in a subconfiguration entry overrides one in the identity and included profile.

Additionally, within an entry, if a specific option keyword is specified more than once, then the associated value, if any, from the first occurrence is the one that is used and subsequent occurrences are ignored.

## Operands

### Acct

specifies that the virtual machine can issue a DIAGNOSE code X'4C' to generate accounting records. For more information about DIAGNOSE code X'4C', see *z/VM: CP Programming Services*.

The Acct operand is not allowed in subconfiguration entries.

### APPLmon

authorizes the virtual machine to issue DIAGNOSE code X'DC' by which an application may declare or delete a buffer for CP monitoring. After the buffer has been declared for monitoring, all data in it is collected by CP into monitor records at each sample interval. For more information about DIAGNOSE code X'DC', see *z/VM: CP Programming Services*.

The APPLmon operand is not allowed in subconfiguration entries.

### CFVM

defines the user as a virtual machine that will only run as a Coupling Facility Service Machine (CFVM). A CF Service Machine is a special disconnected virtual machine that is set up to IPL the Coupling Facility Control Code (CFCC). CFVM may not be specified with CFUSER, RMCHINFO, or CHPIDVirtualization.

The CFVM operand is not allowed in subconfiguration entries.

### CFUSER

indicates that the user is allowed to define and couple Message Devices to a Coupling Facility Service Machine. CFUSER cannot be specified with CFVM or CHPIDVirtualization.

The CFUSER operand is not allowed in subconfiguration entries.

### CHPIDVirtualization

Only one CHPIDVirtualization option can be specified. If more than one is specified, the first is used and any subsequent ones are ignored.

OPTION CHPIDV in a user, identity, or included profile entry overrides GLOBALOPTS CHPIDV for the user.

#### OFF

CHPID virtualization is not active for the virtual machine. For dedicated devices and minidisks, real channel path identifiers (CHPIDs) through which those devices are accessible are visible as virtual CHPIDs to the guest. This is the default.

#### ONE

Single path CHPID virtualization is active for the virtual machine. A single, virtualized CHPID is presented to the guest for dedicated devices and minidisks, independent of the real system CHPID. All online paths will still be used to support the guest I/O. This option is a requirement for a guest to be eligible for live guest relocation. See Chapter 27, "Preparing for Guest Relocations in a z/VM SSI Cluster," on page 749 for more information.

OPTION CHPIDV ONE is not allowed with OPTION CFVM or OPTION CFUSER, whether OPTION CHPIDV ONE is set within the definition using the OPTION statement or is set by default from the GLOBALOPT setting.

This option should be specified only when the guest is going to be relocated. In addition to virtualizing the CHPID numbers, CHPIDV ONE results in DASD path group ID virtualization. CHPIDV ONE should not be specified for z/OS guests.

The CHPIDVirtualization operand is not allowed in subconfiguration entries.

### **COMSRV**

authorizes the indicated virtual machine to act as a communication server, to:

- Route communications on behalf of other virtual machines to other servers
- Establish connections to other servers while handling requests for other users.

With this option, the TSAF virtual machine or any other communications server can put the user ID of the virtual machine that issued the APPC/VM CONNECT in the CONNECT parameter list.

When TSAF sends the connect request to the target virtual machine, the request contains this information about the originating virtual machine. Without this operand, CP would send the connect request with the communications server's user ID.

The COMSRV operand is not allowed in subconfiguration entries.

### **CONceal**

specifies that the user's virtual machine is to be placed in the protected application environment when the user logs on. The environment remains active until the user logs off or until it is made inactive by a CP SET CONCEAL OFF or a CP DEFINE CPU command. This environment is intended for the application end user who does not want to interact with CP. Instead of presenting the user with an unexpected CP READ on occurrence of certain error conditions (for example, paging error, soft abend, disabled wait PSW loaded), the protected application facility forces an automatic re-IPL of the virtual machine. The re-IPL is initiated by using the IPL statement last used for the virtual machine.

To prevent a re-IPL loop, CP does not force a re-IPL if a previous automatic re-IPL has occurred less than a minute before. Not more than 10 automatic re-IPLs are tried between activation and deactivation of the protected application environment. If a re-IPL is not done, CP issues the same message(s) as when the protected application environment is not active and then puts the terminal into CP READ state.

A user whose virtual machine definition specifies OPTION CONCEAL has the break key (for 3270 terminals) disabled at logon. If the user subsequently deactivates the protected application environment using the CP SET CONCEAL OFF command, the break key is enabled again.

### **Cpuid bbbbb**

specifies a processor identification number to be stored as part of the information stored by the STIDP instruction. This operand sets the CPU ID for all of the processors in a virtual MP configuration. This operand is overridden if a CPU ID is specified on the CPU statement for this virtual CPU. If the guest is relocated, this field does not change as a result of the relocation, even if the FORCE ARCHITECTURE or FORCE DOMAIN options were used on the VMRELOCATE command.

### **CRYMeasure**

authorizes the specified virtual machine to obtain crypto measurement data from the crypto hardware on the real machine.

## OPTION

The CRYMeasure operand is not allowed in a subconfiguration entry.

### DEVInfo

authorizes the specified virtual machine to use DIAGNOSE code X'E4' with subcodes X'00' and X'01' to access the relocation and real device information of the specified DASD owned by this or another user ID. For more information about DIAGNOSE code X'E4', see *z/VM: CP Programming Services*.

The DEVInfo operand is not allowed in subconfiguration entries.

### DEVMaint

authorizes the specified virtual machine to use DIAGNOSE code X'E4' with subcode X'02' and X'03' to get a full-pack overlay read/write minidisk of the volume on which the specified minidisk or cylinder/block resides. A user with this option is also authorized to execute any function protected by the DEVINFO and MAINTCCW options. For more information about DIAGNOSE code X'E4', see *z/VM: CP Programming Services*.

The DEVMaint operand is not allowed in subconfiguration entries.

### DIAG88

specifies that the virtual machine is authorized to use DIAGNOSE code X'88' to validate user authorizations and link minidisks. A user whose virtual machine definition contains this operand can run programs that access other users' minidisks without requiring passwords. For information about DIAGNOSE code X'88', see *z/VM: CP Programming Services*.

The DIAG88 operand is not allowed in subconfiguration entries.

### DIAG98

specifies that the virtual machine is authorized to use the DIAGNOSE code X'98' real I/O facility. A user whose virtual machine definition contains this operand can run programs that use the page locking and start real I/O subfunctions to enhance I/O performance to dedicated devices. For information about DIAGNOSE code X'98', see *z/VM: CP Programming Services*.

The DIAG98 operand is not allowed in subconfiguration entries.

### D84NOPAS

specifies that this virtual machine has the ability to issue all subfunctions of DIAGNOSE code X'84' (except LOGPASS and MDISK) without the logon password of the target virtual machine ID. This option only takes effect if there is no access control mechanism, such as RACF, in place. For more information about DIAGNOSE code X'84', see *z/VM: CP Programming Services*.

The D84NOPAS operand is not allowed in subconfiguration entries.

### IGNMAXU

indicates that this virtual machine can log on to the system even if the number of users already logged-on is equal to or greater than the maximum allowed. You set this maximum in one of the following ways:

1. Using the FEATURES statement with the MAXUSERS operand in your system configuration file. For more information, see "FEATURES Statement" on page 150.
2. Using the CP SET MAXUSERS command. For more information, see *z/VM: CP Commands and Utilities Reference*.

The IGNMAXU operand is not allowed in subconfiguration entries.

### Lang *langid*

specifies the 1- to 5-character name of the language that should be set for the virtual machine during logon.



**LKFAC**

indicates that the specified virtual machine is authorized to use:

- Multi-Path Lock Facility RPQ (MPLF) simulation support. MPLF is a lock facility simulated for TPF guests.
- Real Multi-Path Lock Facility (MPLF) support. MPLF is a lock facility available on IBM DASD subsystems.

This support allows multiple TPF guests, running in a loosely coupled configuration, to share a common database through simulation or real MPLF locking channel commands used by the TPF system.

The LKFAC operand is not allowed in subconfiguration entries.

**LNKExclu**

specifies that the virtual machine is authorized to use the stable and exclusive access modes, ER (exclusive read) or EW (exclusive write) of the CP LINK command, the CMS VMLINK command, and DIAGNOSE code X'E4'. This is a global authority allowing the virtual machine to perform stable or exclusive links to any minidisk to which it has password level authorization. For minidisk-specific authorization of stable and exclusive access modes, see "LINK Directory Statement" on page 524 and "MDISK Directory Statement" on page 539. The exclusive access modes negate the ability of other users to acquire any access to the minidisk. This ensures that the issuing user is the only one with access to the minidisk.

The LNKExclu operand is not allowed in a subconfiguration entry.

**LNKNOPAS**

specifies that this virtual machine can link to any other virtual machine's DASD without password authorization. When LNKNOPAS is specified, password authorization may still be required when an external security manager (ESM) is installed. For more information, refer to the documentation provided by your ESM.

The LNKNOPAS operand is not allowed in a subconfiguration entry.

**LNKStabl**

specifies that the virtual machine is authorized to use the stable access modes, SR (stable read-only), and SW and SM (stable write), of the CP LINK command, the CMS VMLINK command, and DIAGNOSE code X'E4'. This is a global authority allowing the virtual machine to perform a stable link to any minidisk to which it has password-level authorization. For minidisk-specific authorization of stable access modes, see "LINK Directory Statement" on page 524 and "MDISK Directory Statement" on page 539. These modes negate the ability of other users to acquire write access the specified minidisk. This ensures that the data can not be changed underneath the user.

The LNKStabl operand is not allowed in subconfiguration entries.

**LXAPP**

specifies the virtual machine can access the SE hard drive using DIAGNOSE X'2C4'. See *z/VM: CP Programming Services* for more information on DIAGNOSE X'2C4'.

**MAINTCCW**

authorizes the specified virtual machine to use diagnostic CCWs, including:

- Diagnostic Write Home Address
- Diagnostic Read Home Address
- Write Record Zero

- Write Home Address
- Diagnostic Load
- Diagnostic Write
- Diagnostic Sense/Read
- Diagnostic Control.

The MAINTCCW operand is not allowed in subconfiguration entries.

### **Maxconn** *maxno*

specifies the maximum number of IUCV and APPC/VM connections allowed for this virtual machine. If the MAXCONN operand is omitted, the default is 64. The maximum is 65,535. The MAXCONN value has implications for users of file pool servers. See the *z/VM: CMS File Pool Planning, Administration, and Operation* for more information.

### **MAXVMCFI** *maxno*

specifies the maximum number of VMCF inbound send messages, including those initiated by SMSG, plus IDENTIFY final response interrupts that may be queued for processing on this virtual machine. The variable *maxno* is a decimal number from 1 to 2147483647. If the MAXVMCFI operand is omitted, the default is 2147483647.

### **MIH**

specifies that CP simulate an interrupt for the virtual machine whenever it detects a missing interrupt condition for an I/O operation it does on behalf of the virtual machine.

### **NOMEMassist**

disables the collaborative memory management assist for this virtual machine. If NOMEMASSIST is omitted, the default is to enable the assist if the real machine supports it; otherwise, the assist is disabled.

For more information about the collaborative memory management assist, see “SET MEMASSIST” in *z/VM: CP Commands and Utilities Reference*, and “Collaborative Memory Management Assist” in *z/VM: CP Programming Services*.

### **NETAccounting**

specifies that Network Data Transmission account records (type 0C) should be generated for this user. For more information on Network Data Transmission account records, see “Accounting Records Network Data Transmissions (Record Type C)” on page 347.

The NETAccounting operand is not allowed in subconfiguration entries.

### **NETRouter**

specifies that this user is a network router, and Network Data Transmission account records (type 0C) should be generated for this user. Transmissions to and from a user designated as a router (over a guest LAN), will be reported in account records separate from transmissions with non-routers. For more information on Network Data Transmission account records, see “Accounting Records Network Data Transmissions (Record Type C)” on page 347.

The NETRouter operand is not allowed in subconfiguration entries.

### **NOMDCFS**

specifies that the virtual machine can use minidisk cache at a rate that is not limited by the fair share limit. This allows virtual machines that have a very high I/O rate (such as the shared file system) to get the full benefit of minidisk cache.

### QUICKDsp

causes a virtual machine to be added to the dispatch list immediately when it has work to do, without waiting in the eligible list.

### RMCHINFO

indicates that the specified virtual machine is authorized to access real-machine configuration information, without regard to the virtual machine's configuration. It should be used when OSA/SF (or any other application that may require real machine configuration information) is running under CMS. RMCHINFO should not be specified for guest operating systems.

The RMCHINFO operand is not allowed in subconfiguration entries.

### SETORIG

specifies that the virtual machine can issue DIAGNOSE code X'F8' subfunction code X'00' to associate originating node and user ID information with a virtual output device. For more information about DIAGNOSE code X'F8', see *z/VM: CP Programming Services*.

The SETORIG operand is not allowed in subconfiguration entries.

### STGEXempt

specifies that the virtual machine is exempt from CP free storage limit detection. This ensures that the machine will not be suspended or forced off if it causes CP to consume too much free storage on its behalf. This option is recommended for non-general purpose virtual machines.

The STGEXempt operand is not allowed in subconfiguration entries.

### SVC76VM

specifies that errors are not recorded by CP. All guest SVC 76 operations are processed by the virtual machine that issued the SVC 76.

### SVMstat

specifies that the virtual machine is a service virtual machine. The monitor data records associated with this virtual machine include the SVMSTAT setting. The only purpose is to allow products that process monitor data to report on service virtual machines separate from end-user virtual machines. No other operations, such as transaction or wait state classification, are affected by this operand.

The SVMstat operand is not allowed in subconfiguration entries.

### TODENable

specifies that the user may change the virtual machine's Time-of-Day (TOD) clock with the SCK instruction or the SET VTOD CP command.

## Usage Notes

1. To run the device support facilities (ICKDSF) program in a virtual machine, you must specify the MAINTCCW operand.
2. The LKFAC option must be specified to authorize the user to use the SET LKFAC CP command to join a lock facility I/O configuration.
3. You may not specify OPTION CONCEAL if the virtual machine definition for this user defines a multiprocessor configuration. The protected application facility supports only virtual uniprocessor systems.
4. Use of the IPL statement is recommended for users of the protected application facility. If the IPL statement is used with the OPTION CONCEAL statement and an appropriate SYSPROF EXEC, the user can be put directly into an application environment during logon and thus be protected from further CP interaction.

## OPTION

5. When virtual machines with OPTION CFVM in their virtual machine definitions are autologged in a VM mode logical partition, CP will change the types of their virtual CPUs to ICF.
6. Though the break key is initially disabled at logon when the OPTION CONCEAL statement is used, its setting may be enabled by using the TERMINAL BRKKEY command.
7. When a user's break key is disabled, the user whose virtual machine is running a full-screen application cannot enter CP commands or place the virtual machine into CP READ unless the application provides a way. The application can use DIAGNOSE code X'08' to pass CP commands or to pass no command at all to enter into CP READ.
8. The TERMINAL MODE CP command allows entry to CP on a console attention interrupt for users running in line mode. In addition, #CP may be used in this mode to enter CP commands and to enter into CP READ.
9. The installation default language is set for the virtual machine if:
  - The LANG option is not specified
  - A valid CP message repository for the language specified by *langid* cannot be accessed.
10. STGEXempt ensures that the user ID is not subject to being suspended or forced due to the amount of CP free storage it causes CP to consume. This option is recommended for:
  - Special purpose user IDs vital to the installation
  - User IDs running trusted code
  - User IDs which should never be forced off.

## Examples

The following examples show various ways of specifying the OPTION statement. Note that you can specify more than one operand on a single OPTION statement.

1. To specify that:
  - The virtual machine can issue DIAGNOSE code X'4C'
  - 012345 is the virtual machine's processor identification number
  - CP is to inform the virtual machine of missing interrupts it detects
  - The virtual machine is authorized to create up to 100 IUCV pathsuse the following OPTION statement in the virtual machine definition:

```
Option Acct CpuID 012345 Mih MaxConn 100
```
2. To specify that:
  - The virtual machine can issue DIAGNOSE codes X'4C' and X'98'
  - 012345 is the virtual machine's processor identification number
  - CP is to inform the virtual machine of missing interrupts it detects
  - The virtual machine is authorized to create up to 100 IUCV pathsuse the following OPTION statement in the virtual machine definition:

```
Option Acct CpuID 012345 Mih MaxConn 100 Diag98
```
3. To place a virtual machine in the protected application environment when the user logs on, use the following OPTION statement in the virtual machine definition:

```
Option Conceal
```
4. To indicate that the virtual machine is to be added to the dispatch list without waiting in the eligible list, use:

Option QuickDsp

5. To indicate that the virtual machine can issue DIAGNOSE code X'F8', subfunction code X'00', use:

Option SetOrig

6. To indicate that the virtual machine can issue DIAGNOSE code X'DC', use:

Option ApplMon

7. To give the virtual machine the authority to enter a CP LINK *userid* 291 392 SR command, use:

Option LnkStabl

8. To allow a virtual machine to operate as a communications server, use:

Option ComSrv

9. To give the virtual machine the authority to enter a CP SET LKFAC command, use:

Option LKFAC

## POOL Directory Statement

```
►►—POOL—LOW—lowbound—HIGH—highbound—PROFile—name—◄◄
```

### Purpose

The POOL statement allows a set of virtual machines to be defined with the same configuration or characteristics.

### How to Specify

The POOL statement is allowed in user and identity entries. If you specify the POOL statement, it must be the only directory statement in the entry.

### Operands

#### LOW *lowbound*

specifies the suffix number for the user ID of the first virtual machine in the pool. The variable *lowbound* must be a decimal number from 0 to 99999.

#### HIGH *highbound*

specifies the suffix number for the user ID of the last virtual machine in the pool. The variable *highbound* must be a decimal number from *lowbound* to 99999.

#### PROFile *name*

specifies the name of the profile to be used for the definition of each virtual machine in the pool.

### Usage Notes

1. The directory statement before a POOL statement must be a USER or IDENTITY statement.
2. The user ID specified on the preceding USER or IDENTITY statement must be from 1 to 3 characters in length.

### Examples

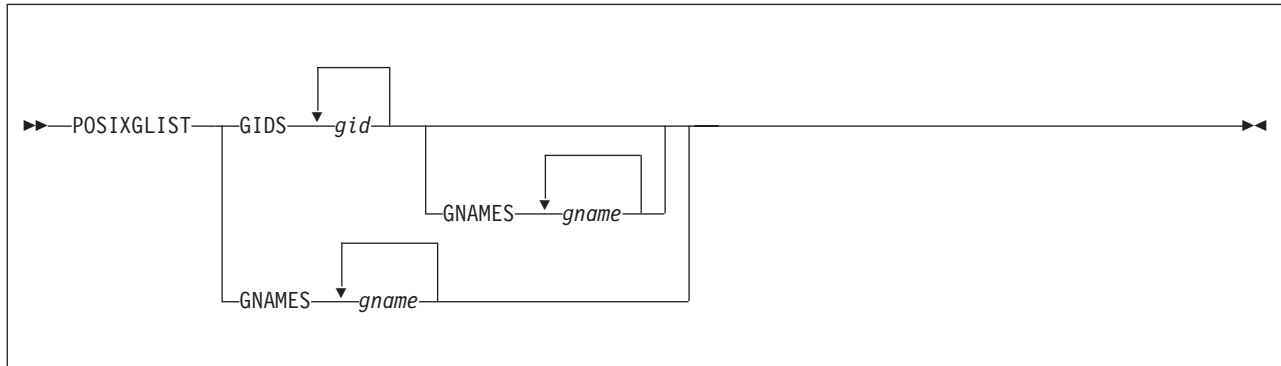
A group of 25 virtual machines with identical configurations could be defined by the following directory entry:

```
User GRP AutoOnly 4m 32m
Pool Low 1 High 25 Profile groupdef
```

This will generate directory entries for virtual machines GRP00001 through GRP00025.

Each machine would have a password of AUTOONLY, thus restricting it from terminal logon. Each virtual machine would have 4 MB of virtual storage, which may be reset up to a maximum of 32 MB. Also, each virtual machine would have a privilege class of G. The rest of the configuration for each machine would be as defined in the directory profile named GROUPDEF.

## POSIXGLIST Directory Statement



### Purpose

The POSIXGLIST statement lists POSIX groups of which the user is a member. Each group on the list can be specified by either group ID (*gid*) or group name (*gname*). POSIXGLIST statements are the primary source for the GIDs that form the user's supplementary group list.

### How to Specify

The POSIXGLIST statement is allowed in a profile, user, or identity entry. This statement must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.)

Multiple POSIXGLIST statements are allowed within a user, identity, or profile entry. The POSIXGLIST information from a user or identity completely replaces that from an included profile.

The POSIXGLIST statement may be continued across multiple records in the source directory file. For detailed information about continued statement rules, see “Continued Directory Statements” on page 461. Note that some operands on this statement are case sensitive, so care should be taken to preserve the case of them when editing the source directory.

### Operands

#### GIDS *gid*

each *gid* must identify a group defined on a POSIXGROUP statement or the default group implicitly defined by DIRECTXA.

#### GNAMES *gname*

specifies, by group name, POSIX groups of which the user is a member. Each *gname* must identify a group defined on a POSIXGROUP statement or the default group implicitly defined by DIRECTXA. The case of each group name is preserved; it is not converted to upper case by DIRECTXA. Each name must match exactly the group name on a POSIXGROUP statement or the default group name.

## Usage Notes

1. If your installation has installed an External Security Manager (ESM), the information specified on this directory statement may be overridden by information provided by the ESM. Consult your ESM documentation for more information.
2. A group's *gid* or *gname* can be specified only one time by GID or GNAME on the POSIXGLIST statements in a user, identity, or profile entry; that is, duplicate *gids* or *gnames* are not permitted.
3. DIRECTXA does not check for duplicate groups across the GIDS-GNAMES lists.
4. The user's primary group defined by a POSIXINFO statement may be listed on a POSIXGLIST statement, but it is not required to be listed. A user is automatically considered a member of his/her primary group.
5. If there is more than one group defined with the same GID, and the user is a member of any of these groups, then it is recommended that group names be used to list these groups on POSIXGLIST in order to avoid an ambiguous specification.
6. The user's supplementary GID list consists of up to 32 unique GIDs. The primary GID (from the POSIXINFO statement) is always included in the initial list. The remainder are taken from the POSIXGLIST statement(s) in the order in which they were specified.

## Examples

1. To define user ID rick to be a member of POSIX groups VMCMS, VMCFT and VMCP, code following POSIXGLIST statement:

```
Globaldefs
PosixGroup VMCFT 100
PosixGroup VMCMS 200
PosixGroup VMCP 300
:
User rick ...
PosixGList gids 200 gnames VMCFT VMCP
```



## POSIXGROUP Directory Statement

```
►►—POSIXGROUP—gname—gid—◄◄
```

### Purpose

The POSIXGROUP statement defines the group name and group ID (GID) for a POSIX group.

### How to Specify

When a POSIXGROUP statement is specified, it must be within the global definition section of the source directory (after the GLOBALDEFS directory statement and before any user, identity, or profile entries). There are no restrictions on the number of POSIXGROUP statements that may be specified. Note that some operands on this statement are case sensitive, so care should be taken to preserve the case of them when editing the user directory file.

### Operands

*gname*

specifies a unique 1- to 8-character mixed-case POSIX group name. The single or double quotation mark is invalid in this operand. The case of this operand is preserved; it is not converted to upper case by DIRECTXA. Any group name specified on other directory statements that refer to this group must match this group's name exactly.

The group name DEFAULT identifies the default group and is reserved by DIRECTXA; it may not be specified on a POSIXGROUP statement. DIRECTXA implicitly defines a default group with a name of DEFAULT and a GID of 4294967295 (X'FFFFFFFF'). This name or GID may be specified on POSIXINFO and POSIXGLIST statements to identify the default group.

*gid*

specifies the POSIX group ID (GID) associated with *gname*. The *gid* is a numeric value from 0 to 4294967295 (X'FFFFFFFF').

### Usage Notes

1. If your installation has installed an External Security Manager (ESM), the information specified on this directory statement may be overridden by information provided by the ESM. Consult your ESM documentation for more information.
2. Duplicate group names are not permitted, but multiple groups may have the same GID. If you define multiple groups with the same GID, do so with caution, because GIDs are used for various authority checks. Also, certain queries that require a GID as input may return information about a group other than the intended one.
3. It is permitted to define a group with no members. That is, a POSIXGROUP statement may define a group that no users identify as one of which they are a member.

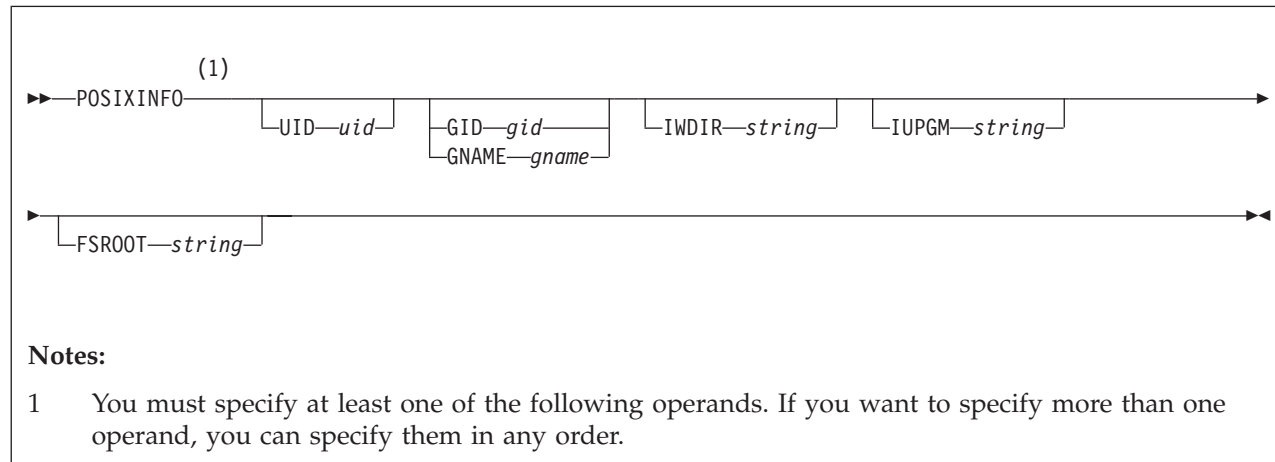
## POSIXGROUP

### Examples

1. To define a POSIX group named VMcp and with a GID of 200, code the following POSIXGROUP statement:

```
Globaldefs
 PosixGroup VMcp 200
```

# POSIXINFO Directory Statement



**GNAME** *gname*

specifies the user's primary group. The *gid* is a numeric value between 0 and 4294967295 (X'FFFFFFFF'). The *gname* is a 1- to 8-character mixed-case POSIX group name. The single or double quotation mark is invalid in the *gname*. The case of the group name is preserved; it is not converted to upper case by DIRECTXA. It must match exactly the group name on a POSIXGROUP statement or the default group name implicitly defined by DIRECTXA. The *gid* or *gname* must identify a group defined on a POSIXGROUP directory statement or the default group name implicitly defined by DIRECTXA. The GID for this group will be the user's real GID, effective GID and saved-set GID when the user logs on.

You may specify the group by either GID or GNAME, but not both. If GNAME is specified, the user's primary GID is obtained from the POSIXGROUP statement defining the group with name *gname*. If GID is specified, the user's primary group name is obtained from a POSIXGROUP statement defining a group with GID *gid*. If there is more than one group with this GID, then one of them is chosen as the user's primary group; it is unpredictable which one is chosen.

If there is no GID or GNAME specification for a user, the user's primary group is the default group, named DEFAULT with GID 4294967295 (X'FFFFFFFF').

**IWDIR** *string*

specifies the user's initial working directory. Its rules for specification are described below.

**IUPGM** *string*

specifies the user's initial user program. Its rules for specification are described below.

**FSROOT** *string*

specifies the user's file system root. Its rules for specification are described below.

The *string* specifying an IWDIR, IUPGM or FSROOT results in a mixed-case 1- to 1023-character string which may contain blanks, single quotation marks, double quotation marks and other special characters. The *string* begins with the first nonblank character following its keyword and may be continued on multiple directory records. If you do not want imbedded blanks or quotation marks in the result, and *string* fits on a single directory record, you may specify *string* as a single blank-delimited token. Otherwise, it must be specified as a *quoted string operand*. See "Quoted String Operands" on page 462 for detailed information on how to specify these operands.

## Usage Notes

1. If your installation has installed an External Security Manager (ESM), the information specified on this directory statement may be overridden by information provided by the ESM. Consult your ESM documentation for more information.
2. UIDs are not required to be unique. The same value can be assigned to multiple users, but this is not recommended. If you define multiple users with the same UID, do so with caution, because UIDs are used for various authority checks and individual user control and accountability will be lost.
3. POSIXINFO statements are permitted in profile entries, but you should not specify the UID in a profile entry because it is likely to result in many users with the same UID. Since UIDs are used to identify individuals for the purposes of authorization and permission checking, extreme care should be

used when assigning UIDs through a profile entry. Similar consideration should be given to assigning GID/GNAME through a profile entry.

4. POSIX *user names*, sometimes referred to as *login names*, are defined to be the lower case version of the user's VM user ID.

## Examples

1. To define a userid CLYDE with 100 as UID, 200 as primary GID, /home/clyde as initial working directory, pxshell as initial user program, and /../VMBFS:VMSYS:ROOT/ as the file system root, code the following directory statements:

```
Globaldefs
PosixGroup VMcp 200
:
User clyde ...
PosixInfo uid 100 gid 200 iwdir /home/clyde ,
 iupgm pxshell
PosixInfo fsroot /../VMBFS:VMSYS:ROOT/
```

2. Assume you have several virtual machines, among them are SUE and DAMIAN, that have the same initial user program pxshell, and /../VMBFS:VMSYS:ROOT/ as the file system root. SUE's UID is 200, primary group has an ID of 101, and initial working directory /home/sue. DAMIAN's UID is 100, primary group is named VMcp, and initial working directory /home/damian. Code the following directory statements:

```
Globaldefs
PosixGroup VMcms 100
PosixGroup VMcp 200
:
Profile posixdef
PosixInfo iwdir /home iupgm pxshell fsroot /../VMBFS:VMSYS:ROOT/
:
User sue ...
Include posixdef
PosixInfo uid 200 gid 100 iwdir /home/sue
:
User damian ...
Include posixdef
PosixInfo uid 101 gname VMcp iwdir /home/damian
```



- 1 You must specify at least one of the following operands. If you want to specify more than one operand, you can specify them in any order.

The `POSIXOPT` statement specifies option settings related to a user ID's POSIX capabilities. It includes authorization to query and set POSIX process and database information.

If you specify the `POSIXOPT` statement, it must precede any device statements you specify in a profile, user, or identity entry. (For a list of device statements, see Table 22 on page 457.)

Multiple POSIXOPT statements are allowed within a user, identity, or profile entry. Each operand can be specified only once within a user, identity, or profile entry. POSIXOPT values within a user or identity entry override those in a profile entry.

The POSIXOPT statement can be continued across multiple records in the source directory file. For detailed information about continued statement rules, see “Continued Directory Statements” on page 461.

## SETIDS

specifies whether the user is authorized to set other users' POSIX UIDs or GIDs.

**DISALLOW**

(the default) specifies the user is not allowed to set other users' POSIX security values.

**ALLOW**

specifies the user is allowed to set other users' POSIX security values on behalf of CP *exec()* processing. The users whose IDs are to be set must have POSIXOPT EXEC\_SETIDS ALLOW specified in their virtual machine definitions. You should generally specify this option (SETIDS ALLOW) only for POSIX byte file system (BFS) servers.

**QUERYDB**

specifies whether the user is authorized to query other users' POSIX database information.

#### **SYSDEFAULT**

(the default) specifies the system default authorization for querying POSIX database information.

The system default authorization (SYSDEFAULT) is set up by the USER\_DEFAULTS system configuration file statement. See “USER\_DEFAULTS Statement” on page 292 for details. If the QUERYDB option is specified, it will override the system default. If it is not specified, then the system default applies.

#### **DISALLOW**

specifies the user is not allowed to query other users' POSIX database information.

#### **ALLOW**

specifies the user is allowed to query other users' POSIX database information.

#### **EXEC\_SETIDS**

specifies whether the user is authorized to have his POSIX security values changed on behalf of a POSIX *exec()* function call designating a file with the *setuid* or *setgid* attributes. The byte file system server must have POSIXOPT SETIDS ALLOW specified in its virtual machine definition.

#### **SYSDEFAULT**

(the default) specifies the system default for having a user's POSIX security values changed by other users.

The system default authorization (SYSDEFAULT) is set up by the USER\_DEFAULTS system configuration file statement. See “USER\_DEFAULTS Statement” on page 292 for details. If the EXEC\_SETIDS option is specified in the directory, it will override the system default. If it is not specified, then the system default applies.

#### **DISALLOW**

specifies the user is prohibited from having his POSIX security values changed on behalf of CP *exec()* processing.

#### **ALLOW**

specifies the user is permitted to have his POSIX security values changed on behalf of CP *exec()* processing.

### **Usage Notes**

1. If your installation has installed an External Security Manager (ESM), the information specified on this directory statement may be overridden by information provided by the ESM. Consult your ESM documentation for more information.
2. If a user has EXEC\_SETIDS DISALLOW specified, then any requests to change this user's POSIX security values on behalf of CP *exec()* processing will be rejected even if the requestor is authorized to change POSIX security values.

### **Examples**

The following examples show various ways of specifying the POSIXOPT statement. Note that you can specify more than one operand on a single POSIXOPT statement.

1. To specify that:
  - A user can set any other users' POSIX security values
  - The user can query any other users' database information

## POSIXOPT

- The user prohibits having his POSIX security values changed by other users on behalf of CP *exec()* processing.

use the following POSIXOPT statement in the virtual machine definition:

```
PosixOpt SetIds allow QueryDb allow Exec_Setids disallow
```

2. To specify that:

- The user cannot set other users' POSIX security values
- The user can not query other users' database information
- The user takes the system default for the Exec\_Setids option

use the following POSIXOPT statement in the virtual machine definition:

```
PosixOpt QueryDb disallow
```



# PROFILE Directory Statement

►►—Profile—*name*—◄◄

## Purpose

A PROFILE statement defines the start of a profile entry in the source directory. Profile entries represent defaults to be set if not specified in the associated user, identity, or subconfiguration entries.

## How to Specify

When PROFILE is specified, all profile entries must follow the last DIRECTORY statement and the global definition entry and precede the first USER, IDENTITY, or SUBCONFIG statement. There are no restrictions on the number of profile entries that can be specified.

Directory profiles are implemented by defining a profile entry in the source directory and specifying an INCLUDE statement in the user or identity entries that refer to the profile. For more information on the INCLUDE statement, see “INCLUDE Directory Statement” on page 508.

## Operands

*name*

specifies the name assigned to the profile entry and is used to refer to the profile. The variable *name* is an alphanumeric string of up to 8 characters. A valid character is any character that can be used in a user ID name. Only one profile name can be specified on a PROFILE statement.

## Usage Notes

1. When directory statements are used in a profile entry, they perform the same function as they do when used in a user, identity, or subconfiguration entry. However, they might operate slightly differently when used in both the profile and user, identity, or subconfiguration entries.
2. The following statements, when placed in the user or identity entry, completely supersede their profile counterparts:

|            |            |            |
|------------|------------|------------|
| ACCOUNT    | IOPRIORITY | SHARE      |
| ACIGROUP   | IPL        | SPOOLFILE  |
| AUTOLOG    | LOADDEV    | STDEVOPT   |
| CLASS      | LOGONBY    | STORAGE    |
| CONSOLE    | MACHINE    | VMRELOCATE |
| CRYPTO     | MAXSTORAGE | XAUTOLOG   |
| DATEFORMAT | NICDEF     | XSTORE     |
| D80ONECMD  | POSIXGLIST |            |

3. Area operands of the SCREEN statements in the user, identity, or subconfiguration entry supersede their profile counterparts. This relationship also holds true when the user, identity, or subconfiguration entry redefines a superset or subset of those areas defined by the profile.

## PROFILE

4. STDEVOPT, POSIXINFO, and POSIXOPT statement operands explicitly coded in a user or identity entry supersede their profile counterparts. However, these statements' operands explicitly coded in a profile supersede uncoded defaults in a user or identity entry.
5. If the CPU number is the same in both the user or identity entry and the profile entry, CPU statement from the user or identity entry supersedes the one in the profile entry. If the CPU numbers are different, however, the statements are simply appended. The order of concatenation is CPU statements from the user or identity entry followed by those in the profile entry.
6. The XCONFIG statement, when placed in the user, identity, or subconfiguration entry, supersedes its profile counterpart if the first (major) operand is the same; if the first operands are different, the definitions are combined.
7. When the following directory statement types are used in a profile entry, they are processed exactly as if they were multiple occurrences of the statement types within the including user or identity entry. (See Usage Note 5.)

|          |          |        |
|----------|----------|--------|
| APPCPASS | NAMESAVE | OPTION |
| IUCV     | NOPDATA  |        |

8. When the following directory statement types are used in a profile entry, they are processed as normal except that a duplicate definition of an address in the profile entry causes a duplication error. However, duplicating an address from the profile with an address used in the including user, identity, or subconfiguration entry simply creates another device definition to be resolved at logon time. That is, at logon, the including user's device definition for the duplicated address is processed first; if this definition fails, the profile device definition for the duplicated address is attempted.

|         |          |         |
|---------|----------|---------|
| CONSOLE | DEDICATE | SPECIAL |
| DASDOPT | LINK     | SPOOL   |

9. The following directory statements are not allowed in a profile entry:

|                     |         |            |
|---------------------|---------|------------|
| BUILD               | INCLUDE | POSIXGROUP |
| CRYPTO <sup>1</sup> | LOAD    | PROFILE    |
| DIRECTORY           | MDISK   | SUBCONFIG  |
| GLOBALDEFS          | MINIOPT | SYSAFFIN   |
| GLOBALOPTS          | POOL    | USER       |
| IDENTITY            |         |            |

<sup>1</sup> CRYPTO APVIRT is allowed in profile entries. CRYPTO operands other than APVIRT are not allowed in profile entries.

10. A profile entry begins with a PROFILE statement and ends with the next PROFILE statement or the first USER, IDENTITY, or SUBCONFIG statement.

## Examples

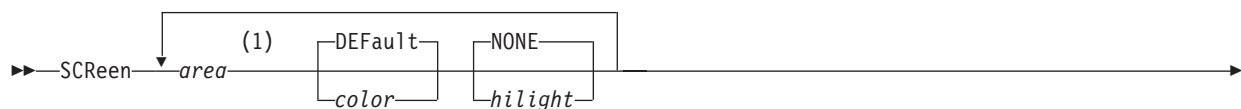
For this example, assume you have several virtual machines that are CMS users and that are also in a ACIGROUP called GROUP1. JOHN1 is a user in this group. Follow the directory statement by the following profile:

```
Directory vdev devtype valid
Profile grpluser
 AciGroup group1
 Ipl cms
```

```

: ← other directory statements common to this group
User john1 ... ← USER statement operands for this user
 Include grpluser
 : ← directory statements unique to this user
 Link jack 495 495 rr ← for example, a link that this user needs
 : but other users in this group do not need
User ...
 :
```

## SCREEN Directory Statement



### Notes:

- 1 You must specify at least one of the operands. If you want to specify more than one, you can specify them in any order.

## Purpose

SCREEN statements in a virtual machine definition define the extended color and extended highlighting options for the virtual machine console.

## How to Specify

The SCREEN statement is allowed in a profile, user, identity or subconfiguration entry. If specified, SCREEN statements must precede any device statements in an entry. (For a list of device statements, see Table 22 on page 457.) You may include as many SCREEN statements as you need to define any areas of the screen you want, but the SCREEN statements must be contiguous.

Any number of SCREEN statements are allowed within a profile entry, and are added to any SCREEN statements in the user, identity, or subconfiguration entry. Duplicate area specifications within a profile are not allowed. The user or identity entry overrides a profile entry for any user-to-profile duplicate area specification. This relationship also holds true when the user identity entry redefines a superset or subset of those areas defined by the included profile.

If a SCREEN statement is contained within a subconfiguration entry, then that set of SCREEN statements replaces either explicitly or implicitly any settings for those specific areas that were also set by SCREEN statements in the identity entry. The result is a combination of settings specified in the subconfiguration, identity, and profile entries, with the identity overriding the profile and the subconfiguration overriding the identity for each specific area.

For example, if ALL is specified in the profile as BLUE and BLINK, OUTAREA is specified in the identity as GREEN and REVVIDEO, and VMOUT is specified in the subconfiguration as RED and UNDERLIN, then the settings are:

- INAREA: BLUE and BLINK
- STATAREA: BLUE and BLINK
- CPOUT: GREEN REVVIDEO
- VMOUT: RED and UNDERLIN
- INREDISP: GREEN and REVVIDEO

## Operands

### *area*

is the area of the screen. Area can be:

**ALL** designating the entire screen. If this area is specified, none of the following areas can be used.

**INArea**  
the input area.

**STAtarea**  
the system status area.

**OUTarea**  
the output areas. If this area is specified, none of the following areas can be used.

**CPOut**  
the output from CP.

**VMOut**  
the output from CMS or the virtual machine operating system running in the user's virtual machine.

**INRedisP**  
the input redisplay.

### *color*

is the color attribute to be assigned to an area of the screen. Color can be:

|           |       |        |                           |
|-----------|-------|--------|---------------------------|
| BLUe      | GREen | PINK   | RED                       |
| TURquoise | WHItE | YELLow | DEFault (green and white) |

### *highlight*

is the extended highlight value to be assigned to an area of a screen. The highlight value can be:

**BLInk** blinking

**NONE** (the default) no extended highlighting

**REVvideo**  
reverse video

**UNDerlin**  
underlining

## Usage Notes

1. A default value of NONE is applied for any unspecified extended highlight attribute. DEFAULT is used for any unspecified extended color attribute. The DEFAULT color is monochrome (green and white).
2. If the ALL operand is used, it must be the only operand specified on the only SCREEN statement for the user.
3. If the OUTAREA operand is used, CPOUT, VMOUT, or INREDISP cannot be specified. If CPOUT, VMOUT, or INREDISP is specified, the OUTAREA operand cannot be specified.
4. No SCREEN statement operands can appear more than once in a b12rctdirectory entry.

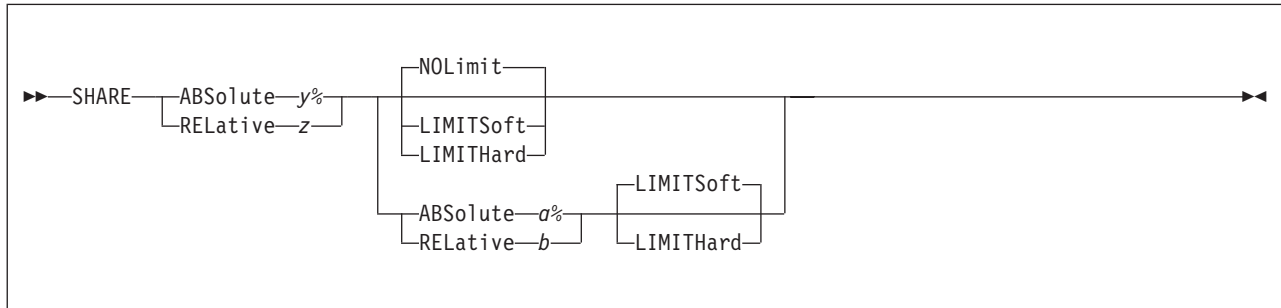
## SCREEN

### Examples

To define the screen output area of a user's virtual console as red and blinking, and the input area yellow and reverse video, use the following SCREEN statement in the virtual machine definition:

```
SCReen OutArea red blink InArea RevVideo yellow
```

## SHARE Directory Statement



### Purpose

The SHARE statement specifies a virtual machine's share of CPU power.

### How to Specify

The SHARE statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the SHARE statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.)

You can specify only one value (ABSOLUTE or RELATIVE) per statement. Though allowed, you should not put multiple SHARE statements in a directory entry. If multiple SHARE statements are found in a directory entry, only the last one is used.

Multiple SHARE statements are allowed within a profile entry, but are used only if no SHARE statements are in the including user, identity, or subconfiguration entry. If multiple SHARE statements are in an included profile, only the last one is used.

A SHARE statement in a subconfiguration entry overrides one in the identity entry.

If you specify more than five tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

#### ABSolute *y%*

specifies absolute share of the all active processors in a system. The variable *y* is a decimal real number—no or one decimal place—from 0.1 to 100 (for example, 20.5%, or 80%).

#### RELative *z*

specifies a relative share of the system. The variable *z* is a decimal integer between 1 and 10000.

#### ABSolute *a%*

specifies a user's maximum absolute share of the all active processors in a system. The variable *a* is a decimal real number—no or one decimal place—from 0.1 to 100 (for example, 20.5%, or 80%). If ABSOLUTE *y%* was specified, *y* must be less than or equal to *a*.

**RELATIVE *b***

specifies a user's maximum relative share of the system. The variable *b* is a decimal integer between 1 and 10000. If RELATIVE *z* was specified, *z* must be less than or equal to *b*.

**NOLimit**

specifies that a user's share of processing resource is not limited.

**LIMITSoft**

specifies that a user's share of processing resource is limited. However, there are times when LIMITSOFT users will receive more than their limit. This occurs when some users are not using all of their shares (for example, they are waiting for I/O to complete), and there are no NOLIMIT users nor users who have not yet reached their limit and can use additional processing resource. If a maximum share is not specified, the minimum share is also the maximum.

**LIMITHard**

specifies that a user's share of processing resource is limited. When LIMITHARD is specified, a user will not receive more than its maximum share of the processing resource. If a maximum share is not specified, the minimum share is also the maximum.

See the SET SRM LIMITHARD command in *z/VM: CP Commands and Utilities Reference* for details of setting the method that the scheduler will use to enforce the limit on the guest's CPU usage.

### Usage Notes

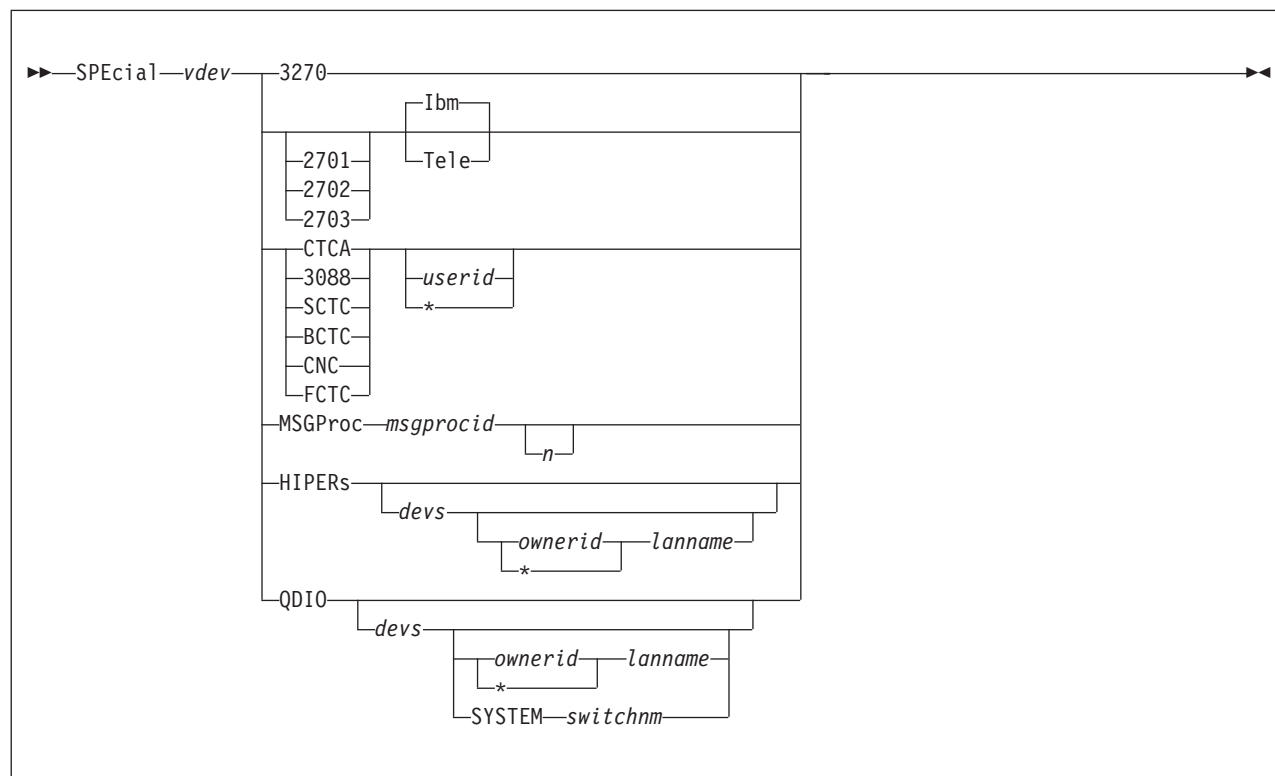
1. If you do not specify a SHARE statement for a virtual machine, CP assigns that virtual machine a relative share of 100.
2. For more information on scheduler shares, see *z/VM: Performance*.
3. If a limit is specified without a maximum share being specified, the user's minimum share is also its maximum share.
4. For more information about setting the SHARE of a userid that has multiple CPUs in its configuration, see the SET SHARE command in *z/VM: CP Commands and Utilities Reference*.

### Examples

1. To assign a minimum absolute share of 50%, use the following SHARE statement in the virtual machine definition:  
`Share Absolute 50%`
2. To assign a minimum relative share of 200, use the following SHARE statement in the virtual machine definition:  
`Share Relative 200`
3. To assign a minimum absolute share of 50% and a maximum absolute share of 60%, use the following SHARE statement in the virtual machine definition:  
`Share ABSOLUTE 50% ABSOLUTE 60%`
4. To assign a minimum relative share of 100 and a maximum absolute share of 75%, where the maximum share is a hard limit, use the following SHARE statement in the virtual machine definition:  
`Share RELATIVE 100 ABSOLUTE 75% LIMITHARD`



## SPECIAL Directory Statement



### Purpose

The SPECIAL statement defines special virtual devices, which are fully simulated by CP and not connected with real devices at definition time. Some SPECIAL devices can be connected with a real device during normal operation. Refer to the DIAL command for 3270 and communication lines and to the COUPLE command for CTCA and 3088 devices. Refer to *z/VM: CP Commands and Utilities Reference* for details.

Use SPECIAL HIPER to create a virtual HiperSockets adapter in the virtual machine, and (optionally) connect it to a guest LAN. During LOGON processing, this statement is equivalent to a DEFINE NIC command followed by a COUPLE command.

### How to Specify

The SPECIAL statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the SPECIAL statement, it must follow any general statements you specify in a directory entry. (For a list of general statements, see Table 22 on page 457.)

Multiple SPECIAL statements are allowed in an entry if no duplicate virtual device numbers are specified in the entry. Any SPECIAL statements in a subconfiguration entry are processed first at logon time, followed by SPECIAL statements in a user or identity entry, followed by SPECIAL statements in a profile entry.

DIRECTXA does not check for extra tokens that might be specified at the end of the MDISK statement. If you specify additional tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified extra tokens.

## Operands

*vdev*

For most **SPECIAL** devices, this is the virtual device address of the device to be defined. For a MSGPROC, HIPERS, or QDIO device, this represents the base (or first) device address in a series of virtual I/O devices that belong to the same unit.

A simulated adapter can also be created using the NICDEF directory statement. The NICDEF statement allows additional configuration options not available on the SPECIAL statement.

**3270**

is the value for a virtual 3270 display device.

**CTCA**

**3088**

**SCTC**

**BCTC**

**CNC**

**FCTC**

specifies a CTCA, 3088, SCTC, BCTC, CNC or FCTC for a virtual 3088 Multisystem Channel Communication Unit logical channel adapter. You can also specify:

*userid*

is the user ID of a virtual machine allowed to connect to this virtual CTCA, 3088, SCTC, BCTC, CNC or FCTC using the CP COUPLE command. For more information about the CP COUPLE command, see the *z/VM: CP Commands and Utilities Reference*.

- \* tells CP that a CP COUPLE command is to be allowed only from another virtual CTCA, 3088, SCTC, BCTC, CNC, or FCTC owned by the same virtual machine that owns the CTCA or 3088 defined by this SPECIAL statement.

If you do not specify a user ID or an asterisk (\*), a virtual machine with any user ID can connect to this virtual CTCA.

**2701**

**2702**

**2703**

is the value for a communication line. This value is optional and used for compatibility only.

**Ibm**

is the virtual device type of the line you are defining. This is a 2741, 3767, or equivalent device. This is the default if it is used with the 270x operand.

**Tele**

is the virtual device type of the line you are defining. This is a 3101, 3151, 3161, 3162, 3163, or equivalent device.

**MSGProc** *msgprocid n*

restricts and defines a virtual message processor and associated message devices in the virtual I/O configuration. It creates a message facility

environment for the user and establishes a connection to the specified Coupling Facility (CF) Service Machine supplying the message processor function.

If this is being used to define a CFLINK, then  $n$  must be between 2 and 8; the default is 2. If this is being used to define a MSGPROC, then  $n$  must be an even number between 4 and 16; the default is 4. However, if the MSGPROC is not in z/Architecture mode, then the default value (2 or 4, as appropriate) is taken for  $n$ , no matter what is specified.

Defining a message processor by the SPECIAL MSGPROC directory statement allows the system administrator to restrict the message processors a user is allowed to define with the DEFINE MSGPROC command. Once a SPECIAL MSGPROC directory statement is specified in the virtual machine definition, the user can define message processors specified only by SPECIAL MSGPROC statements.

The virtual message processor will only be defined if the following conditions exist:

- OPTION CFUSER is specified in the virtual machine definition for this user
- the *vdev* specified is the first of four available consecutive device numbers in the users virtual configuration
- the specified CF Service Machine user ID is running prior to the logging on of this virtual machine.

**Note:** If the above conditions are not met, but OPTION CFUSER was specified in the user directory, the user will have to define the message processor with the DEFINE MSGPROC command after logging on. Since the SPECIAL statement was specified, the user will still be restricted to only defining the message processors specified in his directory.

The MSGPROC option requires OPTION CFUSER, which is not allowed in a subconfiguration entry. Therefore, specifying MSGPROC on a SPECIAL statement in a subconfiguration entry generates an error message.

#### HIPERS

indicates that a simulated HiperSockets adapter should be created based on this statement. A simulated network interface card (NIC) is defined during LOGON with *devs* devices (beginning with the base, *vdev*). If a guest LAN is identified, the NIC is automatically coupled to *ownerid lanname*.

#### QDIO

indicates that a simulated QDIO adapter should be created based on this statement. A simulated network interface card (NIC) is defined during LOGON with *devs* devices (beginning with the base device, *vdev*). If a guest LAN or virtual switch is identified, the NIC is automatically coupled to the specified *lanname* or *switchnm*.

#### *devs*

is the number (decimal) of virtual I/O devices to be created for a simulated network interface card (NIC). This number is evaluated during LOGON processing. For a simulated HiperSockets adapter, *devs* must be a decimal value between 3 and 3,072 (inclusive). For a simulated QDIO adapter, *devs* must be a decimal value between 3 and 240 (inclusive). The default for either HIPERS or QDIO is three (3) devices.

#### *ownerid* | \* *lanname*

identifies a guest LAN for an immediate connection to the network interface card (NIC). When *ownerid* and *lanname* are omitted, the simulated adapter is

left in the default (uncoupled) state. When *ownerid* and *lanname* are specified, the simulated adapter is automatically connected to the designated guest LAN. Note that *ownerid* can be specified as asterisk (\*) to represent the user ID of the current virtual machine.

#### SYSTEM *switchnm*

identifies a virtual switch for an immediate connection to the network interface card (NIC). When **SYSTEM** *switchnm* is omitted, the simulated adapter is left in the default (uncoupled) state. When **SYSTEM** *switchnm* is specified, the simulated adapter is automatically connected to the designated virtual switch.

### Usage Notes

1. When a simulated NIC is defined (**HIPERS** or **QDIO** device types), the **SPECIAL** statement results in the creation of a series of I/O devices. The base device is validated by directory processing, but the remaining devices in the range are validated during LOGON processing. If another device is found in the range established by *vdev* and *devs*, the simulated NIC cannot be created.
2. It is possible to define a simulated HiperSockets NIC or QDIO NIC that will be automatically coupled to a guest LAN (designated by *ownerid lanname*) or to define a simulated QDIO NIC that will be automatically coupled to a virtual switch (designated by **SYSTEM** *switchnm*). However, if the designated guest LAN or virtual switch is not available when this user signs on, the COUPLE cannot be performed. To make effective use of this feature, you should consider adding a **DEFINE LAN** or **DEFINE VSWITCH** statement in the **SYSTEM CONFIG** file to create the target guest LAN or virtual switch during system initialization.
3. The virtual channel-to-channel adapter defined will be equivalent to a System/370 CTCA designed after 1 January 1981. To determine which I/O commands a CTCA supports, refer to the *S/360 S/370 Channel-To-Channel Adapter* book.
4. When **SPECIAL MSGP** is processed, if the creation of the CFLINK is delayed (in case the target was not logged on yet or not ready to be the receiver of a CFLINK), the following message is displayed:  
 HCP2821I SPECIAL MSGP processing was deferred  
 Each time a coupling facility virtual machine (CFVM) finishes logging on, the existing CFVMs reevaluate their **SPECIAL MSGPs** to determine if any will nominate the new CFVM. Then each **SPECIAL MSGP** that matched is handled.
5. The **SPECIAL HIPER** statement generates multiple virtual I/O devices. If any other device exists in the range required for the *vdev* plus *devs* (minus 1), the HiperSockets adapter cannot be created.

### Examples

1. Define a simulated QDIO adapter using I/O devices 0500–0507 (eight devices) which will be coupled to the SYSTEM-owned INEWS LAN during LOGON processing:  
 SPECIAL 500 QDIO 8 SYSTEM INEWS
2. Define a simulated HiperSockets adapter using I/O devices FD20–FD2F (16 devices) which will be coupled to the user's own HSTEST LAN during LOGON processing:  
 SPECIAL FD20 HIPERS 16 \* HSTEST  
 Note that this adapter cannot couple to the designated LAN during LOGON unless it has been defined earlier. This can be accomplished by adding the necessary **DEFINE LAN** statement to the **SYSTEM CONFIG** file.

3. To define a CTCA at virtual device number 2FF that can be coupled by LINKMAN, specify one of the following SPECIAL statements in the virtual machine definition:
 

```
Special 2ff Ctca linkman
Special 2ff 3088 linkman
```
4. To define a 3088 at virtual device number 3F0 that can be coupled to by any virtual machine, specify one of the following SPECIAL statements in the virtual machine definition:
 

```
Special 3f0 3088
Special 3f0 Ctca
```
5. To define virtual 3270 display devices at virtual device numbers 101, 102, and 103, specify the following SPECIAL statements in the virtual machine definition:
 

```
Special 101 3270
Special 102 3270
Special 103 3270
```
6. To define a virtual communication line at virtual device numbers 301, 302, and 303, specify the following SPECIAL statements in the virtual machine definition:
 

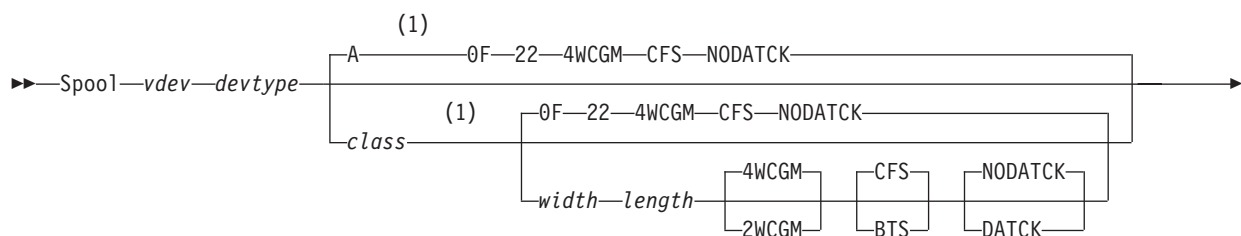
```
Special 301 2702 Ibm
Special 302 2702
Special 303 Ibm
```

**Note:** Although the statements differ in content, they all define the same type of line at their respective device numbers.

7. To define a virtual HiperSockets adapter with I/O devices 0500–0507 (eight devices) and connect it to the system-owned LAN named INEWS during LOGON processing, specify the following SPECIAL statement in the virtual machine definition:
 

```
Special 500 hiper 8 system inews
```

## SPOOL Directory Statement



### Notes:

- 1 The following variables are only recognized for a 3800 printer.

## Purpose

The SPOOL statement defines virtual unit record devices.

## How to Specify

The SPOOL statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the SPOOL statement, it must follow any general statements you specify in a directory entry. (For a list of general statements, see Table 22 on page 457.)

Multiple SPOOL statements are allowed in an entry if no duplicate virtual device numbers are specified in the entry. Any virtual device number in a profile that duplicates a virtual device number in a user, identity, or subconfiguration entry is resolved at logon time. Any SPOOL statements in a subconfiguration entry are processed first at logon time, followed by SPOOL statements in a user or identity entry, followed by SPOOL statements in a profile entry.

When processing the SPOOL statement for 3800 printers, DIRECTXA checks for a maximum of eight tokens: virtual device number, device type, spooling class, width of the paper, length of the paper, number of writable characters, stacker type, and data check setting, in that order. If you specify more than eight tokens, DIRECTXA produces an error message and the directory will not be updated.

When processing the SPOOL statement for all other devices, DIRECTXA checks for a maximum of three tokens: virtual device number, device type, and volume serial number. If you specify more than three tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

## Operands

*vdev*

is the virtual device number for the spooling device.

*devtype*

is the device type. Valid device types are:

1403

3262

3800-3<sup>4</sup>

Printer<sup>5</sup>

|                   |                     |                    |                     |
|-------------------|---------------------|--------------------|---------------------|
| 2501              | 3505                | 4245               | PRT <sup>5</sup>    |
| 2540 <sup>1</sup> | 3525                | 4248               | RDR <sup>7</sup>    |
| 3203              | 3800 <sup>2</sup>   | PCH <sup>6</sup>   | Reader <sup>7</sup> |
| 3211              | 3800-1 <sup>3</sup> | PUnch <sup>6</sup> | VAFP <sup>8</sup>   |

**Notes:**

1. Specify 2540 for a reader or a punch.
2. 3800 defaults to a 3800 Model 1 printer.
3. Specify 3800-1 for a 3800 Model 1 printer.
4. Specify 3800-3 for a 3800 Model 3 printer.
5. Printer or PRT defaults to a 1403 printer.
6. PCH or PUnch defaults to a 2540 punch.
7. RDR or Reader defaults to a 2540 reader.
8. Specify VAFP for a virtual advanced functional printer. For more information, see the DEFINE (Spooling Device) command in the *z/VM: CP Commands and Utilities Reference*.

*class*

is the spooling class. If omitted, A is used as a default. The variable *class* is a 1-digit alphanumeric character from A to Z, from 0 to 9, or an asterisk (\*). A reader is the only valid device that can use an asterisk (\*).

For spooled output devices, the class governs the punching or printing of the real spooled output. For spooled input devices, the class controls access to spool files by virtual card readers.

*width length*

specifies the physical characteristics of the paper to be loaded into the 3800 printer. The variable *width* is the hexadecimal form width code of the paper, and *length* indicates the decimal length of the paper. Specify *length* as a decimal number using *half-inches*. If *width* and *length* are omitted, 14-7/8 x 11 inches is used as a default.

The following table lists available form-width codes (values other than those listed below are rejected):

| Code | Width in Inches | Width in Millimeters |
|------|-----------------|----------------------|
| 01   | 6-1/2           | 165                  |
| 02   | Reserved        | 180                  |
| 04   | 8-1/2           | 215                  |
| 06   | 9-1/2           | 235                  |
| 07   | 9-7/8           | 250                  |
| 08   | 10-5/8          | 270                  |
| 09   | 11              | 280                  |
| 0A   | 12              | 305                  |
| 0B   | Reserved        | 322                  |
| 0D   | 13-5/8          | 340                  |
| 0E   | 14-3/10         | 363                  |
| 0F   | 14-7/8          | 378                  |

**2WCGM****4WCGM**

specifies the number of writable character generation modules (WCGM) for the virtual 3800 printer. A WCGM is a 64-position portion of the 3800's character

## SPOOL

generation storage that holds the scan elements of one character set. A 3800-1 can have either two or four WCGMs. A 3800-3 has four WCGMs. If omitted, the default is 4WCGM.

### **BTS**

### **CFS**

specifies the type of stacker for the virtual 3800 printer. You may specify either CFS (continuous forms stacker) or BTS (burster trimmer stacker). If omitted, the default is CFS.

### **DATCK**

### **NODATCK**

specifies whether CP processes certain virtual 3800 data checks for the virtual machine. If you specify DATCK, CP reflects all data checks to the virtual machine (if the Block Data Check CCW is not issued). If you specify NODATCK, only data checks due to invalid translate table specifications or unmatched FCB codes are reflected to the virtual machine. If omitted, the default is NODATCK.

**Note:** Specifying DATCK severely increases the overhead associated with simulation of Write and Skip CCWs to the virtual 3800. In general, the reflection of data checks due to overprinting and invalid EBCDIC codes is not necessary. Therefore, specify DATCK only when absolutely necessary.

## **Examples**

1. To define at 00C a spooled reader that can read any class of spool file, specify the following SPOOL statement in the virtual machine definition:

```
Spool 00c Reader *
```

2. To define at 00D a spooled punch that creates only class P spool files, specify the following SPOOL statement in the virtual machine definition:

```
Spool 00d Punch p
```

3. To define at 00E a spooled 1403 printer that processes class E spool files, specify the following SPOOL statement in the virtual machine definition:

```
Spool 00e 1403 e
```

4. To define at 00E a virtual 3800 printer with these characteristics:

- Only class Z spool files
- 11 X 11 inch paper
- Two WCGMs
- The continuous forms stacker
- No CP reflection of data checks

specify the following SPOOL statement in the virtual machine definition:

```
Spool 00e 3800 z 09 22 2wcgm Cfs NoDatCk
```



## SPOOLFILE Directory Statement

►►—SPOOLFile—MAXSPOOL—*nnnn*—◄◄

### Purpose

The SPOOLFILE statement describes virtual machine spool file characteristics. Use the MAXSPOOL *nnnn* operand to specify the maximum number of spool files allowed for a virtual machine.

### How to Specify

The SPOOLFILE statement is allowed in profile, user, identity, and subconfiguration entries. If specified, it must precede any device statements in the entry. (For a list of device statements, see Table 22 on page 457.) If the SPOOLFILE statement is omitted, the default maximum number of spool files is 9999.

One SPOOLFILE statement is allowed in an entry. A SPOOLFILE statement in a user or identity entry overrides one in a profile entry. A SPOOLFILE statement in a subconfiguration entry overrides one in an identity entry.

When processing the SPOOLFILE statement, DIRECTXA checks for a maximum of two tokens: the MAXSPOOL keyword and the decimal number of spool files, in that order. If you specify more than two tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

#### MAXSPOOL *nnnn*

specifies the maximum number of spool files the user can have at one time. The variable *nnnn* is a decimal number from 1 to 9999. The spool file ID numbers for this user will be in this range.

### Usage Notes

1. If a virtual machine's maximum is reset to a value below currently allocated spool IDs, those files and spool IDs remain valid. No additional files will be allocated above the new maximum, and when an old file is deleted, that spool ID will no longer be available.
2. In an SSI cluster, a single-configuration virtual machine can own up to the MAXSPOOL number of spool files, but only one quarter of the MAXSPOOL number of spool files may be originated on any one particular member of the cluster. A multiconfiguration virtual machine can own up to the MAXSPOOL number of spool files on each member of the cluster, but each instance of the virtual machine can view only the spool files originated on the member where the instance is logged on. For more information, see “Spool File ID Assignment and Limits” on page 747.

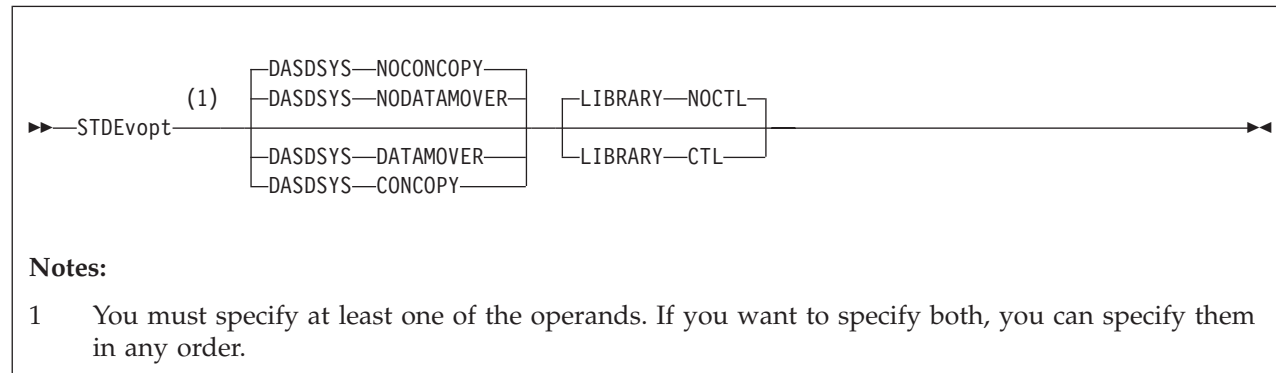
## SPOOLFILE

### Examples

To indicate that the virtual machine has a limit of 1000 spool files, specify the following SPOOLFILE statement in the virtual machine definition:

```
SpoolFile MaxSpool 1000
```

## STDEVOPT Directory Statement



### Purpose

The STDEVOPT statement specifies the optional storage device management functions available to a virtual machine.

### How to Specify

The STDEVOPT statement is allowed in profile, user, and identity entries. If you specify the STDEVOPT statement, it must precede any device statements you specify in the user, identity, or profile entries. (For a list of device statements, see Table 22 on page 457.)

Multiple STDEVOPT statements are allowed within an entry. Conflicting operands within an entry are flagged as errors.

### Operands

#### DASDSYS

tells CP whether the virtual machine is authorized to control and process Concurrent Copy and peer-to-peer remote copy CCWs.

#### NODATAMOVER

(the default) tells CP that the virtual machine is not authorized for Concurrent Copy or peer-to-peer remote copy.

#### NOCONCOPY

same as NODATAMOVER (left here to be compatible with previous releases of VM).

#### DATAMOVER

tells CP that the virtual machine is authorized to issue Concurrent Copy and peer-to-peer remote copy CCWs.

#### CONCOPY

same as DATAMOVER (left here to be compatible with previous releases of VM).

#### LIBRARY

tells CP whether the virtual machine is authorized to control a 3494 or 3495 Tape Library Dataserver.

### **NOCTL**

(the default) tells CP that the virtual machine is not authorized to control a tape library.

### **CTL**

tells CP that the virtual machine is authorized to issue tape library control commands.

## **Usage Notes**

1. The status of a storage device management function not explicitly specified in the user or identity entry defaults to nonauthorization (NODATAMOVER or NOCTL), unless the authorization (DATAMOVER or CTL) is defined in a profile. An authorization or nonauthorization explicitly specified in the user or identity entry supersedes the authorization status defined in a profile.
2. With LIBRARY CTL authorization, tape library control commands can be used to access any volume in the library. To ensure integrity of the volumes in the library, LIBRARY CTL authorization should be granted only to virtual machines that control the mounting and demounting of volumes, such as a guest virtual machine for an operating system, or a service virtual machine for a tape library control program that provides automated mounting and demounting functions.
3. LIBRARY CTL should not be used to authorize a virtual machine to access a particular tape library. LIBRARY CTL allows a virtual machine to issue tape library commands to any tape device, regardless of the library in which the device resides.
4. CONCOPY and NOCONCOPY are still accepted for compatibility reasons. They provide the same authorization control as DATAMOVER and NODATAMOVER, respectively. That is, specifying CONCOPY will authorize a virtual machine for both Concurrent Copy commands and peer-to-peer remote copy commands. Specifying NOCONCOPY will disallow all Concurrent Copy commands and peer-to-peer remote copy commands.
5. Only one DASDSYS option (DATAMOVER, NODATAMOVER, CONCOPY, NOCONCOPY) is allowed in a user or profile directory. Specifying more than one option will result in error message 776E being sent to the user console and the directory will not get updated.

## **Examples**

1. To specify that a guest virtual machine can initiate and control Concurrent Copy and peer-to-peer remote copy, specify the following STDEVOPT statement in the virtual machine definition:  

```
STDEVopt DASDSYS DATAMOVER
```
2. To specify that a virtual machine can control a 3494 or 3495 Tape Library Dataserver, specify the following STDEVOPT statement in the virtual machine definition:  

```
STDEVopt LIBRARY CTL
```
3. To specify that a guest virtual machine can control Concurrent Copy sessions and peer-to-peer remote copy, and can control a tape library, specify the following STDEVOPT statement in the virtual machine definition:  

```
STDEVopt LIBRARY CTL DASDSYS DATAMOVER
```

## STORAGE Directory Statement

►►—STORAGE—*size*—◀◀

### Purpose

The STORAGE statement specifies the default (logon) virtual storage size for a user.

### How to Specify

The STORAGE statement is allowed in profile, user, identity, and subconfiguration entries. The STORAGE statement, if used, must precede any device statements. (For a list of device statements, see Table 22 on page 457.) A STORAGE statement is allowed in a profile entry if the USER or IDENTITY statement default storage size field of each including virtual machine is either omitted or specified as an asterisk (\*). A STORAGE statement in a user or identity entry overrides one in a profile entry.

If STORAGE or MAXSTORAGE statements are specified in the subconfiguration entry, then those statements override any in the identity entry. If either a STORAGE or MAXSTORAGE statement is specified, but not the other, within a subconfiguration entry, then the default is applied to the other in the subconfiguration entry. The combination of the specified value and the default then override whatever settings were specified in the identity entry.

### Operands

#### *size*

is the default (logon) storage size of the virtual machine. Specify *size* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 30).

Table 30. Maximum Input Values for Storage Units

| Storage unit suffix ( <i>u</i> ) | Maximum input value ( <i>n</i> ) |
|----------------------------------|----------------------------------|
| K - kilobytes                    | 9999999                          |
| M - megabytes                    | 9999999                          |
| G - gigabytes                    | 9999999                          |
| T - terabytes                    | 9999999                          |
| P - petabytes                    | 16384                            |
| E - exabytes                     | 16                               |

#### Notes:

1. A K specification is rounded up to a MB value.
2. The maximum input value of 9999999 for the K, M, G, or T suffix is not a size limit but the physical limit of the operand (7 digits plus suffix). If the

## STORAGE

maximum input value for one of these suffixes does not allow you to define the amount of storage you want, you need to use a larger storage unit.

3. The maximum size you can specify is 16E or 16384P, although the actual maximum size supported may be restricted by the model of the server where the directory is used.
4. An XC virtual machine can address up to 2047 MB of storage in its base address space.
5. Allowing many virtual machines to have large storage sizes might affect real storage availability. See usage note 2.

### Usage Notes

1. A default storage setting on a USER or IDENTITY statement overrides a STORAGE statement in a profile.
2. Allowing many virtual machines to have large storage sizes might affect real storage availability. For each virtual machine, CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables, segment tables, and higher level (region) tables.

CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; as such, their impact on real storage depends on how frequently the MBs of storage they reference are used.

Segment tables and region tables are allocated from host real storage and are not pageable:

- To reference the page tables for a primary address space or data space up to 2 GB, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.
- For a primary address space larger than 2 GB, multiple segment tables are created, plus one or more region tables to reference the segment tables. Each region table occupies 1 - 4 contiguous frames. If needed, multiple levels of region tables are created.

## SUBCONFIG Directory Statement

```
►►—SUBCONFIG—id—◄◄
```

### Purpose

The SUBCONFIG statement starts a subconfiguration entry. This entry contains a set of directory statements in a multiconfiguration virtual machine definition that are specific to one of its virtual machine instances within the SSI cluster.

### How to Specify

No additional operands are allowed after the *id*. If you specify extra operands, DIRECTXA produces an error message and the directory will not be updated.

### Operands

*id* defines the virtual machine's 1- to 8-character SUBCONFIG ID. LOGNxxxx, LOGLxxxx, LOGVxxxx, LOGNSYSC, LOGNSYSG, SYSTEM, and SYSTEMMP are reserved for CP use.

The SUBCONFIG ID cannot be the same as a user ID specified on an IDENTITY statement or USER statement.

You should not assign SUBCONFIG IDs that are system keywords (such as command names, command operands, or 1- to 4-digit user IDs that could be spool IDs). Assigning system keywords as IDs can cause unpredictable results. For a list of restricted IDs, see *z/VM: CP Commands and Utilities Reference*.

You should not assign SUBCONFIG IDs that contain colons (:), periods (.), semicolons (;), or slashes (/). These characters are used, or might be used in the future, as delimiters in several CP commands that also take a user ID as a parameter. Results are unpredictable when these commands are entered with a SUBCONFIG ID containing any of these delimiter characters.

The characters that you can use for SUBCONFIG IDs are restricted by translation test tables in HCPTBL to:

#### **alphabetics**

A through Z

#### **numerics**

0 through 9

**others** @ # \$ \_ (underscore) - (hyphen)

**Note:** It is recommended that the characters @, #, €, and " not be used in the *id* because the system, by default, assigns these characters as logical line editing symbols. For a discussion of the system defaults settings for logical line editing symbols, see Appendix B in *z/VM: CP Commands and Utilities Reference*.

You can override the translation tables in HCPTBL. See "TRANSLATE\_TABLE Statement" on page 287.

### Usage Notes

1. The SUBCONFIG statement is used in combination with the IDENTITY and BUILD statements to specify a multiconfiguration virtual machine definition. See “IDENTITY Directory Statement” on page 502 and “BUILD Directory Statement” on page 473.
2. If duplicate specifications exist in an identity entry and its subconfiguration entry, the specification in the subconfiguration entry overrides the one in the identity entry. Refer to the individual statement descriptions for specific override rules.
3. The ID on a SUBCONFIG entry must match the ID specified on a BUILD statement. SUBCONFIG IDs that are not referenced by BUILD statements are not allowed.
4. A null SUBCONFIG definition is allowed. This enables a multiconfiguration virtual machine instance to be logged on to different members in the SSI cluster simultaneously by using just the statements in the identity entry.
5. The following statements are not allowed within a subconfiguration entry:
  - ACCOUNT
  - ACIGROUP
  - APPCPASS
  - AUTOLOG
  - BUILD
  - CLASS
  - CPU
  - D80NECMD
  - INCLUDE
  - IOPRIORITY
  - IUCV
  - LOGONBY
  - MACHINE
  - NAMESAVE
  - NOPDATA
  - POOL
  - POSIXGLIST
  - POSIXINFO
  - POSIXOPT
  - STDEVOPT
  - XAUTOLOG
6. The following OPTIONS are not allowed within a SUBCONFIG definition:
  - ACCT
  - APPLMON
  - CFUSER
  - CFVM
  - CHPIDVirtualization
  - COMSRV
  - CRYMEASURE
  - DEVINFO
  - DEVMAINT
  - DIAG88
  - DIAG98
  - D84NOPASS
  - IGNMAXU
  - LKFAC
  - LNKEXCL
  - LNKNOPAS

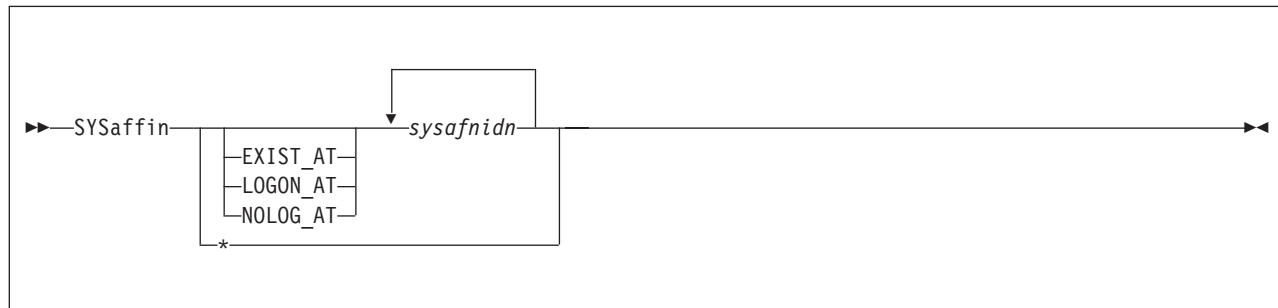


- LNKSTBL
- MAINTCCW
- NETACCOUNTING
- NETROUTER
- RMCHINFO
- SETORIG
- STGEXEMPT
- SVMSTAT

**Examples**

1. See examples in “IDENTITY Directory Statement” on page 502.

## SYSAFFIN Directory Statement



### Purpose

The SYSAFFIN statement is an optional statement that can be used to define how and to which systems of a multisystem complex the subsequent statements apply.

SYSAFFIN specifications are allowed only in a non-SSI source directory. If SYSAFFIN specifications are found in an SSI-ready or SSI-enabled source directory, then an error results.

### How to Specify

A SYSAFFIN statement has two forms, prefix and internal. The prefix form is placed before user entries to describe where or how the user is to be applied to the systems of the complex. The internal form can be used to define which statements apply to which systems in the complex. Only the internal form of the SYSAFFIN statement is allowed within a global definition or profile entry.

Each SYSAFFIN prefix statement applies only to the USER statement that immediately follows it.

A SYSAFFIN internal statement applies to the statements that immediately follow it. It is active until the next SYSAFFIN prefix or internal statement, or until the next PROFILE or USER statement, whichever comes first.

**Note:** The system affinity ID, *sysafnid*, that is used in the following statements is a 1- to 8-character alphanumeric value assigned to a system and used on a DIRECTORY statement in the beginning of the source directory. The SYSAFFIN statement, and the statements to which it applies, affect the system identified by *sysafnid*.

### Operands

#### EXIST\_AT *sysafnidn*

specifies that the following user entry is to be compiled into the object directory by the DIRECTXA utility only when running on a system with one of the system affinity IDs (*sysafnidn*) listed on the SYSAFFIN statement. When DIRECTXA is running on any other system, this user entry is not to be compiled into the object directory. This means that any resources owned by this user entry (for example, minidisks) do not appear in the object directory of the other systems and, therefore, cannot be linked to by users on those systems.

**LOGON\_AT** *sysafnidn*

specifies that the virtual machine definition is to be compiled into the object directories of all systems, but the associated virtual machine is to operate (for example, LOGON) only on specified systems. On any other system, the logon password is replaced with the keyword NOLOG. However, the virtual machine with this user ID and all its resources, including minidisks, exist in the object directories of the other systems and can be referenced by users on those systems.

**NOLOG\_AT** *sysafnidn*

specifies that the specified virtual machine definition is to be compiled into the object directories of all systems, but the associated virtual machine is not to be operable on the identified systems (*sysafnidn*). However, the virtual machine and all its resources, including minidisks, are to exist as virtual machine definitions in the object directories of these systems and can be referred to by users on those systems.

\*

*sysafnidn*

is a 1- to 8-character alphanumeric string that identifies the system that the subsequent statements apply to. Valid *sysafnidns* are defined on the DIRECTORY statement. \* indicates that the subsequent statements apply to all systems.

## Usage Notes

1. The default system affinity for user entries not otherwise prefixed by a SYSAFFIN statement is LOGON\_AT \*. This means that the user entry is applied to and that the defined user can log on at all systems in the complex. The default system affinity for all other statements is \*, meaning that all subsequent statements apply to all systems in the complex.
2. In a system that uses the LOGON\_AT or NOLOG\_AT operands of the SYSAFFIN statement, the class B virtual machine that does the DIAGNOSE code X'84' operations should have D84NOPAS specified on the OPTION statement.
3. Except for the logon status of the virtual machine (as defined by the use of a SYSAFFIN prefix statement), the data on the USER statement is common to all systems in the complex where the user is defined to exist.
4. The internal form of the SYSAFFIN statement can be used in user entries, profile entries, and the global definition entries. These statements define which portions of the various definitions apply to which systems in the complex.

## Examples

In the examples that follow, assume this multisystem complex definition:

```
Directory 07a4 3380 vmaipl *01234-2064 vma
Directory 0b64 3380 vmbipl 104567-2064 vmb
Directory 0cF4 3380 vmcipl *15211-2064 vmc
Directory 0664 3380 vmdipl *00012-2064 vmd
```

1. The PROFILE DEPT1234 definition will be available on all systems. Profiles cannot use the prefix form of the SYSAFFIN statement. They can, however, be tailored using the internal form:

```
Profile dept1234
SysAffin vma
Account 00000001 00000002
SysAffin vmb
Account 00000003 00000004
SysAffin *
```

## SYSAFFIN

```
Link deptdb 100 100 rr
Link deptdb 101 101 rr
SysAffin vma
Link deptdb 200 200 rr
SysAffin vmb
Link deptdb 201 200 rr
```

2. Defined below are users of DEPTDB with different system affinity situations.

- This is the department database, with common disks 100 and 101 and unique disks 200 and 201, depending on whether the system is VMA or VMB:

```
SysAffin Exist_At vma vmb
User deptdb ...
Mdisk 100 ...
Mdisk 101 ...
SysAffin vma
Mdisk 200 ...
SysAffin vmb
Mdisk 201 ...
```

- User TOM has access to all systems and through the INCLUDE statement has access to the department database. Depending on whether he is logged on to VMA or VMB, he will have linked a different disk as his 200. He will also have an appropriate set of R/W minidisks for each system.

```
User tom ...
Include dept1234
Account 12340001
SysAffin vma
Mdisk 191 ...
Mdisk 193 ...
SysAffin vmb
Mdisk 191 ...
Mdisk 193 ...
```

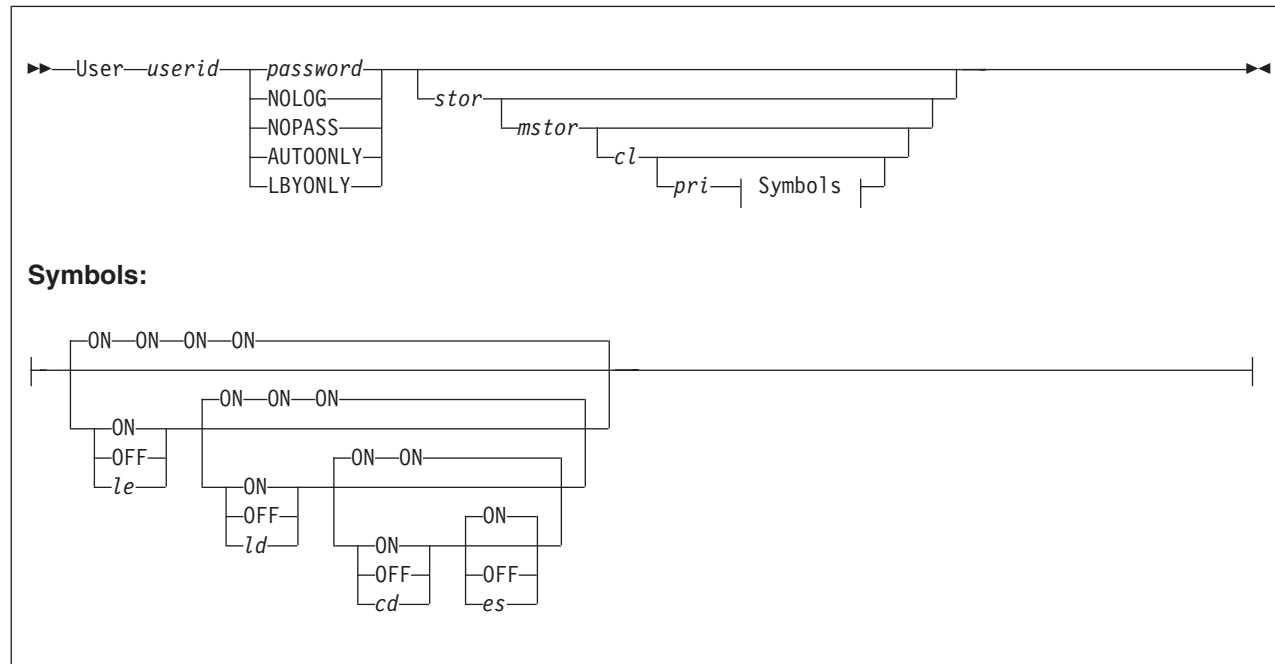
- User MARY is limited to VMA access and will have access to the department database on VMA only.

```
SysAffin Logon_At vma
User mary ...
Include dept1234
Account 12340002
Mdisk 191 ...
Mdisk 193 ...
```

3. The following global definition entry would define a default machine mode of XA on system vma and a default machine mode of ESA on system vmb.

```
Globaldefs
Sysaffin vma
Globalopts machine xa
Sysaffin vmb
Globalopts machine esa
```

## USER Directory Statement



### Purpose

The USER statement starts a single-configuration virtual machine definition. The statement also defines a user ID and password, a logon and maximum virtual machine storage size, command privileges, and special symbol usage for the virtual machine.

### How to Specify

When processing the USER statement, DIRECTXA checks for a maximum of ten tokens: userid, password, logon storage size, maximum storage size, privilege class, a placeholder for compatibility with VM/SP, line-end symbol, line-delete symbol, character-delete symbol, and escape character, in that order. If you specify more than ten tokens, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

#### *userid*

defines the virtual machine's 1- to 8-character user ID. LOGNxxxx, LOGLxxxx, LOGVxxxx, SYSTEM, and SYSTEMMPP are reserved for CP use. The xxxx can be any character, number, or symbol.

The user ID cannot be the same as a user ID specified on an IDENTITY statement or an ID specified on a SUBCONFIG statement.

You should not assign user IDs that are system keywords (such as command names, command operands, or 1- to 4-digit user IDs that could be spool IDs). Assigning system keywords as user IDs can cause unpredictable results. For a list of restricted user IDs, see *z/VM: CP Commands and Utilities Reference*.

## USER

You should not assign user IDs that contain colons (:), periods (.), semicolons (;), or slashes (/). These characters are used, or can be used in the future, as delimiters in several CP commands that also take a user ID as a parameter. Results are unpredictable when these commands are entered with a user ID containing any of these delimiter characters.

The characters that you can use for user IDs are restricted by translation test tables in HCPTBL to:

**alphabetics**

A through Z

**numerics**

0 through 9

**others** @ # \$ \_ (underscore) - (hyphen)

**Note:** It is recommended that the characters @, #, ¢, and " not be used in the *userid* because the system, by default, assigns these characters as logical line editing symbols. Refer to Appendix B in the *z/VM: CP Commands and Utilities Reference* for a discussion of the system defaults settings for logical line editing symbols

You can override the translation tables in HCPTBL. See the "TRANSLATE\_TABLE Statement" on page 287.

*password*

specifies a 1- to 8-character password that a user enters during the logon procedure.

**Note:** If DELETEUSER is specified as the password of a user when the DELTA option of the DIRECTXA utility is in effect, the user will be marked for deletion in its user index entry. See the description of DIRECTXA in the *z/VM: CP Commands and Utilities Reference* for more information.

**NOLOG**

specifies that a user cannot log on. You can use the NOLOG option to create virtual machines to which no one can log on. For example, you can place special system DASD areas (allocation, warm-start, and checkpoint areas) on minidisks and then assign the minidisks to virtual machines with NOLOG passwords. This helps you identify areas on a DASD.

Also, you can create minidisks for common user data and then assign the minidisks to virtual machines with NOLOG passwords. Users can then enter a CP LINK command to access those minidisks when they need the data.

**Note:** It is recommended that the characters @, #, ¢, and " not be used in the *userid* because the system, by default, assigns these characters as logical line editing symbols. Refer to Appendix B in the *z/VM: CP Commands and Utilities Reference* for a discussion of the system defaults settings for logical line editing symbols

**NOPASS**

specifies that a user does not require a password to log on. It also specifies that a virtual machine can be automatically logged on using the XAUTOLOG command without password authorization.

Even though a user ID is defined with the NOPASS operand, LOGON password authorization might be required when an External Security Manager is installed. For more information, refer to documentation provided by your External Security Manager.

**AUTOONLY**

specifies that a user can be autologged, but not logged on at a terminal.

**LBYONLY**

specifies that:

- Logging on to this virtual machine with the LOGON command requires use of the BY option.
- This user ID cannot be used to log on to any virtual machine with the BY option

Furthermore, this user ID might not be able to perform functions that require password validation, since LBYONLY is not accepted as a valid password.

CP allows an External Security Manager (ESM) to override these restrictions, so they are effective only when no ESM is installed or when the ESM defers to CP's processing. See the ESM documentation for more information.

**stor**

specifies the virtual machine's primary address space size at logon. Specify *stor* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 31).

This operand can contain an asterisk (\*) as a placeholder. If the operand is omitted or specified as an asterisk, this indicates that the storage size is defined by a STORAGE statement in either the user entry or a profile entry.

Table 31. Maximum Input Values for Storage Units

| Storage unit suffix ( <i>u</i> ) | Maximum input value ( <i>n</i> ) |
|----------------------------------|----------------------------------|
| K - kilobytes                    | 9999999                          |
| M - megabytes                    | 9999999                          |
| G - gigabytes                    | 9999999                          |
| T - terabytes                    | 9999999                          |
| P - petabytes                    | 16384                            |
| E - exabytes                     | 16                               |

**Notes:**

1. A K specification is rounded up to a MB value.
2. The maximum input value of 9999999 for the K, M, G, or T suffix is not a size limit but the physical limit of the operand (7 digits plus suffix). If the maximum input value for one of these suffixes does not allow you to define the amount of storage you want, you need to use a larger storage unit.
3. The maximum size you can specify is 16E or 16384P, although the actual maximum size supported might be restricted by the model of the server where the directory is used.
4. An XC virtual machine can address up to 2047 MB of storage in its base address space.
5. Allowing many virtual machines to have large storage sizes might affect real storage availability. See usage note 1 on page 613.

**mstor**

specifies the maximum size of the virtual machine's primary address space. Specify *mstor* as *nu*, where *n* is a 1- to 7-digit decimal number and *u* is the 1-character storage unit suffix (see Table 31). The default is 1M (1 MB).

This operand can contain an asterisk (\*) as a placeholder. If the operand is omitted or specified as an asterisk, this indicates that the maximum storage size is defined by a MAXSTORAGE statement in either the user entry or a profile entry.

*cl* specifies the privilege class or classes of CP commands a user can enter. Command classes are A through Z, and 1 through 6. You can specify up to 32 classes (if they fit). Each character represents a single privilege class and can appear in any order, without duplication, and must not be separated by blanks. The class field can also contain an asterisk (\*) as a placeholder. If the field is not specified, or if it contains an asterisk (\*) and there is no CLASS statement, CP uses the default class or classes assigned by the PRIV\_CLASSES statement in the system configuration file (see “PRIV\_CLASSES Statement” on page 212).

**Note:** If you have not changed your classes from the IBM-defined defaults, only classes A through G are valid. Refer to Chapter 16, “Redefining Command Privilege Classes,” on page 443 for information on defining your own user class structure. For a description of the different command classes, see the *z/VM: CP Commands and Utilities Reference*.

*pri* is for VM/SP compatibility and serves no z/VM function. It must be a number from 0 to 99. If the *pri* specification is not entered, the line-end (*le*), line-delete (*ld*), character-delete (*cd*), and escape (*es*) characters default to ON.

*le*  
ON  
OFF

*le* is a 1-character line-end symbol or a 2-digit hexadecimal equivalent of the symbol. Input following a line-end symbol begins a new logical line. ON means that the virtual machine uses the system value. OFF means that CP will not recognize line-end symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the line-end symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

*ld*  
ON  
OFF

*ld* is a 1-character line-delete symbol or a 2-digit hexadecimal equivalent of the symbol. A line-delete symbol causes the previous logical line input to be ignored. ON means that the virtual machine uses the system value. OFF means that CP will not recognize line-delete symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the line-delete symbol, use the CHARACTER\_DEFAULTS statement in the system configuration file. For more information about setting system-wide defaults, see “CHARACTER\_DEFAULTS Statement” on page 68.

*cd*  
ON  
OFF

*cd* is a 1-character delete symbol or a 2-digit hexadecimal equivalent of the symbol. A character-delete symbol causes the previous character input to be ignored. ON means the virtual machine uses the system value. OFF means that CP will not recognize character-delete symbols. If omitted, the default is ON.



**Note:** If you want to set a system-wide default for the character-delete symbol, use the `CHARACTER_DEFAULTS` statement in the system configuration file. For more information about setting system-wide defaults, see “`CHARACTER_DEFAULTS` Statement” on page 68.

`es`

**ON**

**OFF**

`es` is a 1-character escape symbol or a 2-digit hexadecimal equivalent of the symbol. The escape symbol causes CP to treat the following character literally, without consideration as an *le*, *ld*, or *cd* character. ON means that the virtual machine uses the system value. OFF means that CP will not recognize escape symbols. If omitted, the default is ON.

**Note:** If you want to set a system-wide default for the escape symbol, use the `CHARACTER_DEFAULTS` statement in the system configuration file. For more information about setting system-wide defaults, see “`CHARACTER_DEFAULTS` Statement” on page 68.

## Usage Notes

1. Allowing many virtual machines to have large storage sizes might affect real storage availability. For each virtual machine, CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables, segment tables, and higher level (region) tables. CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; as such, their impact on real storage depends on how frequently the MBs of storage they reference are used. Segment tables and region tables are allocated from host real storage and are not pageable:
  - To reference the page tables for a primary address space or data space up to 2 GB, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.
  - For a primary address space larger than 2 GB, multiple segment tables are created, plus one or more region tables to reference the segment tables. Each region table occupies 1 - 4 contiguous frames. If needed, multiple levels of region tables are created.
2. The *cl* field can contain an asterisk (\*) as a placeholder. If no further options are to be specified on the `USER` statement, the asterisk (\*) is not required. In either case, if the `CLASS` statement is not supplied, CP uses the default class or classes assigned by the `PRIV_CLASSES` statement in the system configuration file (see “`PRIV_CLASSES` Statement” on page 212).
3. If any of the options are specified, all prior options must also be specified. The default for unspecified options is ON.
4. The `USER` statement defines the special symbol usage for a specific virtual machine. To override the special symbol usage for a specific virtual machine, have the user issue the CP `TERMINAL` command described in *z/VM: CP Commands and Utilities Reference*. To set default special symbol usage for the entire system, use the `CHARACTER_DEFAULTS` statement in the system configuration file (see “`CHARACTER_DEFAULTS` Statement” on page 68). You cannot use any of the letters A through Z, the numbers 0 through 9, or the bytes X'0E' (shift out) or X'0F' (shift in) for the line-end, line-delete, character-delete, or escape symbols.

## USER

### Examples

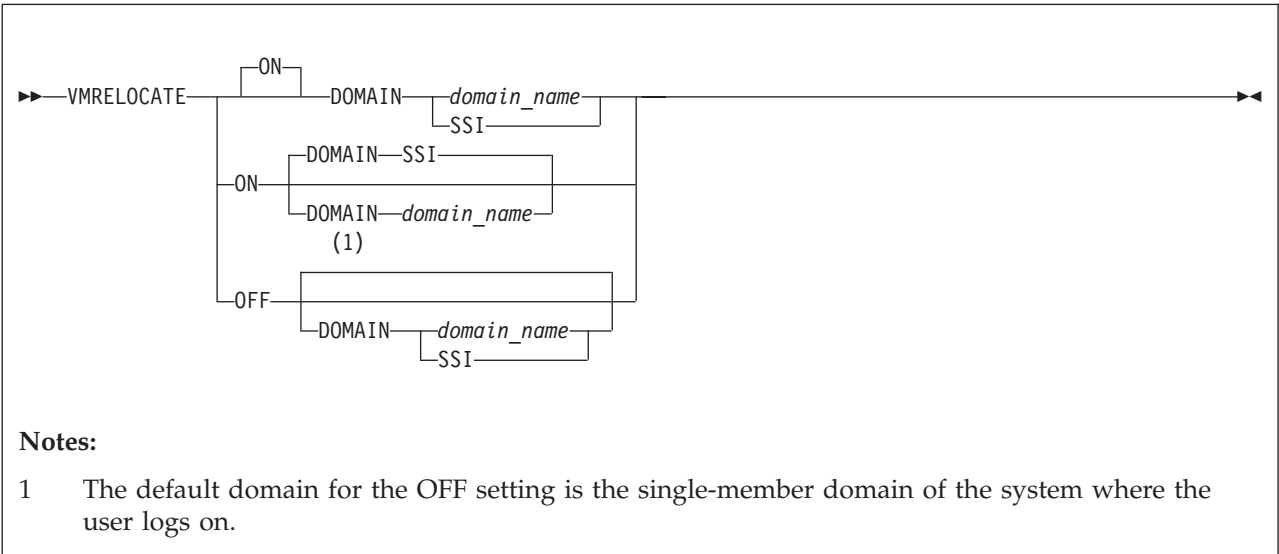
1. To start a directory entry for user ID BONES that specifies:
  - WW11QQ as BONES's password
  - 8M as BONES's virtual machine storage size at logon
  - 16M as the maximum virtual machine storage size BONES can define
  - BONES can enter only class S commandsspecify the following USER statement:  

```
User bones ww11qq 8m 16m s
```
2. To start a directory entry for user ID WIZARD that specifies:
  - JK76TG as WIZARD's password
  - 4M as WIZARD's virtual machine storage size at logon
  - 6M as the maximum virtual machine storage size WIZARD can define
  - WIZARD can enter class A, B, C, Z, 3, 4, and G commandsspecify the following USER statement:  

```
User wizard jk76tg 4m 6m abcz34g
```
3. To start a directory entry for user ID SHARDATA that specifies the NOLOG option, specify the following USER statement:  

```
User shardata NoLog
```

# VMRELOCATE Directory Statement



## Purpose

The VMRELOCATE statement sets a user's relocation domain, indicating the set of members of the SSI cluster to which it may be relocated, or disallows relocation of this virtual machine. When the user logs on, the virtual machine is assigned a virtual architecture level that is the maximal common subset of the architectural features of the cluster members in the specified or default relocation domain.

## How to Specify

The VMRELOCATE statement is allowed in a user entry, or a profile included in a user entry, in an SSI-ready or SSI-enabled source directory. If specified, the VMRELOCATE statement must go before any device statements in an entry. (For a list of device statements, see Table 22 on page 457.) Only one VMRELOCATE statement is allowed in a user entry or profile entry. A VMRELOCATE statement in a profile entry is used only if no VMRELOCATE statement exists in the user entry.

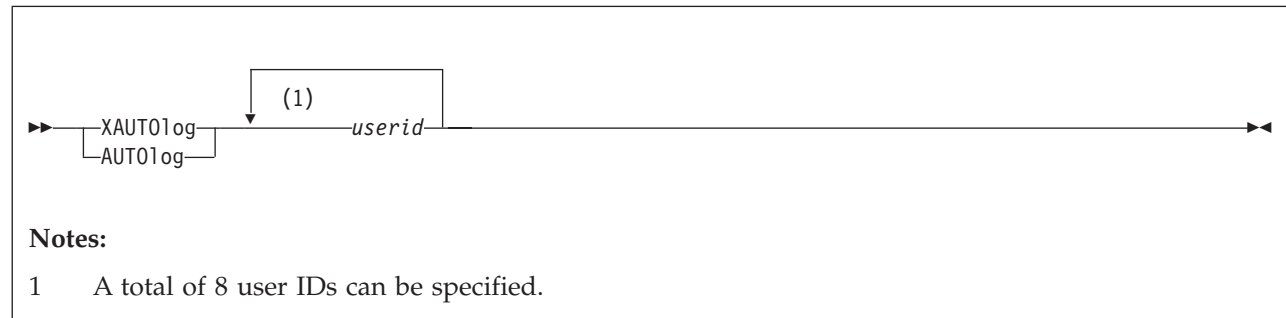
## Operands

- ON** enables relocation for the specified user. If neither ON nor OFF is specified, then ON is the default. When the user first logs on, relocation is enabled. If a relocation domain is not specified, the default is domain SSI.
- OFF** disables relocation for the specified user. When the user first logs on, relocation is disabled. If a relocation domain is not specified, the default is the single-member domain of the cluster member where the user is logging on.
- DOMAIN domain\_name** specifies the relocation domain associated with the user when the user first logs on.
- SSI** is the relocation domain that includes the entire SSI cluster membership.

### Usage Notes

1. The VMRELOCATE statement is not allowed in a multiconfiguration virtual machine definition. A relocation domain cannot be set for such a virtual machine because it cannot be relocated.
2. If you omit the VMRELOCATE statement when you code a virtual machine definition, relocation is enabled for that user by default, and the default relocation domain is domain SSI.
3. The relocation capability of the user can be dynamically changed with the CP SET VMRELOCATE command.
4. For more information about relocation domains and the virtual architecture level, see "Using Relocation Domains" on page 750.

## XAUTOLOG Directory Statement



### Purpose

The XAUTOLOG statement designates up to eight users that can enter the XAUTOLOG command for the virtual machine. All users with class A or class B privileges can enter the XAUTOLOG command for any virtual machine. Therefore, their user IDs do not have to appear on the XAUTOLOG statement.

### How to Specify

The XAUTOLOG statement is allowed in profile, user, and identity entries. If you specify the XAUTOLOG statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.) A directory entry can contain multiple XAUTOLOG statements, but only a total of eight user IDs (including those in AUTOLOG statements) is allowed.

Multiple XAUTOLOG statements are allowed within a profile entry, but are used only if no XAUTOLOG (or AUTOLOG) statements are in the including user or identity entry.

### Operands

*userid*

specifies a 1- to 8-character user ID of a user whom you authorize to enter the XAUTOLOG command for the virtual machine whose virtual machine definition you are creating. A total of eight user IDs (including those in AUTOLOG statements) can be specified.

### Usage Notes

1. AUTOLOG is an acceptable synonym for the XAUTOLOG statement. The minimum abbreviation is AUTO. The XAUTOLOG statement, whether named XAUTOLOG or AUTOLOG, authorizes the use of the XAUTOLOG command and does not authorize the use of the AUTOLOG command. The AUTOLOG command authorization is through the use of a password only.
2. In addition to being listed on an XAUTOLOG directory statement, a user must have class G privileges to enter the XAUTOLOG command for the virtual machine. (Users with class A or B privileges can enter the XAUTOLOG command for any virtual machine without being specified in an XAUTOLOG statement.)

## XAUTOLOG

### Examples

1. To authorize a user whose ID is LARRY (and has class G privileges) to enter the XAUTOLOG command for a virtual machine, specify the following XAUTOLOG statement in the virtual machine definition:

```
XautoLog larry
```

2. To authorize users whose IDs are OPER1, OPER2, OPER3, and JONES (and have class G privileges) to enter the XAUTOLOG command for a virtual machine, specify the following XAUTOLOG statement in the virtual machine definition:

```
XautoLog oper1 oper2 oper3 jones
```

---

## XCONFIG Directory Statement

### Purpose

The XCONFIG statement specifies control parameters for the extended-configuration facilities provided in the XC virtual machine architecture: access lists and address spaces. Some of the control parameters specified on the XCONFIG statement are used only by XC virtual machines, whereas others are used in all types of virtual machines.

Each XCONFIG statement contains one of the mutually exclusive major operands ACCESSLIST or ADDRSPACE and specifies control parameters for a single aspect of the extended-configuration facilities. For example, a single XCONFIG statement can contain the ACCESSLIST operand with parameters for access lists, but cannot also contain the ADDRSPACE option with parameters for address spaces. Descriptions of the ACCESSLIST and ADDRSPACE operands follow.

To specify control parameters for more than one element of the extended-configuration facilities, you can specify multiple XCONFIG statements. However, each major option can each appear on, at most, one XCONFIG statement within a user, identity, or subconfiguration entry, and on, at most, one XCONFIG statement within a profile entry.

Any major option on an XCONFIG statement specified in the user or identity entry override those specified (or defaulted) in the profile entry. Operands that are specified (or defaulted) in the profile entry but not also specified in the user or identity entry are used as specified (or defaulted) in the profile entry.

Each XCONFIG keyword (ACCESSLIST and ADDRSPACE) is treated separately so that an XCONFIG statement in a subconfiguration entry overrides the identity entry only for the keywords specified on XCONFIG statements in the subconfiguration.

### How to Specify

If you specify any XCONFIG statements, they must precede any device statements, both when specified within a user, identity, or subconfiguration entry and when specified within a profile entry. (For a list of device statements, see Table 22 on page 457.)

### Usage Notes

1. The XCONFIG statements are processed by CP at the time of a user's logon, and the control parameters in effect at logon are used for the user's entire session. If changes are made to XCONFIG statements in a virtual machine definition, the user must log off and log on again for the changed parameters to take effect.

## XCONFIG ACCESSLIST Operand

►►—XCONfig—ACCEsslist—ALSIZE—*alecount*—◄◄

### Purpose

The XCONFIG ACCESSLIST operand specifies the size of the host access list to be provided for this virtual machine. CP creates a host access list for each virtual machine. For XC virtual machines, each entry in the virtual machine's host access list designates an address space that can be accessed when the virtual machine is in the access-register mode. For XA, or ESA virtual machines, each entry in the virtual machine's host access list designates an address space that can be accessed using DIAGNOSE code X'248' (Copy to primary service). Valid host access list entries are added and removed using the ALSERV macroinstruction (access list services). For more information about the ALSERV macroinstruction, see the *z/VM: CP Programming Services* book.

### How to Specify

The XCONFIG ACCESSLIST statement is allowed in profile, user, identity, and subconfiguration entries. If you do not specify an XCONFIG statement with an ACCESSLIST operand, CP will give the virtual machine a 62-entry host access list, by default.

### Operands

#### ALSIZE *alecount*

specifies the size, in number of access-list entries, for this virtual machine's host access list. The variable *alecount* is a decimal number from 1 to 1022.

CP allocates host access lists in sizes that contain 6, 14, 30, 62, 126, 254, 510 or 1022 entries. If you do not specify *alecount* as one of these numbers, then CP rounds *alecount* up to the next largest number in this set.

### Usage Notes

1. A virtual machine's host access list resides in host storage. When a host access list is initially created for a virtual machine, sufficient host storage is allocated for a 6-entry host access list. As more host access list entries are required, additional host storage is allocated to hold the next larger-sized host access list, until the access-list size reaches the size specified by this directory statement. CP will reuse any host access list entry that is in the invalid state before expanding the host access list in this manner, but once a host access list has been expanded, it will not be compressed if host access list entries subsequently return to being in the invalid state.
2. A 254-entry host access list can require up to one page of host storage and a 1022-entry host access list can require up to four pages of host storage.
3. The host storage allocated for a virtual machine's host access list is not available for use by CP for paging or other operations. To minimize the host storage used for access lists, allocate the smallest-sized host access list that meets the requirements for a particular virtual machine.

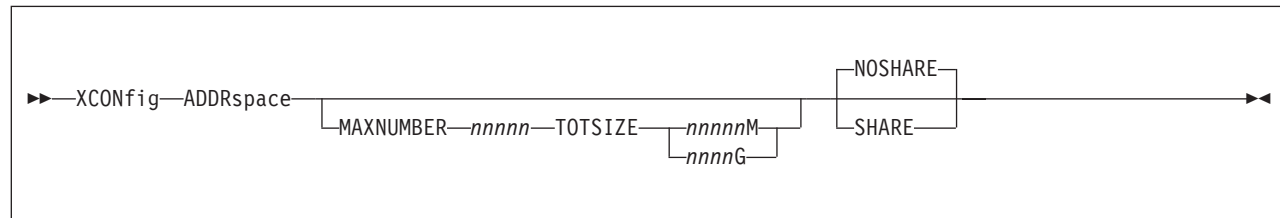


## **Examples**

To specify that a virtual machine is to have a 126-entry host access list, use the following statement in the virtual machine definition:

```
Xconfig AccessList ASize 126
```

## XCONFIG ADDRSPACE Operand



### Purpose

The XCONFIG ADDRSPACE operand specifies the maximum number of non-primary address spaces (sometimes known as data spaces) and the total size in bytes of all non-primary address spaces that the virtual machine can own simultaneously. These address spaces are created using the ADDRSPACE macroinstruction (address-space services) CREATE function. It also specifies whether the virtual machine can allow other virtual machines to share its address spaces. Only XC virtual machines can create and destroy address spaces using the CREATE and DESTROY functions of the ADDRSPACE macroinstruction. ESA, XA, and XC virtual machines can allow other virtual machines to share their address spaces by using the PERMIT function of the ADDRSPACE macroinstruction. (This is limited to sharing the virtual machine's primary address space.) For more information about the ADDRSPACE macroinstruction, see the *z/VM: CP Programming Services* book.

### How to Specify

XCONFIG ADDRSPACE is allowed in profile, user, identity, and subconfiguration entries. If you do not specify an XCONFIG ADDRSPACE statement, CP uses a default of 0 for MAXNUMBER, which indicates no additional address spaces can be created.

### Operands

#### MAXNUMBER *nnnnn*

specifies the maximum number of non-primary address spaces that this virtual machine can create and have existing concurrently. The variable *nnnnn* is a decimal number from 0 to 32767.

If you omit the MAXNUMBER and TOTSIZ operands from the XCONFIG ADDRSPACE statement, the default is MAXNUMBER 0, that is, no additional address spaces can be created.

#### TOTSIZ *nnnnnM*

#### TOTSIZ *nnnnG*

specifies the maximum total size, in bytes, of all address spaces that this virtual machine can create and have existing concurrently. The variable *nnnnnM* is a decimal number from 1 megabyte to 99999 megabytes. The variable *nnnnG* is a decimal number from 1 gigabyte to 8192 gigabytes.

The minimum value for TOTSIZ is 1M for each address space permitted by the MAXNUMBER operand; if the TOTSIZ operand specifies a total less than this number, then an error message is issued. The maximum that can be specified for TOTSIZ is 8192G.

**NOSHARE**

tells CP that the virtual machine cannot use the PERMIT function of the ADRSPACE macroinstruction to make its address spaces available for access by other virtual machines. The default is NOSHARE.

**SHARE**

tells CP that the virtual machine can use the PERMIT function of the ADRSPACE macroinstruction to make its address spaces available for access by other virtual machines.

**Usage Notes**

1. Allowing users to create large numbers of address spaces or very large size address spaces might affect real storage availability. CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables and segment tables.

CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; as such, their impact on real storage depends on how frequently the MBs of storage they reference are used.

Segment tables are allocated from host real storage and are not pageable. To reference the page tables for an address space, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.

**Examples**

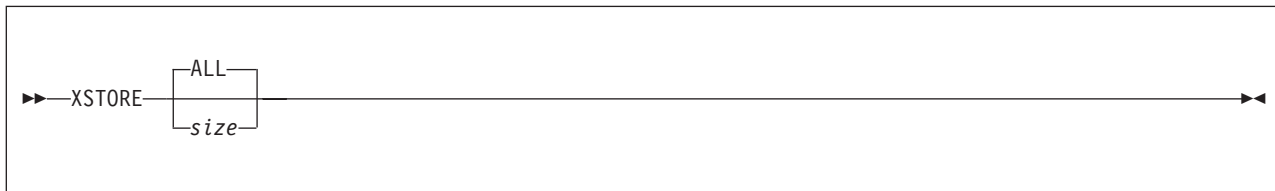
1. To authorize a virtual machine to create up to 128 address spaces, with a total of 1000 MB of storage, use the following statement in the virtual machine definition:  

```
Xconfig AddrSpace MaxNumber 128 TotSize 1000M
```
2. To authorize a virtual machine to create up to 25 address spaces, with a total of 2 GB of storage, and allow the virtual machine to share its primary address space and any of its created address spaces with other virtual machines, use the following statement in the virtual machine definition:  

```
Xconfig AddrSpace MaxNumber 25 TotSize 2G Share
```
3. To authorize a virtual machine to share its primary address space with other virtual machines, but not to create any additional address spaces, use the following statement in the virtual machine definition:  

```
Xconfig AddrSpace Share
```

## XSTORE Directory Statement



### Purpose

The XSTORE statement authorizes a virtual machine that supports Expanded Storage to use the Expanded Storage facility.

### How to Specify

The XSTORE statement is allowed in profile, user, identity, and subconfiguration entries. If you specify the XSTORE statement, it must precede any device statements you specify in a directory entry. (For a list of device statements, see Table 22 on page 457.) Refer to Chapter 19, “Expanded Storage Planning and Administration,” on page 633 for additional information about allocating Expanded Storage.

Only one XSTORE statement is allowed in an entry. An XSTORE statement in a subconfiguration entry overrides one in an identity entry. An XSTORE statement in a user or identity entry overrides one in a profile entry.

When processing the XSTORE statement, DIRECTXA checks for a maximum of one token: the real Expanded Storage size. If you specify more than one token, DIRECTXA ignores the extra tokens and system processing continues as if you had not specified the extra tokens.

### Operands

#### ALL

tells CP that all of Expanded Storage configured on the system be allowed to be used for this user's guest partition. If you specify XSTORE without any operands, the default is ALL.

#### size

is the size expressed as *nnnnnnnnnn*M megabytes of real Expanded Storage to be allocated to the user's virtual machine on megabyte boundaries. The maximum size that can be specified is 16777216 MB.

The real Expanded Storage may be allocated to any number of virtual machines at the same time.

User and operator commands are available to manage the allocation of Expanded Storage after user logon (see the *z/VM: CP Commands and Utilities Reference*).

### Usage Notes

1. Several commands allow you to attach, detach, and display information about the Expanded Storage facility. These commands include ATTACH XSTORE, DETACH XSTORE, and QUERY XSTORE. For more information on these commands, see the *z/VM: CP Commands and Utilities Reference*.

2. If the request for Expanded Storage cannot be satisfied at logon time, the maximum amount that can be attached at this time is attached to the virtual machine.
3. Multiple users may have Expanded Storage attached to their virtual machines.

### **Examples**

To authorize a virtual machine to use all of Expanded Storage, specify the following XSTORE statement in the virtual machine definition:

```
Xstore
```



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## **Part 4. Storage Planning and Administration**





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## Chapter 18. Host Storage Planning and Administration

This chapter provides information on assessing your real storage needs and managing your storage configuration.

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### Real Storage Management

The amount of real storage you need depends upon the type of work your installation will be performing and the number and size of the virtual machines you define. Your system might include many virtual machines, and each one requires some real storage. (See “Virtual Machine Considerations” on page 631.)

For example, you may find that the processor does not have enough storage for your system to provide acceptable response times. If you find your system's response time to be slow or erratic, you may need to do one or both of the following:

- Add more real storage.
- Run fewer or smaller virtual machines.

The minimum amount of real storage that is required to operate z/VM first-level (IPLed in a logical partition) is 256 MB. The minimum amount of storage that is required when IPLed in a virtual machine is 32 MB. The difference is because running first-level requires CP to reserve 128 MB of storage for stand-alone dump to use. The storage reserved for stand-alone dump usage is allocated for second-level z/VM systems only if the virtual machine size is at least 256 MB.

The maximum amount of real storage that z/VM supports is 1 TB (Terabyte).

Using the IBM Hardware Management Console (HMC), you can define the INITIAL and RESERVED real storage for the logical partition in which z/VM is installed. When you IPL z/VM, CP assumes that all of the INITIAL storage is available to it. If you want to limit the amount of storage used by z/VM, you can specify `STORE=nnnnu` as an IPL parameter passed to CP by the Stand-Alone Program Loader (SAPL). For more information, see “Passing IPL Parameters” on page 36.

You can use the `STORAGE` system configuration statement to allocate storage for specific system usage, for example, subchannel measurement blocks (SCMBKs,) internal trace tables, the global aging list size, etc. For more information, see “`STORAGE` Statement” on page 262.

After you IPL, you can dynamically increase the online real storage (the amount of storage used by z/VM) by using the CP `SET STORAGE` command. The additional storage is typically obtained from standby storage. Standby storage is a calculated value based on the amount of installed storage that is not currently claimed by active logical partitions and the `RESERVED` storage specified for this partition. However, if the current online storage is less than the amount of storage configured for this partition (`INITIAL`), the remaining configured storage is also available. z/VM could be using less storage than configured if the `STORE=` IPL parameter was used on the SAPL screen or on the `SHUTDOWN REIPL` command. Issue the `QUERY STORAGE` command and see the response for the amount of

## Host Storage Planning and Administration

storage z/VM is currently using (STORAGE=), the amount of storage configured for this logical partition (CONFIGURED=), and the amount of standby storage that is available to be brought online (STANDBY=).

To display the status of real storage and how the storage frames are currently allocated, issue the QUERY FRAMES command.

For descriptions of the SET STORAGE, QUERY STORAGE, and QUERY FRAMES commands, see *z/VM: CP Commands and Utilities Reference*.

### Attention:

Good change management procedures suggest that you should avoid simultaneous storage configuration operations. Before issuing the SET STORAGE command:

1. Ensure that all other storage reconfigurations have completed. This includes logical partition activation or deactivation, storage configuration actions by any other operating system, and any other SET STORAGE command.
2. Issue the QUERY STORAGE command as necessary to ensure that the reported STANDBY= and RESERVED= values are stable.
3. Ensure that the desired increase in storage size is available:  
$$\text{increase} \leq \text{STANDBY} + (\text{CONFIGURED} - \text{STORAGE})$$
4. Only then issue the SET STORAGE command.

z/VM supports central storage configurations established by logical partition activation, or through use of the SET STORAGE command by a previous instance of z/VM running in the logical partition. In addition, when running at second level, z/VM supports any virtual configuration established through the DEFINE STORAGE command. However, if you choose to run z/VM at second level in the same virtual machine where a non-z/VM operating system was previously running, it is suggested that you log off or issue DEFINE STORAGE commands to trigger a SYSTEM RESET CLEAR (to reestablish the original storage configuration) before you IPL z/VM.

---

## Storage Requirements for Generating a CP Module

The CP module requires approximately 17 MB of real storage. This amount will vary slightly based on the parameters specified on the STORAGE statement and the number of devices specified on RDEVICE statements in the system configuration file. Additional virtual storage in the virtual machine generating the CP module is required for CMS, the VMFBLD program, and access to the CMS disks containing the CP module text decks and related files. A virtual machine size of 40 MB should be sufficient.

In order to IPL the system, there must be sufficient available storage to hold the warmstart area. This storage is returned to general system use once spooling is initialized. Usually, one cylinder of CKD DASD or 75 four-kilobyte (4 KB) pages of FBA DASD are defined for the spooling warmstart area. This is easily contained in a small virtual machine. However, if you define a large warmstart area, the virtual machine size must be increased to accommodate it.

Other factors affecting storage requirements include the size of the trace tables and the number of devices defined in the system.

---

## Host Logical Storage

The address space in which CP executes is called the system execution space. This address space (also known as host logical storage) consists of three parts:

- System execution area
- System execution space page management table
- System frame table

The system execution area contains the CP nucleus, the prefix pages, dynamically allocated free storage and other CP-use pages, aliases (references to guest pages), and routines loaded with the CPXLOAD system configuration statement or the CP CPXLOAD command. The system execution area resides below 2 GB; its size depends on the real storage size. The system execution space page management table and the system frame table reside above 2 GB. To display the host logical storage address ranges that are in use or usable by the system for the system execution space, issue the CP QUERY SXSSTORAGE command.

Host logical storage addresses in the CP nucleus and the prefix pages are identity mapped to real storage (that is, the host logical storage addresses and host real storage addresses are identical). The rest of the system execution area is dynamic (not identity mapped). Host logical storage pages must be backed with frames in real storage before they can be used, but backing frames are not necessarily contiguous. Frames below 2 GB are used only when required, freeing CP to exploit backing frames above 2 GB for most operations. To check the status of pages in the system execution area, issue the CP QUERY SXSPAGES command. This command displays information such as the number of pages that are available or in use; the number of pages that are backed below 2 GB, above 2 GB, or unbacked; and the number of pages that are locked or reserved.

For descriptions of QUERY SXSSTORAGE and QUERY SXSPAGES, see the *z/VM: CP Commands and Utilities Reference*.

---

## Virtual Machine Considerations

Each virtual machine requires some real storage. Allowing many virtual machines to have large storage sizes (primary address spaces or data spaces) might affect real storage availability. CP creates dynamic address translation (DAT) tables to reference the virtual machine storage. DAT tables include page tables, segment tables, and higher level (region) tables.

CP keeps the page tables in page management blocks (PGMBKs). Each 8 KB PGMBK references 1 MB of virtual machine storage. PGMBKs might be pageable; for example, PGMBKs for nonshared guest pages are pageable. CP creates a PGMBK only when the corresponding MB of virtual machine storage is first referenced. However, if many large virtual machines are very active, it could affect the availability of real storage.

Segment tables and region tables are allocated from host real storage and are not pageable:

- To reference the page tables for a primary address space or data space up to 2 GB, 1 - 4 contiguous frames are allocated for the segment table, one frame for each 512 MB of storage.

## Host Storage Planning and Administration

- For a primary address space larger than 2 GB, multiple segment tables are created, plus one or more region tables to reference the segment tables. Each region table occupies 1 - 4 contiguous frames. If needed, multiple levels of region tables are created.

PGMBKs, segment tables and region tables can reside anywhere in host real storage, but CP creates them above 2 GB if possible.

You should consider the combined effect of giving many users large storage sizes and allowing users to create many data spaces, or large data spaces, or both. Considerable real storage might be consumed by the PGMBKs, segment tables, and region tables.

---

## Chapter 19. Expanded Storage Planning and Administration

The expanded storage facility is an optional feature of certain processor models. It can be:

- Dedicated to CP
- Dedicated to one or more virtual machines for use by an operating system
- Partitioned for use between CP and one or more virtual machines.

This chapter tells you what expanded storage is and how to:

- Attach expanded storage to a virtual machine
- Map expanded storage
- Handle fragmentation of expanded storage
- Allocate expanded storage to CP
- Allocate retained expanded storage
- Use expanded storage as a minidisk cache.

---

### Overview

Expanded storage acts as another level of real storage. It allows for the rapid transfer of 4 KB pages between itself and real storage. As real storage is divided into 4 KB frames, expanded storage is divided into 4 KB units called blocks. It is available in increments whose size varies with the model of the processor.

You can partition expanded storage. Part of it may be attached to one or more virtual machines. A CP partition may also be defined for paging. The frame reclaim process always backs page content on DASD; it may additionally write the content to xstore when room is available. See “Configuring Processor Storage” on the z/VM performance web site at IBM: VM Performance Resources ([www.ibm.com/vm/perf/](http://www.ibm.com/vm/perf/)) for more information on the usage of expanded storage for paging.

To retain some or all of expanded storage exclusively for CP use, the class B operator can enter the RETAIN XSTORE command. The command assigns the specified amount of storage to the CP partition. The CP partition size limits the amount of expanded storage available for virtual machine partitions.

All or part of expanded storage can be retained for CP's exclusive use. This CP partition can occupy multiple discontinuous areas of expanded storage. All or part of the remainder can be dedicated to virtual machines.

If there is a request for additional expanded storage to be retained by CP and not enough contiguous expanded storage is available, the request can be satisfied by retaining multiple discontinuous areas of expanded storage. If a request to retain expanded storage for CP use is for a larger amount than is available because it is in use by one or more virtual machines, CP retains the amount of expanded storage currently available. It also issues a pending request for the remainder. The pending request is satisfied when enough expanded storage is detached from one or more virtual machines.

## Expanded Storage Planning and Administration

Basically, you can configure expanded storage in any manner that meets your installation's needs. The granularity is in 1 MB sections, and you can attach it to as many virtual machine guests as you have megabytes of expanded storage.

In addition, CP uses expanded storage as a minidisk cache that shares expanded storage with paging.

---

### Expanded Storage Considerations with Shared CMS Minidisks

If you have DASD volumes that contain CMS minidisks that are shared among different processors, you must take special action before IPLing z/VM. For each DASD volume that contains CMS minidisks that are physically shared among processors, specify one of the following:

- SHARED YES on the RDEVICE TYPE DASD statement in the system configuration file
- SHARED YES on the SET RDEVICE TYPE DASD command

This definition prevents all minidisks on these volumes from being eligible for minidisk caching. If you do not specify YES for the SHARED parameter or operand, a data integrity exposure can exist if any system other than the one that is caching data through the minidisk cache has write access to the volume.

For more information on minidisk caching, see “Using Expanded Storage as a Minidisk Cache” on page 638. For information on the RDEVICE system configuration file, see “RDEVICE Statement (DASD)” on page 226. For information on the SET SHARED and SET RDEVICE commands, see the *z/VM: CP Commands and Utilities Reference*.

---

### Attaching Expanded Storage to a Virtual Machine

You can use either the XSTORE directory statement or the ATTACH XSTORE command to attach expanded storage to a virtual machine for its direct use. The difference is that if you use the XSTORE directory statement, the area of expanded storage specified is automatically attached to the virtual machine at logon. With the ATTACH XSTORE command, the area is attached when the command is entered. For more information on the XSTORE directory statement, see “XSTORE Directory Statement” on page 624.

When CP attaches expanded storage to a virtual machine, it looks for contiguous expanded storage that is not already attached to another virtual machine or assigned as CP-retained expanded storage. This search starts from expanded storage block 0.

The amount and location of the expanded storage that is attached depends on how expanded storage is currently allocated. The response from the ATTACH command indicates the amount that is actually attached. The QUERY XSTORE MAP command can be used to determine its location.

The term contiguous is emphasized because certain types of fragmentation can occur that permit CP to attach expanded storage that is larger than what would be truly contiguous. See “Fragmentation” on page 635 for more information about fragmentation.

## Mapping Expanded Storage

You should develop a map of expanded storage and determine which virtual machines should have access to this valuable resource. Any expanded storage that you attach for CP's exclusive use (retained) should be at the top of the map (highest block number), and any expanded storage attached to virtual machines should be drawn from the lowest block numbers. This ordering for the map matches the most likely format produced as the output of the QUERY XSTORE MAP command.

With this map, you can check that expanded storage requirements are not over-committed. You can use the class B QUERY XSTORE MAP command to determine how CP has actually attached expanded storage. This should match your map for this configuration.

Because the amount of expanded storage varies from one configuration to another, this map only serves one particular configuration. One map for each configuration may be useful. See "Attaching Expanded Storage to a Virtual Machine" on page 634 for a description of how CP attaches expanded storage as users log on with XSTORE directory statements or enter ATTACH XSTORE commands.

## Fragmentation

Two types of fragmentation can occur when expanded storage is attached to CP and virtual machines:

- QUERY XSTORE MAP shows a section of expanded storage as N/A (not applicable). This is caused by the hardware configuration. For example, the second and fourth sections of expanded storage could be partitioned to the other side of a multiprocessor.

This expanded storage is not available for use by CP or any virtual machine. When CP attaches expanded storage for a virtual machine, it can cross these areas to attach the amount requested. The amount of N/A expanded storage is not counted toward satisfying the request.

- The portion of expanded storage is attached to a virtual machine or is retained by CP.

This is true fragmentation. CP cannot attach expanded storage to a virtual machine that crosses an area already attached to a virtual machine or retained for CP.

## Discontinuous Expanded Storage

Generally, expanded storage is not expected to become fragmented. It is assigned when the system operator first IPLs the system and logs on critical virtual machines. In general, this situation remains static.

However, if expanded storage is attached to virtual machines, detached, and attached again with a different size, fragmentation can occur that the system operator may want to correct. By using the QUERY XSTORE MAP command, the system operator can keep track of how expanded storage is attached and determine whether fragmentation exists.

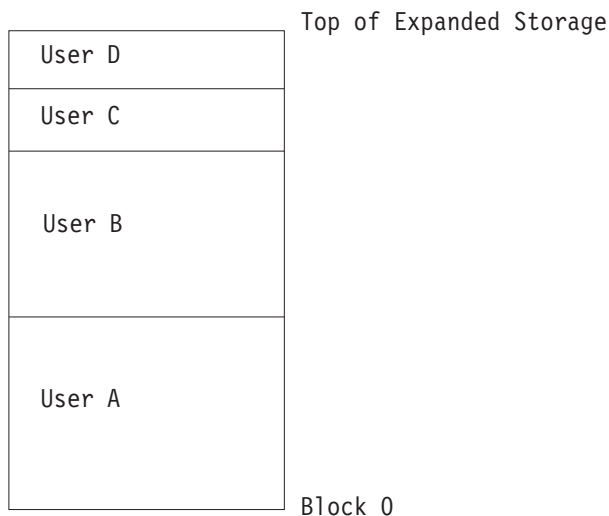
If fragmentation does occur, the operator can use the RETAIN XSTORE, ATTACH XSTORE, and DETACH XSTORE commands to rearrange the attachment of expanded storage. By doing this carefully, fragmentation can be reduced or eliminated.



## Expanded Storage Planning and Administration

**Note:** The system operator must be certain that all virtual machines that have expanded storage attached and that will be manipulated by this rearrangement are not running a guest that would be affected by the detaching of expanded storage. In general, you should do this when the guest is no longer using expanded storage, the guest operating system is reset, or the logged-on expanded storage is released.

The example shown in Figure 20, Figure 21 on page 637, and Figure 22 on page 637 shows how a normal attachment can become fragmented and then rearranged. In all cases where a virtual machine owns expanded storage, no guest is running in that virtual machine at the time a detach is done.



*Figure 20. Map of Expanded Storage Allocation—No Fragmentation*

If User C logs off and User X logs on with a request for a smaller amount of expanded storage, a small amount of unattached expanded storage exists (see Figure 21 on page 637, step 1). This by itself is not fragmentation. However, if User B logs off and User Y logs on with a request for less than User C had but larger than the previously unattached amount, fragmentation occurs (see Figure 21 on page 637, step 2). The two discontinuous fragments cannot be joined. If User Q logs on and requests an amount equal to the sum of the two pieces, User Q's virtual machine only gets the amount associated with the larger piece (see Figure 21 on page 637, step 3). `QUERY XSTORE` or `QUERY XSTORE USER` also shows this fragmentation, since the last response has the total amount that can be attached that is greater than the maximum that can be attached to a single virtual machine.



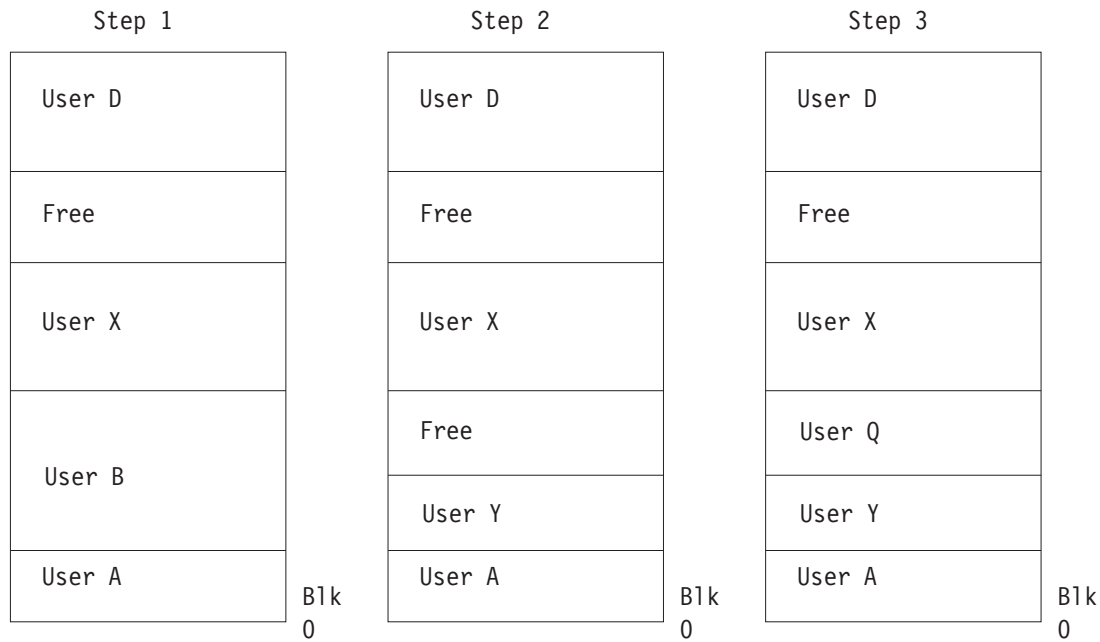


Figure 21. Map of Expanded Storage Allocation—with Fragmentation

By using several commands, this situation can be corrected. First, detach the expanded storage associated with User Q. This is the virtual machine that received the wrong amount of expanded storage (see Figure 22, step 1). Then, detach the expanded storage associated with User X. This is between the two free areas (see Figure 22, step 2). This creates a large contiguous portion of expanded storage. Now, attach expanded storage to User Q and User X with their original amounts. The fragmentation is now removed (see Figure 22, step 3).

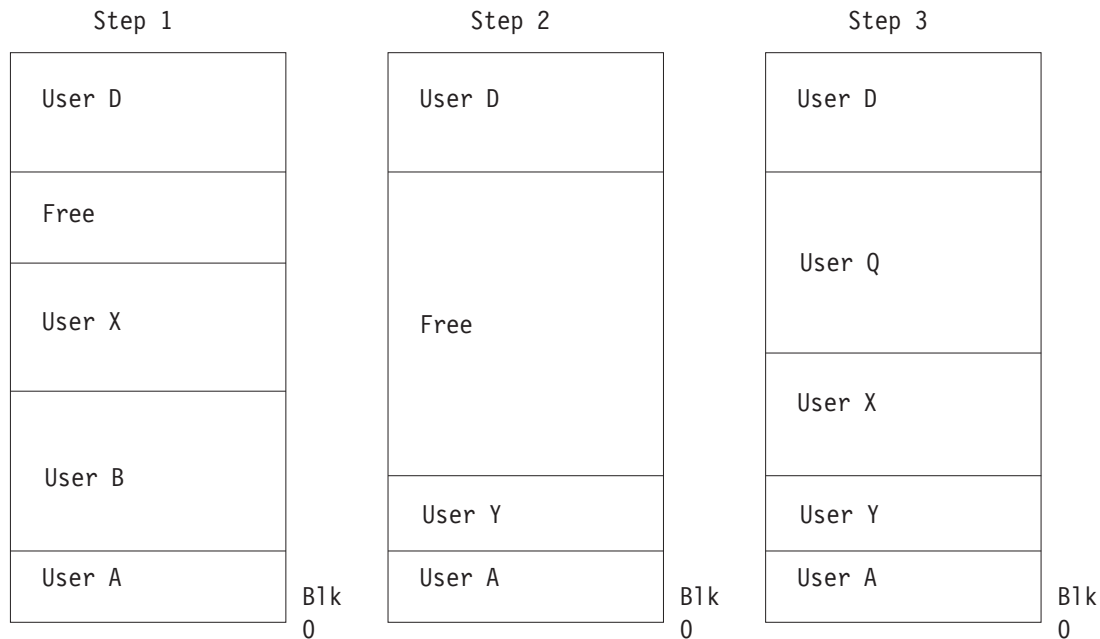


Figure 22. Map of Expanded Storage Allocation — Fragmentation Removed

This example is a fairly simple one. The fragmentation might be worse. It could also contain some sections that are marked CP(RETAINED). In the cases where

CP(RETAINED) exists, you can enter RETAIN XSTORE NONE to start the process. After you have corrected the expanded storage fragmentation, use the RETAIN XSTORE command to reinstate the amount to be retained for CP.

---

### Allocating Expanded Storage to CP

System initialization attaches expanded storage to CP by default. Use the RETAIN XSTORE command to set aside expanded storage for the exclusive use of CP. Retained expanded storage is not available to be attached to virtual machines.

**Note:** The RETAIN XSTORE command is used to prevent a guest with an XSTORE directory statement in its virtual machine definition from logging on and taking enough expanded storage from the system to cause performance problems. It controls inadvertent operational errors.

### Allocating Retained Expanded Storage

When the RETAIN XSTORE command is entered, CP sets aside expanded storage for CP's exclusive use starting with the highest block number. This corresponds to the top of the map discussed under "Mapping Expanded Storage" on page 635.

If the amount to be retained cannot be found at the highest block numbers, CP takes any expanded storage not assigned to virtual machines. This action could cause fragmentation. To minimize fragmentation, the system operator should enter RETAIN XSTORE immediately after the system initializes. If the map for the configuration is followed, the presence of virtual machines logging on at the time should not cause a problem. Expanded storage is attached to the virtual machines starting from the lowest block number.

### Pending Retained Expanded Storage

If not enough expanded storage is available to satisfy a RETAIN XSTORE command, the remaining amount is designated as pending retained expanded storage. When a virtual machine detaches expanded storage, CP uses some or all of the amount detached to fulfill the pending retain. If the operator wants to delete pending retain, the RETAIN XSTORE command should be entered again with the amount given on the command equal to the current amount retained.

**Note:** Since virtual machines can detach expanded storage in an unpredictable way, pending retain can also cause fragmentation.

---

### Using Expanded Storage as a Minidisk Cache

For performance recommendations and guidance in the usage of expanded storage for minidisk cache, see "z/VM Minidisk Cache" on the z/VM performance web site at IBM: VM Performance Resources ([www.ibm.com/vm/perf/](http://www.ibm.com/vm/perf/)).

Expanded storage can also be used as a write-through minidisk cache for CMS or other guests' data. (Write-through means that anything written to the minidisk is also reflected in the cache.) This use of expanded storage is self-tuning and totally transparent. It can help eliminate I/O bottlenecks and improve system response time. Response time may be improved because many reads become synchronous instructions and less CP time is spent on I/O related tasks.

Real storage can also be used for minidisk caching.

Using expanded storage as a minidisk cache may also reduce the complexity of configuring I/O and tuning. You may be able to eliminate replication of heavily used read-only shared minidisks such as the CMS S and Y disks and the tools disks. You can limit load balancing to write activity on DASD volumes. You can allow more DASD per control unit, while maintaining a given response time.

Expanded storage is faster than DASD control unit caches. Control unit caches transfer at channel speeds; expanded storage transfers at near central storage speeds.

CP-managed centralized cache has automatic load balancing. There is no need to decide which DASD to cover. It also uses space more efficiently.

For cacheable I/O, data integrity is maintained by always updating the cache after an I/O operation. (This includes I/O error conditions.) Where minidisk caching has been specifically prohibited for an otherwise cacheable interface, cache invalidation may be used to ensure data integrity.

For non-cacheable I/O, CP cannot always determine which records on the minidisk are being referenced. CP causes cache invalidation if, after investigation of the channel program it determines the data cannot be cached. Data integrity is maintained by cache invalidation.

Blocks are discarded from the cache when the data on the physical volume is changed in a way that bypasses the cache. The cache is invalidated when:

- An I/O error occurs on cacheable I/O
- A noncacheable I/O operation occurs to a writeable minidisk that either:
  - May have data in the cache
  - Overlaps another minidisk which may have data in the cache
- DASD is detached from the system
- The expanded storage partition that contains minidisk caching blocks is attached to a guest virtual machine.

Unnecessary cache invalidation decreases performance by reducing the cache hit ratio. To avoid problems, see “Planning for and Using Minidisk Caching” on page 642.

### CP Minidisk Cache Enhancements:

The following are potential items to consider when migrating from previous VM release:

- Reconfigure expanded storage as real storage if it is specifically for minidisk cache.

Some processors allow a portion of the real storage to be configured as expanded storage. Installations that configure real storage as expanded storage in order to use minidisk cache should consider reconfiguring this expanded storage as real storage.

- Review storage allocation for minidisk cache.

The amount of real storage or expanded storage allocated for minidisk cache can be fixed or bounded (minimum and maximum) with the SET MDCACHE command. The RETAIN XSTORE MDC command is maintained only for

compatibility purposes. When the amount of storage allocated for minidisk cache is not a fixed amount, the arbiter function of minidisk cache determines how much storage to allocate.

If the size of the minidisk cache was previously fixed or bounded, you will want to either allow the arbiter to dynamically determine the minidisk cache size or you will want to alter the values in consideration of both real storage and expanded storage usage.

A method of influencing the arbiter is to set a bias with the SET MDCACHE STORAGE BIAS or SET MDCACHE XSTORE BIAS commands. This can be preferable to setting a fixed minimum or maximum for systems where paging and/or minidisk cache size requirements vary significantly over time.

- Try letting the minidisk cache size default.

For both MDC in real storage and MDC in expanded storage, the default is no cache size restrictions and no biasing (that is, a bias setting of 1.00). Under these conditions, the real storage arbiter usually strikes a good balance between using real storage for MDC and using it for demand paging. Likewise, the expanded storage arbiter usually makes a good trade-off between using expanded storage for MDC and using it for paging. The default settings should be good for most systems and are at least a good starting point. One potential exception is when storage is very unconstrained. In that case, bias settings in the range of 0.1 to 0.5 may give better results.

- When using expanded storage for minidisk cache, also use some real storage for minidisk cache.

In situations where expanded storage is to be used for most minidisk caching, it is better to allow some real storage to also be used for minidisk caching rather than setting the real MDC size to 0 or setting it off.

- Use SET MDCACHE or SET RDEVICE commands to enable minidisk cache on volumes.

You cannot define all DASD volumes as shared volumes in the system generation or system configuration file and then enable particular volumes for minidisk cache with the SET SHARE OFF command. You must explicitly use the SET MDCACHE RDEV command or the SET RDEVICE command with MDC option to enable minidisk cache.

- Enable caching for minidisks that were poor candidates in the past.

There may be minidisks that were disabled for caching because most of the I/O to them were writes. It may now be reasonable to enable these minidisks because the writes will not cause inserts in the cache and the reads might benefit from caching. Some overhead to check for data in the cache when performing a write I/O (to maintain integrity) does exist. Therefore, disabling minidisk cache for write-only minidisks would save some system resources.

- Disable caching for minidisks that are poor candidates.

You may want to revisit and change the devices for which you disabled or enabled minidisk caching. There may be some minidisks that are poor candidates for minidisk cache, but did not matter in the past since the type of I/O or format made them ineligible for minidisk cache. With several restrictions being lifted, (such as the 4 KB block size) it may be worthwhile to revisit these minidisks and make sure they have minidisk cache disabled. VSE paging volumes may be candidates.

- Consider using minidisk caching with guest operating systems.

Minidisk caching can often be used to improve the performance of guest operating systems. The main benefits of minidisk caching are to reduce the load

on the I/O subsystem and to reduce elapsed time by eliminating read I/Os when the requested records are found in the cache.

Minidisk caching uses a fair share concept to prevent any one virtual machine from flooding cache storage by inserting large amounts of data. As with servers that support many users, you should normally use the directory option NOMDCFS (no minidisk cache fair share) to turn off the minidisk cache fair share limit for production guest virtual machines.

- Reformat some minidisks to smaller blocksize.

Each CMS file consists of at least one DASD record even if the file is very small. The capacity of 4 KB formatted minidisks that consist of mostly small files may be increased by reformatting them using 2 KB, 1 KB or 512-byte sizes. Care must be taken, however, because as the record size gets smaller, the number of available bytes per track is reduced.

- Prepare for minidisk caching on devices shared between first and second level systems.

Because minidisk cache can use real storage instead of expanded storage, second level systems benefit. Care should be used for minidisks shared with first level systems in order to have all changes reflected to the second level system. For example, a minidisk is cached by a second level system and a change is made to the minidisk by the first level system. The change will not be reflected on the second level system if the data had been in the second level system cache. You must purge the cache on the second level system with the SET MDCACHE MDISK FLUSH command and reaccess the minidisk to see the changes.

- Avoid mixing standard format and non-standard format records on the same cylinder.

Mixing different format records on the same cylinder makes the minidisk cache feature less efficient. The minidisk cache is more efficient for standard format records. However, when both formats exist on the same cylinder, CP treats all I/O to that cylinder as non-standard.

### What Devices Can Be Cached

Minidisk caching does not apply to:

- DEVNO defined full-pack minidisks
- FBA minidisks that are not page-aligned
- Virtual disks in storage
- Dedicated or attached DASD
- Shared DASD
- Devices other than DASD.

Minidisk caching applies to linked minidisks. This includes:

- Normal user minidisks
- CMS S and Y disks
- Temporary disks
- Overlapping minidisks
- Minidisks formatted and reserved for use by the \*BLOCKIO system service, for example:
  - SQL/DS minidisks
  - Shared file system minidisks.

### Turning Caching Off

By default, CP caches all eligible minidisks on all volumes unless minidisk caching has been turned off. To turn off minidisk caching for the system, enter the command as follows:

```
set mdcache system off
```

To turn off minidisk caching for all minidisks on a volume, you can do one of the following:

- SET MDCACHE RDEV
- Define SHARED YES on the RDEVICE TYPE DASD system configuration file statement for that volume

To turn off minidisk caching for an individual minidisk, code the NOMDC option on the MINIOPT directory statement in the CP directory. For more information, see “MINIOPT Directory Statement” on page 550.

### Planning for and Using Minidisk Caching

The sharing of expanded storage between a minidisk cache and paging is done automatically. To control the sizes of the minidisk cache portion of expanded storage, use the RETAIN or SET MDCACHE commands to set the minimum and maximum size of expanded storage. The size of the minidisk cache can be fixed by setting the maximum equal to the minimum. Use the QUERY MDCACHE command to show the sizes. For the format and description of these commands, see the *z/VM: CP Commands and Utilities Reference*.

To display the current size of the minidisk cache and the minimum and maximum of its possible size, use the QUERY MDCACHE command.

To display the rate per second at which information is read and written to the minidisk cache, use the INDICATE LOAD command. This command also displays the number of successful cache lookups. The INDICATE command statistics are for both real and expanded storage MDC use.

**Attention:** If different systems share a minidisk, use the MINIOPT directory statement to avoid caching those minidisks. If the minidisk is used in read-only status, it can be shared between two systems.

#### Special Considerations for CMS Minidisk Volumes Shared between Processors

If you have DASD volumes that contain CMS minidisks that are shared among different processors, you must take action before IPLing z/VM. This also applies if you are running z/VM as a guest when the guest will be using minidisk caching and the first-level system will be caching using minidisk caching.

For each DASD volume that contains CMS minidisks and that more than one processor physically shares, specify one of the following:

- SHARED YES on the RDEVICE TYPE DASD statement in the system configuration file
- SHARED YES on the SET RDEVICE TYPE DASD command

This prevents all minidisks on those volumes from being eligible for minidisk caching. If you do not specify YES for the SHARED parameter or operand, a data integrity exposure can exist. The exposure is caused if any system other than the one that is using minidisk caching to cache data has write access to the disk.

Note, the SET SHARED ON command disables minidisk caching for all minidisks on a real DASD volume. The SET MDC RDEV command disables minidisk caching on a volume, and the SET MDC MDISK disables caching for a single minidisk. Defining a shared device using either the SET RDEVICE command or the RDEVICE system configuration file statement or macroinstruction, described in the previous list, is the recommended method for shared volumes. It prevents any caching of data that might occur before the SET SHARED command can be entered. For example, caching might occur as part of initialization of operator and autologged virtual machines.

### Notes:

1. One possible exception is that if only one processor among the sharing processors is writing, and the same processor is the only one trying to cache data for that volume, for that processor only, minidisk caching may be allowed (YES need not be specified for the SHARED parameter or operand). For all other sharing processors, YES should be specified for the SHARED parameter or operand.
2. The SET SHARED command and either the SET RDEVICE SHARED YES command or the RDEVICE SHARED YES system configuration file statement can also be used to specify whether virtual reserve/release CCWs should be translated to real reserve/release CCWs. For more information, see Chapter 22, "DASD Sharing," on page 665.

### Performance Considerations

Minidisk cache should be turned off for minidisks that are only read and written via MAPMDISK and the corresponding data space. Minidisks which use a combination of data space access/MAPMDISK and virtual I/O (Diagnose and channel program) should be evaluated on an individual basis to determine if minidisk cache should remain enabled.

To prevent unnecessary cache invalidation, do the following:

- Perform backup with read-only links whenever possible.
- Consider restoring minidisks without full-pack writeable access as follows:
  - Link to the user's minidisk rather than relocating it within a full-pack minidisk
  - Define another minidisk to exactly overlap the one being restored.
- Consider disabling caching for minidisks that are accessed by both CMS users running on the first-level z/VM system and by CMS users running on a second-level guest where the second-level system has write access.

In addition, to improve performance when using minidisk caching, do the following:

- Eliminate replicated volumes
- Aligned FBA minidisks on page boundaries
- Consider moving the following to cached control units:
  - Minidisks frequently accessed through the noncacheable interfaces
  - Minidisks shared between first- and second-level systems
  - Real devices that are physically shared across processors
- Specify NOMDC on the MINIOPT directory statement for minidisks not to be cached. Specifically, do this for write-only minidisks such as those used for journaling, logs, and tracking.



## Expanded Storage Planning and Administration

Minidisk caching is generally self-tuning. You may either need to try some manual tuning (such as the recommendations above) or add additional expanded storage or real storage if your installation experiences:

- A large oscillation in the number of blocks in the cache. (Paging is causing less expanded storage from being used for caching.)
- A high I/O activity to DASDs that contain cacheable minidisks
- A low minidisk caching hit ratio.



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## Chapter 20. Allocating DASD Space

This chapter tells you how to calculate disk space for the following CP storage areas:

- CP module
- Warm start data
- Checkpoint data
- User directory
- Paging space
- Spooling space.

In addition, it includes an explanation of adding CP DASD space to a running z/VM system.

---

### Direct Access Storage Requirements

In the following paragraphs you will find many references to disk space. It is important to understand the fundamentals of disk space to avoid confusion when dealing with various DASD types.

It is helpful to understand z/VM's requirements for disk space in general. It is also helpful to understand the differences and similarities between z/VM's view of Count-Key-Data (CKD) and fixed block architecture (FBA) devices. Examples of these devices are:

**CKD** 3380, 3390

**FBA** 9336, emulated 9336 on SCSI disk

**Note:** z/VM may support some DASD types only as an emulation mode on other DASD. See the list of supported devices in *z/VM: General Information*.

z/VM's reference to disk space is always done in units called pages. A disk page is a 4096-byte record on disk. This means that z/VM requires that all its disk space (warm start data, directory, and so on) be formatted as 4096-byte records. z/VM also requires that you identify the use for which specific pages on disk are allocated to each type of z/VM reference. For example, you must identify pages for paging, for the directory, and for other areas.

### CKD Device Geometry

z/VM views CKD devices by their geometric characteristics (such as number of cylinders). Each cylinder has a fixed page capacity, meaning that a fixed number of 4 KB records fit on a cylinder. This number varies for each CKD DASD type. z/VM references its data by a cylinder number and a page number on that cylinder. For z/VM space you must format and allocate pages in groups of cylinders.

**Note:** z/VM supports only CKD devices that accept the Extended-Count-Key-Data (ECKD) channel program protocol. Space on these devices is also expressed in units of cylinders. For more efficient disk I/O, an extended channel command

## Allocating DASD Space

architecture is used. This architecture is based primarily on the CKD command set. Therefore the term CKD, as used in this and other z/VM books, really refers to ECKD.

Later in this chapter you are asked to figure your particular DASD requirements as a number of records or pages, then convert this number to an equivalent number of cylinders. This means dividing the page requirements by the number of pages per cylinder for particular device types. Allocating space for minidisks on z/VM-owned ECKD volumes is also done in units of cylinders. Use of space within this allocation is also done in units of cylinders by way of the MDISK directory statement. This is convenient because no conversion is required in this case.

## FBA Device Geometry

FBA devices appear as linear address spaces of 512-byte blocks. The blocks are consecutively numbered from 0 to n, where n is the highest block number on the volume. z/VM groups eight consecutive blocks to form a z/VM page and this page must begin on a 4 KB boundary. z/VM then views the volume as a collection of pages numbered from 0 to  $(n-7)/8$ . For example, blocks 0-7 make up page 0. There is no concept of cylinder boundaries in this structure.

You must allocate space on FBA volumes in units of pages (in contrast to units of cylinders on CKD volumes). When you figure your disk space requirements as a number of pages, you can use these numbers directly in system configuration file statements or in the ICKDSF service program (pages). Page numbers must be multiplied by 8 to convert them into block numbers used by the MDISK directory statement. When assigning minidisk space, you must know the available extents of your disk in block numbers (see Table 33 on page 647).

**Note:** It is recommended that all FBA minidisks as well as full-pack minidisk volumes be aligned on page boundaries for optimization of disk space. Otherwise, the resulting residual blocks of disk space might not be formatted and utilized. Additional restrictions apply for SFS file pool minidisks that are not page-aligned. For more information, see *z/VM: CMS File Pool Planning, Administration, and Operation*. If the starting block number is a multiple of eight and the number of blocks is a multiple of eight, then the minidisk is defined to be on a page boundary.

It is helpful to understand how much disk space you need to allocate for CP storage areas. This chapter shows you how to calculate CP storage areas in terms of the number of cylinders on the various types of CKD devices and the number of 4 KB pages on FBA devices.

## Storage Calculations

For each area of storage, a calculation to determine the number of cylinders or 4 KB pages needed is given. You will need to refer to information in the system configuration file for some of the calculations.

Table 32 on page 647 lists the storage capacity of various CKD devices. Table 33 on page 647 lists the storage capacity of FBA devices.

Table 32. CKD DASD Storage Capacities

| DASD Type                                                                                                                                | Pages per Track | Tracks per Cylinder | Cylinders per Disk | Pages per Cylinder |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|--------------------|--------------------|
| 3380<br>Model K                                                                                                                          | 10              | 15                  | 2655               | 150                |
| 3380<br>Model E                                                                                                                          | 10              | 15                  | 1770               | 150                |
| 3380<br>All other<br>models                                                                                                              | 10              | 15                  | 885                | 150                |
| 3390-1                                                                                                                                   | 12              | 15                  | 1113               | 180                |
| 3390-2                                                                                                                                   | 12              | 15                  | 2226               | 180                |
| 3390-3                                                                                                                                   | 12              | 15                  | 3339               | 180                |
| 3390-9                                                                                                                                   | 12              | 15                  | 10017 <sup>1</sup> | 180                |
| 3390-A                                                                                                                                   | 12              | 15                  | Note <sup>2</sup>  | 180                |
| <b>Note:</b><br><sup>1</sup> Value can be up to the maximum number of cylinders on the disk.<br><sup>2</sup> As allowed by the hardware. |                 |                     |                    |                    |

**Note:** One page of host storage is equivalent to 4096 bytes of contiguous disk space.

Table 33. FBA DASD Storage Capacities

| DASD Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Number of<br>Blocks           | Number of<br>Access<br>Positions | Number of<br>Blocks Per<br>Access Position | Number of<br>Pages Per<br>Access<br>Position |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------|--------------------------------------------|----------------------------------------------|
| 9336-20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,672,881                     | 2153                             | 777                                        | 111                                          |
| Emulated 9336-20 on<br>SCSI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,147,483,640 <sup>1, 2</sup> | –                                | 777 <sup>3</sup>                           | 111 <sup>3</sup>                             |
| <b>Notes:</b><br><sup>1</sup> FBA DASD space allocated by CP for use as directory, paging, and spooling must reside within the first 16,777,215 pages (64 GB minus 1 page) of the volume.<br><sup>2</sup> Because the CMS file system requires file status and control information to reside below 16 MB in virtual storage, there is a practical limitation on the size of CMS minidisks. As a minidisk increases in size, or more files reside on the disk, the amount of virtual storage associated with the disk for CMS file system status and control increases in storage below 16 MB. The current ECKD DASD limitation for CMS is 65520 cylinders for a 3390 disk on an IBM TotalStorage DASD subsystem, or about 45 GB of data. The maximum size for FBA SCSI disks supported for use by CMS or GCS is 381 GB. IBM suggests that customers defining disks for use by CMS should set a practical limit of about 22 GB. If larger disks are defined, they should be limited to contain very few files, or the CMS file system may not be able to obtain enough virtual storage below 16 MB to format or access those disks. For more information, see the ACCESS command in the <i>z/VM: CMS Commands and Utilities Reference</i> .<br><sup>3</sup> These values are simulated for emulated 9336-20 on SCSI and are not directly related to the total number of blocks allowed on real SCSI hardware. |                               |                                  |                                            |                                              |

### CP Module

The CP module resides on a CMS-formatted minidisk, usually the parm disk. You need to allocate sufficient disk space for the parm disk, which may contain:

- System configuration files
- One or more CP modules
- Logo files
- Text decks for CP exits

The size of the CP module depends on the size of:

- IBM-supplied text decks
- Customized HCPSYS (system definition) and HCPRIO (real I/O configuration) ASSEMBLE files, if used
- Other customized text decks included in the CP module
- Use of the HCPLDR option PAGEB

The size of the system configuration file does not affect the size of the CP module. Therefore, if you are migrating from a previous VM release in which you used the HCPSYS and HCPRIO files to define your system, IBM strongly recommends that you migrate all of the data from your HCPSYS and HCPRIO files to the system configuration file.

Table 34 shows the minimum contiguous cylinders/4 KB pages required for the CP module when you are not using the HCPSYS and HCPRIO files or the HCPLDR PAGEB option.

*Table 34. Minimum Space Required for the CP Module*

| Device | Number of Cylinders or Pages |
|--------|------------------------------|
| 3390   | 18 cylinders                 |
| FBA    | 3200 pages                   |

### Warm Start Data

You specify the number of cylinders or 4 KB pages to allocate to the warm start area. The number required is based on the maximum number of spool files that can exist at one time, which in turn is determined by the number of users defined in the directory and the number of spool files permitted each user, or the number of cylinders or pages available for spool files. You can specify up to 9 cylinders (CKD DASD) or 2000 4 KB pages (FBA DASD) for the warm start area. The warm start and checkpoint save area cannot begin at cylinder 0 (CKD DASD) or before page 16 (FBA DASD).

Use the WARMSTART operand of the SYSTEM\_RESIDENCE statement in the system configuration file to specify the location and size of the area to be used for warm start data:

- The starting location is specified as the cylinder or page number that designates the real starting location where the CP warm start information is to be saved. For CKD device types, this value is a nonzero decimal cylinder number ranging from 1 to 65511. For FBA devices, this value is a 4 KB page number beginning with page 16 or greater.
- The maximum size of the warm start area is specified as the number of cylinders or 4 KB pages to be allocated for the warm start information area. For CKD

devices, this must be a number from 1 to 9 that represents cylinders. For FBA devices, this must be a number from 1 to 2000 that represents 4 KB pages. You can use one of the following formulas to calculate the size.

If the warm start volume is a CKD DASD, use this formula to calculate number of cylinders required:

$$n = \frac{\text{maxfiles}}{1022 \times \text{ppc}}$$

If the warm start volume is an FBA DASD, use this formula to calculate number of 4 KB pages required:

$$p = \frac{\text{maxfiles}}{1022}$$

$n$  is the number of cylinders required for the warm start area.

$p$  is the number of 4 KB pages required for the warm start area.

*maxfiles*

is the maximum number of spool files that can exist at one time.

*ppc*

is a device-dependent value selected from Table 32 on page 647. The value represents the number of 4 KB pages that will fit on one cylinder.

## Example

For example, assume you chose a 3390 DASD as the device to be used for warm start data. Each 4 KB page of a CKD DASD allows 1022 spool file pointers. A 3390 DASD has 180 four-kilobyte (4 KB) pages per cylinder. Therefore each cylinder of a 3390 DASD can point to 183960 files. So a 9-cylinder warm start area (the maximum) allows a system-wide maximum of more than 1.6 million (1655640) spool files.

For information on how to specify the operands, see “SYSTEM\_RESIDENCE Statement” on page 273.

---

## Checkpoint Data

You specify the number of cylinders or 4 KB pages to allocate the checkpoint area. The number required for the checkpoint area is based on the number of CP-owned volumes in the configuration, the number of real spooling devices defined in the real I/O configuration, and the maximum number of users that will be logged on at the same time. Accounting, EREP, and symptom records are also stored in the checkpoint area. Normally, these records are retrieved by virtual machines identified in the system configuration file. But if those virtual machines are not actively retrieving the records, they will accumulate and take up space in the checkpoint area.

You can specify up to 9 cylinders (CKD DASD) or 2000 four-kilobyte (4 KB) pages (FBA DASD) for the checkpoint area. The warm start and checkpoint save area cannot begin at cylinder 0 (CKD DASD) or before page 16 (FBA DASD).

Use the CHECKPOINT operand of the SYSTEM\_RESIDENCE statement in the system configuration file to specify the location and size of the area to be used for checkpoint (system restart) data:

## Allocating DASD Space

- The starting location is specified as the cylinder or page number that designates the real starting location where the CP warm start information is to be saved. For CKD devices, this value is a nonzero decimal cylinder number ranging from 1 to 65511. For FBA devices, this value is a 4 KB page number beginning with page 16 or greater.
- The maximum size of the checkpoint area is specified as the number of cylinders or 4 KB pages to be allocated for the checkpoint information area. For CKD devices, this must be a number from 1 to 9 that represents cylinders. For FBA devices, this must be a number from 1 to 2000 that represents 4 KB pages. You can use one of the following formulas to calculate the size.

If the checkpoint volume is a CKD DASD, use this formula to calculate number of cylinders required:

$$n = \frac{ppc + 4 + ((nvl + 119) / 120) + ((nrs + 60) / 61) + (((nau * 10) + 39) / 40)}{ppc}$$

If the checkpoint volume is an FBA device, use this formula to calculate number of 4-KB pages required:

$$p = 100 + ((nvl + 119) / 120) + ((nrs + 60) / 61) + (((nau * 10) + 39) / 40)$$

$n$  is the number of cylinders required for the checkpoint area.

$p$  is the number of 4 KB pages required for the checkpoint area.

$ppc$

is a device-dependent value selected from Table 32 on page 647. The value represents the number of 4 KB pages that will fit on one cylinder.

$nvl$

is the number of CP-owned volumes present in the configuration when the checkpoint process began.

$nrs$

is the number of real spooling devices defined in the real I/O configuration.

$nau$

is the number of users active on the system when the checkpoint process began.

---

## Directory Space

To allocate a disk so that it contains space for the directory, use the Device Support Facilities program (ICKDSF). See the *Device Support Facilities User's Guide and Reference* book for additional information. The z/VM user directory cannot begin before page 16 on FBA DASD.

If you follow the installation procedures in the *z/VM: Installation Guide*, you should have enough disk space for two directories. This allows you to build a new directory whenever needed, without reformatting and reallocating space each time. If you wish to reallocate the area on which the directory resides, you may use the ICKDSF program, which can be invoked by the CP utility CPFMTXA.

A minimum of 4 cylinders (CKD DASD) or 600 pages (FBA DASD) should be allocated to the z/VM directory. This provides for two directories of 2 cylinders (CKD DASD) or 300 pages (FBA DASD) each. The space required for the directory depends on the number and size of the virtual machine configurations defined. If you have not allocated enough space for your directory, you will receive a message saying so.

You can estimate the minimum disk space required for your directory by using one of the following formulas:

For CKD DASD, use the formula below (round up any fraction to the next whole number) to calculate the minimum number of cylinders required to contain the object directory:

$$\text{cylinders} = \frac{tcbs}{ppc} * 2$$

For FBA DASD, use the formula below to calculate the minimum number of pages required to contain the object directory:

$$\text{pages} = tcbs * 2$$

*cylinders*

is the minimum number of cylinders of the CKD DASD type targeted to contain the object directory.

To calculate the minimum disk space required for an object directory, use the formula below for total control block space (*tcbs*) to calculate the number of pages. Then divide the result (*tcbs*) by the pages per cylinder value to obtain the number of cylinders for that type of DASD.

*pages*

is the minimum number of 4-KB pages of FBA DASD targeted to contain the object directory.

To calculate the minimum disk space required for an object directory, use the formula below for *tcbs* to calculate the number of pages.

*ppc*

is the number of pages per cylinder for the device type you intend to use for your object directory, as listed in Table 32 on page 647.

*tcbs*

is an estimate of the total number of pages required for directory control blocks, comprising the index pages, the profile specifications, the user specifications, and the identity specifications. The number can be found by using the following formula:

$$tcbs = 12 + (((512 + cpus * 16 + devices * 104 + iucvs * 32) / 4096) * users) + identities * 512$$

where

*cpus*

is the number of virtual CPUs defined for a typical virtual machine.

*devices*

is the number of virtual devices defined for a typical virtual machine, including those defined using SPOOL, CONSOLE, DEDICATE, MDISK, SPECIAL, and LINK statements. Include in the count for a user any devices that are defined in an imbedded profile or subconfiguration entry.

*iucvs*

is the number of IUCV statements defined for a typical virtual machine.

*identities*

is the number of virtual machines defined in the user directory using the IDENTITY statement.



## Allocating DASD Space

*users*

is the number of virtual machines in the user directory, including those defined using USER, IDENTITY, SUBCONFIG, PROFILE, and POOL statements.

### Example

For an installation with 5000 users, the numbers might look like:

users = 5000

cpus = 1

devices = 20

iucvs = 2

For these values, the number of pages of storage required would be:

$$tcbs = 12 + ((512 + 1 \times 16 + 20 \times 80 + 2 \times 32) / 4096) \times 5000$$
$$tcbs = 12 + 2676 = 2688$$
$$cylinders = 2688 / 180 \times 2 = 15 \times 2 = 30$$
$$pages = 2688 \times 2 = 5376$$

For a 3390 at 180 pages per cylinder, the required space would be 30 cylinders. For an FBA device, the required space would be 5376 pages.

This is the minimum amount of space to be allocated. You should apply a growth factor to this amount to accommodate changes and additions to your system. Also, since this is only an approximation, if you make extensive use of directory statements not mentioned in the explanation of operands in the formula, you should apply a larger growth factor to the result.

### Directory Size Constraints

The constraining factors on the number of users in the directory are as follows:

- The maximum size of the source directory that can be handled by the file editor. To maximize the effective size of the source directory, you can do the following:
  - Minimize the amount of virtual storage CMS is using by accessing as few disks as possible. This allows as much virtual storage as possible for the source directory.
  - Decrease the average number of records needed to describe a virtual machine by eliminating comments and by effective use of profiles.
  - Convert a very large monolithic source directory to cluster form.
- Disk space. The object directory must fit on one disk volume. With the size of disk supported by CP, this should not be a problem. The other limitations will come into play before this one is reached.

---

## Paging Space

**Attention:** Underestimating your paging capacity may result in a system outage (PGT004 abend). Periodically use the QUERY ALLOC PAGE command to monitor paging space utilization and consider adding more paging space once your usage approaches 75% of the available space.

To determine the amount of paging space you will need to allocate on disk, you must consider the following characteristics of your installation:



1. Maximum total virtual machine size
  - Consider the logon and maximum allowed storage sizes for each virtual machine. A virtual machine has the potential to instantiate all of the pages within its base address space plus any data spaces it is allowed to create.
2. Maximum total size of virtual disks in storage (VDISKs)
  - Consider both shared and private VDISKs and the number of pages that can be instantiated for each.
3. NSS/DCSS
  - Include the total number of shared pages within all NSS/DCSSs, plus the number of exclusive pages multiplied by the number of virtual machines loading them.
  - If any of your DCSSs are defined with the LOADNSHR option, you will need to allow for a separate copy of the DCSS for each expected non-shared usage of the DCSS.
4. System overhead
  - Include the number of CP object directory pages as reported by the DIRECTXA utility, plus an additional amount for future directory growth (possibly two times or more).
  - Allow approximately 1% of items 1, 2, and 3 for pageable PGMBKs.
  - The number of system virtual pages can vary based on your workload. Allow approximately 10% of your real storage size, with a maximum of 4G for system virtual pages.
5. System Growth
  - Any changes to the CP Directory to define more users, to increase virtual storage sizes for existing users, and to increase the number of allowable VDISKs must be monitored to ensure your existing paging capacity can handle the growth.
  - When operating within an SSI cluster, you must take into consideration the possibility for guests to relocate from other members of the cluster. Consideration should be given to the size of the guests to be relocated, including the size of VDISKs allocated to those guests.

#### Notes:

1. For CKD devices, to calculate the number of cylinders of that device type needed, divide the number of disk pages needed for paging space by the number of pages per cylinder for that device type, and round up.
2. For FBA devices to determine the number of blocks needed for paging space, multiply the number of pages by 8, since the number of 512-byte blocks in a page is 8.

---

## Spooling Space

Spooling space is space on disk that CP requires to hold spool files on disk. When you allocate spool space, you should take these requirements into consideration:

- Normal spooling space
- The space required to write a dump
- The space required for a named saved system (NSS)
- The space required for system data files, such as:
  - Saved segments
  - UCR data files

- Trace data files
- Image libraries
- NLS files.

### Allocating Space for CP Hard Abend Dumps

CP hard abend dumps and CP snapdumps share spooling space with other spool files. Dumps can be sent to spool as long as enough spool space is available to contain the dump. The amount of spool space required for a dump is directly related to the amount of real storage used by the following:

1. The CP nucleus.

The size of the CP nucleus is fairly constant but grows with each release of z/VM. Specifying the HCPLDR PAGEB operand, usually done only on test systems, can significantly increase the size of the CP nucleus. To find the size of the CP nucleus, look in the CPLOAD MAP file for the address of @LOADEND. For example, for z/VM V6.3, it is approximately X'BE9000' if the HCPLDR PAGEB operand is not specified. This value means that X'BE9' four-kilobyte (4 KB) pages (or 3049 four-kilobyte pages) are used by the CP nucleus. That is about 11.9 MB.

2. The CP Frame Table.

The CP Frame Table is directly proportional to the real storage size of the machine in which CP is executing. Its size is 1/128th the size of real storage.

Every 1 MB of data that must be dumped requires 256 four-kilobyte (4 KB) pages of spool. On a system with 512 MB of storage,  $512 / 128 = 4$  MB. This means 1024 pages of spool are required to dump the CP Frame Table.

As the size of real storage increases, the size of the CP Frame Table becomes increasingly important to the size of the dump. On a system with 8 GB of storage,  $8192 \text{ MB} / 128 = 64 \text{ MB}$ . This means 16384 pages of spool are required just to dump the CP Frame Table.

**Note:** In systems with multiple noncontiguous storage extents, the CP Frame Table must map the highest real storage address. The CP Frame Table will contain entries for storage that is not configured. In this environment, the CP Frame Table is not proportionate to the amount of storage as it is for environments with contiguous online storage.

3. System Execution Space data structure.

The System Execution Space Page Management Table will account for a significant portion of the dump. Its size is 1/128th the size of real storage up to 2 GB. It is constant at 4096 pages for real storage sizes above 2 GB.

4. CP control blocks and structures based on your system's workload.

During system initialization, CP tries to set aside enough spool space to contain a dump. This space changes dynamically as the system operates. As users log on, more CP control blocks are used and the pages required for dump space increases. Different types of production workloads could require significantly different CP control blocks and therefore have different requirements for dump space.

Because workloads can vary from system to system, the amount of spool space required for a dump also varies. Table 35 on page 655 provides a method to estimate how much spool space to provide for each dump. Other information to consider:

- Dumps from various z/VM systems were analyzed and used to generate these estimates. Use the low percentage if you are estimating for a system with low utilization. Use the high percentage if you are estimating for a busy production system.

It is important that you periodically check the amount of dump space allocated on your running system and make adjustments as necessary.

A privilege class B user can display the current dump setting with the QUERY DUMP command. A privilege class D user can display the current spool space status with the QUERY ALLOC SPOOL command. A privilege class D user can determine if any dump SPOOL files (spool class D) exist by issuing "CP QUERY RDR ALL CLASS D SHORTDATE".

- You should provide space for more than one dump. Space for three dumps is recommended -- space for the next dump and space for two dumps that you may not have yet processed with DUMpload or DUMPLD2. It is recommended you purge dumps from spool after loading them to disk and successfully transmitting them to IBM Support, or when you are sure they are no longer needed.

*Table 35. Amount of Dump Space Based on Real Storage and Type of DASD.* An aid to estimating how much spool space to allow.

| Real Storage Size | Percent of Real Storage that will be dumped | 4 KB Pages of Spool Space       | 3390 Cylinders             | FBA 512-byte Blocks              |
|-------------------|---------------------------------------------|---------------------------------|----------------------------|----------------------------------|
| 256 MB            | 22 to xx% <sup>1</sup>                      | 14,418 to xxxxx <sup>1</sup>    | 80 to xxx <sup>1</sup>     | 115,344 to xxxxx <sup>1</sup>    |
| 512 MB            | 12 to xx% <sup>1</sup>                      | 15,729 to xxxxx <sup>1</sup>    | 87 to xxx <sup>1</sup>     | 125,832 to xxxxx <sup>1</sup>    |
| 1 GB              | 7 to xx% <sup>1</sup>                       | 18,350 to xxxxx <sup>1</sup>    | 102 to xxx <sup>1</sup>    | 146,800 to xxxxx <sup>1</sup>    |
| 2 GB              | 5 to xx% <sup>1</sup>                       | 26,214 to xxxxx <sup>1</sup>    | 146 to xxx <sup>1</sup>    | 209,712 to xxxxx <sup>1</sup>    |
| 4 GB              | 4 to xx% <sup>1</sup>                       | 41,943 to xxxxx <sup>1</sup>    | 233 to xxx <sup>1</sup>    | 335,544 to xxxxx <sup>1</sup>    |
| 8 GB              | 3 to xx% <sup>1</sup>                       | 62,915 to xxxxx <sup>1</sup>    | 350 to xxx <sup>1</sup>    | 503,320 to xxxxx <sup>1</sup>    |
| 16 GB             | 2 to xx% <sup>1</sup>                       | 83,886 to xxxxx <sup>1</sup>    | 466 to xxx <sup>1</sup>    | 671,088 to xxxxx <sup>1</sup>    |
| 32 GB             | 2 to xx% <sup>1</sup>                       | 167,772 to xxxxx <sup>1</sup>   | 932 to xxx <sup>1</sup>    | 1,342,176 to xxxxx <sup>1</sup>  |
| 64 GB             | 2 to xx% <sup>1</sup>                       | 335,544 to xxxxx <sup>1</sup>   | 1,864 to xxx <sup>1</sup>  | 2,684,352 to xxxxx <sup>1</sup>  |
| 128 GB            | 2 to xx% <sup>1</sup>                       | 671,089 to xxxxx <sup>1</sup>   | 3,728 to xxx <sup>1</sup>  | 5,368,712 to xxxxx <sup>1</sup>  |
| 256 GB            | 2 to xx% <sup>1</sup>                       | 1,342,177 to xxxxx <sup>1</sup> | 7,457 to xxx <sup>1</sup>  | 10,737,416 to xxxxx <sup>1</sup> |
| 512 GB            | 2 to xx% <sup>1</sup>                       | 2,684,355 to xxxxx <sup>1</sup> | 14,913 to xxx <sup>1</sup> | 21,474,840 to xxxxx <sup>1</sup> |
| 1,024 GB          | 2 to xx% <sup>1</sup>                       | 5,368,709 to xxxxx <sup>1</sup> | 29,826 to xxx <sup>1</sup> | 42,949,672 to xxxxx <sup>1</sup> |

<sup>1</sup> At the time of publication, IBM had not yet completed the evaluation necessary to accurately estimate the high number of the range. An estimate will be provided at the following web site: IBM: z/VM Technical Resources (<http://www.ibm.com/vm/techinfo/>) when the product is generally available.

As stated above, it is important that you periodically check the amount of dump space allocated on your running system and make adjustments as necessary.

Information in this table is based on the following:

- Every 1 MB of data that must be dumped required 256 pages of spool space.
- There are 180 four-kilobyte (4 KB) pages per 3390 cylinder. If you are using 3380 DASD, there are 150 four-kilobyte (4 KB) pages per cylinder and you will need to adjust the estimate accordingly.
- One 4 KB page is 8 FBA 512-byte blocks.

## Allocating DASD Space

To illustrate how the values in the table were calculated, suppose your system is not very busy and has 4 GB of storage.

$$4 \text{ GB} \times 1024 \text{ (MB per GB)} \times 4\% \times 256 \text{ (pages per MB)} = 41943 \text{ pages}$$

$$41943 \text{ pages} / 180 \text{ (pages per 3390 cylinder)} = 233 \text{ cylinders}$$

$$41943 \text{ pages} \times 8 \text{ (blocks per page)} = 335544 \text{ FBA 512-byte blocks}$$

For real storage amounts not listed in the table, find the line that is closest to your amount of real storage and perform the above calculations.

A class B user can change the dump setting with the SET DUMP command. The SET DUMP command also allows the class B user to specify a preferred order of multiple disk volumes to be used for allocation of the dump space.

IBM strongly recommends the following practices in respect to dump space allocation:

1. Use the DUMP option on the CP\_OWNED system configuration file statement to reserve certain spool volumes to be used for dump space only. Also, fully allocate these DUMP volumes as SPOL space. These practices reduce spooling space fragmentation and will enable dump space allocation to find large clusters of available space.
2. When assigning devices for dump space, remember to consider that the speed of the device directly influences dump time.

## Named Saved System

To save a copy of an operating system running in a virtual machine, space must be reserved on a CP-owned volume for the named saved system. Named saved systems require one page of spool space for each page saved, plus an additional information page or pages. CP uses the information pages to save the virtual machine's register contents, PSW, and storage keys. The number of information pages required depends on the number of virtual machine pages being saved. The following formula shows this relationship:

$$\text{information pages} = 1 + \text{virtual machine pages} / 4096$$

Round up the result of this calculation to the next whole number.

For example, to save a 32 MB virtual machine, you need 8195 pages on disk (8192 virtual machine pages plus 3 information pages).

## Spool Space Example

The following table shows you how much spooling space in files per pack you need to specify for CKD DASD based on the type of DASD you have and the average spool file size on your system. Three average spool file sizes are given: small (2 KB), medium (50 KB), and large (100 KB).

| Device | Small (2 KB) | Medium (50 KB) | Large (100 KB) |
|--------|--------------|----------------|----------------|
| 3390-1 | 100,170      | 15,411         | 8,014          |
| 3390-2 | 200,340      | 30,822         | 16,028*        |
| 3390-3 | 300,510      | 46,233         | 24,042         |
| 3390-9 | 901,530      | 138,696        | 72,122         |

\* Large work load (100 KB) and using a 3390-2

$$\begin{array}{ccccccc} 2226 & \times & 12 & = & 26712 & \times & 15 & = & 400680 & / & 25 & = & 16,028 & \text{ files/pack} \\ | & & | & & | & & | & & | & & | & & | & \\ \text{Number of} & & \text{Pages/Track} & & \text{Tracks/Cyl.} & & \text{Pages/File} & & & & & & & \\ \text{Cylinders} & & & & & & & & & & & & & \end{array}$$

The table below shows you how much spooling space in files per pack you need to specify for FBA DASD based on the type of DASD you have and the work load running on your system. Three work load sizes are given: small (2 KB), medium (50 KB), and large (100 KB).

| Device  | Small (2 KB) | Medium (50 KB) | Large (100 KB) |
|---------|--------------|----------------|----------------|
| 9336-20 | 104,554      | 16,085**       | 8,364          |

\*\* Medium work load (50 KB) and using a 9336-20

$$\begin{array}{ccccccc} 1,672,881 & / & 8 & = & 209,110 & - & 2 & = & 209,108 & / & 13 & = & 16,085 & \text{ files/pack} \\ | & & | & & | & & | & & | & & | & & | & \\ \text{Number of} & & \text{Blocks/Page} & & \text{Reserved Pages} & & \text{Pages/File} & & & & & & & \\ \text{Blocks} & & & & & & & & & & & & & \end{array}$$

## Switching Operating Modes for 3390 Devices

**Attention:** All mode switches require the affected device to be formatted, so you should move your data off the device before beginning this procedure.

To switch operating modes for a 3390 device, you will need to vary the device offline. If the device is defined to z/VM or is to be dynamically sensed, you may need to perform a SET RDEVICE so that CP recognizes the new device type. Otherwise, the integrity of the control blocks associated with the device is jeopardized.

If you have the devices defined in the system configuration file:

When the device is defined as a 3380 it is necessary to update the RDEVICE statement to define the device as a 3390. Defined in this manner, z/VM will recognize the mode switch when the device is varied online. This should be done at a convenient time, such that the next IPL of the system will have the necessary definitions. Although it is not a requirement, for consistency, the device type can also be specified as 3390 in the I/O Configuration Dataset (IOCDs).

If you are switching from 3380 track compatibility mode to 3390 mode, and the device type is not defined as a 3390, z/VM does not allow the device to be varied back online without first performing a SET RDEVICE to change the device type. If the device type is not also changed in the system configuration file, the device will remain offline and unusable after the next IPL.

If the devices are dynamically sensed:

No changes are required in the system configuration file. The SET RDEVICE command can be used to change the device definition for the current mode of the 3390 device. During IPL, the 3390 device will be brought online in its current mode of operation.

Remember that the 3390 Model 9 does not support 3380 track compatibility mode, so do not perform this procedure with this device.

### Mode Switch Procedure

Use the following procedure for switching 3390 operating modes:

1. Prevent all applications and users from using the device. For example, if the device is being used by the system for minidisks, all users must detach those minidisks, and the device must be detached from the system. If the device is being used by one guest, that guest must detach the device.
2. Move the data off the affected device. The procedure of switching modes destroys the data on the device and changes the track format.  
If you wish to restore the data to the same device after switching modes, you should not use service programs that require identical track formats (such as DASD Dump Restore). For information on moving data, see *Using IBM 3390 Direct Access Storage in a VM Environment*, GC26-4575.
3. Vary the device offline to all processors that have access to it, except the one from which you perform the mode switch.
4. Attach the device to the virtual machine of the person who is performing the mode switch; typically, this person is the system programmer. The virtual machine to which the device will be attached must have Class F authority.
5. Use the *SETMODE* parameter of the ICKDSF INSTALL command to change the mode. For information about using ICKDSF for this operation, see *Using IBM 3390 Direct Access Storage in a VM Environment*, GC26-4575.
6. Reformat the affected device when all mode switches are made, being sure that you have moved the data off the device before you begin.

You should use ICKDSF for formatting and allocating disks rather than CPFMTXA, which has been used for those purposes in the past. For information on using this option, see the *Device Support Facilities User's Guide and Reference*, GC35-0033.

Any CMS minidisks on the device also must be formatted using CMS FORMAT.

7. Detach the device from the virtual machine of the person who performed the mode switch.
8. If the mode switch is:
  - For a device defined in the system configuration file:
    - **From** 3380 track compatibility mode **to** 3390 mode and the device type is defined as a 3380, you must redefine the device as a 3390 by first varying the device offline and then entering *either* of the following commands:

```
set rdevice rdev type dasd
set rdevice rdev clear
```

Then vary the device back online. You must also change the definition of this device in the system configuration file.
    - **From** 3380 track compatibility mode **to** 3390 mode and the device type is defined as a 3390, vary the device offline and then back online.
    - **From** 3390 mode **to** 3380 track compatibility mode, vary the device offline and then back online.
  - For a dynamically sensed device:
    - **From** 3380 track compatibility mode **to** 3390 mode or **from** 3390 mode **to** 3380 track compatibility mode, you must redefine the device by varying the device offline and entering *either* of the following commands:

```
set rdevice rdev type dasd
set rdevice rdev clear
```

Then vary the device back online.



For information on reformatting the volume for a particular use (CP and CMS minidisks), and moving CP-owned volumes and CMS minidisks, see the *Using IBM 3390 Direct Access Storage in a VM Environment*, GC26-4575.

Remember that the device type you use when restoring data is different from the one you used to back up the data in Step 2 on page 658.

9. After the data is restored, attach the device again to the system or guest and allow applications to continue.

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## Migration Considerations for the 3390 Model 9

The z/VM support of 3390 Model 9 will not affect migration, but there are data migration considerations if you plan to move data from other devices to a 3390 Model 9.

The 3390 Model 9 is formatted as a CKD device and is supported for formatting by ICKDSF and the CPFMTXA utility. The allocation map format on a 3390 Model 9 device will be an extent-based allocation map as opposed to the cylinder-based allocation map currently used for existing CKD DASD. This is because the existing 4K cylinder-based allocation record is not large enough to account for the number of cylinders on a 3390 Model 9 device.

Because the DDR command is capable of doing a straight copy from an existing 3390 device to a 3390 Model 9 device, this may result in a Model 9 device having a cylinder-based allocation map record. The 3390 Model 9 device will still be usable by z/VM, but because of the limitation of the cylinder-based allocation map record, only the first 4K cylinders of the device will be capable of being used.

The reverse situation is also possible where a 3390 Model 1, 2 or 3 device could have an extent-based allocation map. This, however, will not be allowed by CP. If a 3390 contains an extent-based allocation map and an operator attempts to attach this 3390 Model 1, 2 or 3 as a CP volume, a warning message will be issued.

If either type of data movement is performed, the output disk should be reallocated using the ICKDSF CPVOLUME ALLOCATE command if the device is intended to be used as a CP volume. ICKDSF will convert a cylinder-based allocation map record on a 3390 Model 9 device into the extent-based allocation record that is necessary to use the entire device. An extent-based allocation record found on a 3390 model 1, 2 or 3 can also be converted by ICKDSF into a cylinder-based allocation map record.

The following coexistence considerations should also be noted:

- 3390 Model 9 devices can coexist in the same string with other 3390 devices, but cannot coexist in the same string with other 3380 devices.
- 3390 Model 9 B-units (B9C) cannot be intermixed in a string with other models of the 3390.

---

## Adding DASD Space to a Running System

You can dynamically add CP-owned volumes to your running z/VM system. In order to do so, you must have CP\_OWNED statements with slots specified as RESERVED in your system configuration file. You should always have RESERVED slots for this purpose. Up to 255 CP-owned slots can be defined, and you can specify all unused slots as RESERVED with a single statement:

```
CP_OWNED Slot 255 RESERVED
```

## Allocating DASD Space

Adding new volumes in RESERVED slots does not disturb the relative entry number (slot number) that is used to locate existing spool files. This means you can warm start the system after the new volumes have been added.

For information about the CP\_OWNED statement, see “CP\_OWNED Statement” on page 74.

**Attention:** If you delete any volume that contains spool space from the CP-owned volume list, or move any volume that contains spool space to a different slot in the CP-owned volume list, a clean start is required. A clean start causes the deletion of spool files and system data files, including named saved systems and saved segments. Files that need to be preserved over such a change must be dumped to tape using the SPXTAPE DUMP command.

After the clean start, SPXTAPE LOAD must be used to restore the spool files and system data files from tape. This ensures that spool files and system data files that existed on the system before deletion or movement of volumes containing spool space are restored correctly.

Use the following steps to add a DASD volume in a RESERVED slot:

1. Issue the QUERY CPOWNED command to determine which slots are available (defined as RESERVED). Select the slot where the volume will be added.
2. Locate an available DASD volume.
3. ATTACH the volume to your z/VM user ID.
4. Use the CPFMTXA utility to format the entire DASD volume, and assign a label (for example, NEWSPL). Allocate the volume as follows:

```
PERM 0 0
(type of CP space) 1 END
```

Type of CP space - PAGE, SPOL, TDISK, etc.

5. Update your system configuration file (usually located on MAINT's CF1 disk) by adding or updating a CP\_OWNED statement to assign the new volume to the selected RESERVED slot. This ensures that the new volume will be available to the system at the next IPL. For example:

```
CP_OWNED Slot 25 RESERVED
 is changed to:
CP_OWNED Slot 25 NEWSPL
```

6. Run the CPSYNTAX utility against the updated system configuration file to check for errors.
7. DETACH the volume from your z/VM user ID.
8. Issue the DEFINE CPOWNED command to define the new volume NEWSPL to your active system:

```
DEFINE CPOWNED Slot 25 NEWSPL
```

9. Issue the ATTACH command to bring the new volume online:

```
ATTACH rdev SYSTEM
```

CP will begin using the space allocated on the new volume.

For information about the CP commands, see *z/VM: CP Commands and Utilities Reference*.



---

## Chapter 21. How the CP-Owned List Is Processed

When a z/VM system is initialized, the list of CP-owned DASD volumes for that system, as specified on CP\_OWNED statements in the system configuration file, is processed to determine:

- Which directory (DRCT), paging (PAGE), spooling (SPOL), and temporary disk (TDSK) allocations and checkpoint and warm start areas on each volume to bring online
- Whether the volume is owned by that system or shared with another system

After initialization, the DEFINE CPOWNED and ATTACH commands can be used to add a volume to the CP-owned list for the current session, and such a volume is processed in the same manner when attached.

**Note:** If the OWN or SHARED operand is specified on a CP\_OWNED system configuration statement or a DEFINE CPOWNED command, the operand is ignored.

In a z/VM Single System Image (SSI) cluster, each CP-owned volume is marked with ownership information to ensure that CP on one member of the SSI cluster cannot define allocations and areas on a volume owned by another member. The ownership information consists of the name of the SSI cluster and the system name of the member, if any, that owns the volume. Ownership information is recorded on the volume by using the OWNER operand of the CPFMTXA utility. For information about how to specify the ownership information, see the CPFMTXA utility in *z/VM: CP Commands and Utilities Reference*. For additional information about SSI clusters, see Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.

In non-SSI configurations, ownership information may be recorded on CP-owned volumes but is not required. However, when a non-SSI z/VM system is installed, ownership information consisting of the system name and no cluster name is recorded on each CP-owned volume.

Standard DASD copy utilities will include the ownership information in the copy.

The processing of the CP-owned list includes any ownership information recorded on the volumes. The results depend on whether the system is a member of an SSI cluster. If no allocations or areas can be brought online for a CP-owned volume due to its ownership information, CP takes one of the following actions:

- If there is PERM space on the volume, the volume is attached to the system with the PERM space available for MDISK usage. Message HCP6631I is issued.
- If there is no PERM space on the volume, the volume is not attached to system, and remains a free device. Message HCP6629I is issued.

Marking ownership information on user volumes is optional. If you wish to mark your user volumes, use the CPFMTXA utility to format cylinder 0, allocate them as PERM 0-END, and mark their ownership appropriately. If the volume is to be used in an SSI cluster, it should be marked either with the SSI cluster name and no system name (in the case of a volume shared among cluster members) or with the SSI cluster name and the system name of a member (in the case of a volume

holding member-specific (local) minidisks). If the volume is to be used in a non-SSI configuration, it should be marked with no cluster name (NOSSI) and the name of the owning system.

### Processing for a Member of an SSI Cluster

When the CP-owned list is processed for a member of an SSI cluster, the volume allocations and areas are brought online as shown in Table 36.

**Note:** If the system has been IPLed in REPAIR mode, this table does not apply. See “Processing for a System IPLed in REPAIR Mode” on page 663.

*Table 36. CP-Owned Volume Allocations and Areas Brought Online for a Member of an SSI Cluster*

| SSI Cluster Name on Volume   | System Name on Volume                                   | SPOL Extents (Owner or Shared)          | DRCT, PAGE, and TDSK Extents and Checkpoint and Warm Start Areas (Nonshared) |
|------------------------------|---------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------|
| None                         | None                                                    | No                                      | No                                                                           |
| None                         | Name of this member                                     | Yes (owner, single-member cluster only) | Yes                                                                          |
| None                         | Not the name of this member                             | No                                      | No                                                                           |
| Name of this cluster         | None                                                    | No                                      | No                                                                           |
| Name of this cluster         | Name of this member                                     | Yes (owner)                             | Yes                                                                          |
| Name of this cluster         | Name of another member                                  | Yes (shared)                            | No                                                                           |
| Name of this cluster         | Not the name of a member (probable configuration error) | No                                      | No                                                                           |
| Not the name of this cluster | Any value                                               | No                                      | No                                                                           |

The following rules are enforced for the members of an SSI cluster:

- **Spooling (SPOL) extents**  
Spooling space can be owned by only one member and must be shared by the other members. If the cluster name and system name recorded on the volume match the values specified in the system configuration file for the member being initialized, the SPOL extents are brought online as owned (this member owns the spooling space). If another member in this SSI cluster owns the volume, the SPOL extents will be brought online as shared (this member is sharing the spooling space). Otherwise, the SPOL extents will not be brought online.  
A shared spooling volume must have the same slot number in each member of the cluster.
- **Paging (PAGE) and temporary disk (TDSK) extents**  
Multiple members cannot simultaneously use the PAGE or TDSK extents on a volume. Only the owning member can bring the PAGE and TDSK extents online.
- **Checkpoint and warm start areas**

A member's checkpoint and warm start areas cannot be on the same volume as another member's checkpoint and warm start areas. If a member attempts to use a checkpoint or warm start area on a volume that it does not own, the member will enter wait state 6626.

## Processing for a System That Is Not a Member of an SSI Cluster

When the CP-owned list is processed for a system that is not a member of an SSI cluster, the volume allocations and areas are brought online as shown in Table 37.

**Note:** If the system has been IPLed in REPAIR mode, this table does not apply. See “Processing for a System IPLed in REPAIR Mode.”

*Table 37. CP-Owned Volume Allocations and Areas Brought Online for a System That Is Not a Member of an SSI Cluster*

| SSI Cluster Name on Volume | System Name on Volume       | SPOL Extents (Owner) | DRCT, PAGE, and TDSK Extents and Checkpoint and Warm Start Areas (Nonshared) |
|----------------------------|-----------------------------|----------------------|------------------------------------------------------------------------------|
| None                       | None                        | Yes                  | Yes                                                                          |
| None                       | Name of this system         | Yes                  | Yes                                                                          |
| None                       | Not the name of this system | No                   | No                                                                           |
| Any value                  | Any value                   | No                   | No                                                                           |

## Processing for a System IPLed in REPAIR Mode

Using the Stand-Alone Program Loader (SAPL), you can IPL a z/VM system with the REPAIR parameter to bypass certain processing. For more information about the REPAIR parameter, see “Passing IPL Parameters” on page 36.

When the CP-owned list is processed for a system IPLed in REPAIR mode, the volume allocations and areas brought online are determined by the system name recorded on the volume and whether the system configuration file contains an SSI statement. Any SSI cluster name recorded on the volume is ignored.

If the system configuration file contains an SSI statement (valid or invalid), the volume allocations and areas are brought online as shown in Table 38.

*Table 38. CP-Owned Volume Allocations and Areas Brought Online for an SSI Cluster Member IPLed in REPAIR Mode*

| Cluster Name on Volume | System Name on Volume       | SPOL Extents (Owner) | DRCT, PAGE, and TDSK Extents and Checkpoint and Warm Start Areas (Nonshared) |
|------------------------|-----------------------------|----------------------|------------------------------------------------------------------------------|
| Ignored                | None                        | No                   | No                                                                           |
| Ignored                | Name of this system         | Yes                  | Yes                                                                          |
| Ignored                | Not the name of this system | No                   | No                                                                           |

# CP-Owned List

If the system configuration file does not contain an SSI statement, the volume allocations and areas are brought online as shown in Table 39.

Table 39. CP-Owned Volume Allocations and Areas Brought Online for a Non-SSI System IPLed in REPAIR Mode

| SSI Cluster Name on Volume | System ID on Volume         | SPOL Extents (Owner) | DRCT, PAGE, and TDSK Extents and Checkpoint and Warm Start Areas (Nonshared) |
|----------------------------|-----------------------------|----------------------|------------------------------------------------------------------------------|
| Ignored                    | None                        | Yes                  | Yes                                                                          |
| Ignored                    | Name of this system         | Yes                  | Yes                                                                          |
| Ignored                    | Not the name of this system | No                   | No                                                                           |

---

## Chapter 22. DASD Sharing

Under z/VM, you can share information on a DASD volume among:

- Multiple virtual machines.
- One virtual machine and operating systems running on other processors.
- Multiple virtual machines and operating systems running on other processors.
- Multiple systems in a z/VM single system image (SSI) cluster. For more information on this, see Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.
- Multiple non-SSI systems using cross-system link (XLINK). For more information on this, see Appendix D, “Using Cross-System Link (XLINK),” on page 859.

Note that the guest operating system or application must provide the protection by using reserve/release. CP only grants access to the DASD and handles virtual reserve/release for MDISK and LINK definitions.

This chapter tells you how to share DASD under various circumstances:

- Among multiple virtual machines by using reserve/release
- Without using virtual reserve/release
- Using the CMS Shared File System
- Between a virtual machine and other systems
- Among multiple virtual machines and other systems

This chapter also includes information on the following topics:

- Restrictions for using reserve/release
- Using the Multi-Path Lock Facility (MPLF)
- Using cached DASD as high-speed storage devices
- Using IBM Parallel Access Volumes
- Using IBM HyperParallel Access Volumes
- Using Persistent FlashCopy®
- Space-Efficient Volumes

---

### Sharing DASD among Multiple Virtual Machines by Using Virtual Reserve/Release

If you need to share data among virtual machines running under VM but do not need to share it with operating systems running on other processors, the following method of sharing DASD gives you the best results for non-CMS guests. This method is called virtual reserve/release.

Sharing data between virtual machines involves the use of minidisks. A minidisk is a virtual DASD for a specific virtual machine. This virtual DASD is mapped to an extent of cylinders on a real DASD. CP can manage DASD sharing in full-pack minidisks and on smaller minidisks.

**Note:** Virtual reserve/release is also supported for virtual disks in storage, which are minidisks allocated from host storage rather than mapped to real DASD.

To share a minidisk among virtual machines, you must do the following:

1. Code the MDISK directory statement in the virtual machine definition. For example, the following MDISK directory statement for a virtual machine (VM1):

```
MDISK 197 3390 001 100 WORKPK MW VM1PASS
```

- Defines a minidisk at VM1's 197 virtual device number
- Specifies that this minidisk is to be on the 3390 DASD with the volume ID WORKPK
- Specifies that this minidisk starts at cylinder 001 and encompasses 100 cylinders. Ensure that no other MDISK directory statement is defined to use any of these same cylinders. DASD RESERVE/RELEASE is not intended to control sharing of overlapping minidisks.
- Includes an access mode of MW (multi-write) with a V (indicating that this minidisk can be shared between virtual machines) and a password of VM1PASS.

2. Code the LINK directory statement in another virtual machine's directory. The LINK directory statement and the CP LINK command each allow virtual machines to access another user's minidisk. Suppose a second virtual machine (VM2) has this LINK directory statement in its directory:

```
LINK VM1 197 197 MW
```

This statement links VM2 to VM1's minidisk. MW indicates that VM2 requests multi-write access to the minidisk. (The MW access mode on the MDISK directory statement permits VM2 to obtain write access to this minidisk at the same time that VM1 has write access to it.)

If VM2 does not have this LINK statement in its directory, it can link to VM1's minidisk with the CP LINK command. For example, entering:

```
link vml 197 197 mw vmlpass
```

will perform this link. Or you can use the CMS VMLINK command to link and access the disk. VMLINK finds a free virtual device number and access mode letter:

```
vmlink vml 197 <= = mw> (noname pw vmlpass
```

With the LINK and VMLINK commands, VM2 needed to specify the appropriate password (VM1PASS in this example) to be granted access. Using minidisk passwords helps you to protect shared data, because only those users who know the correct password can link to the minidisk with the CP LINK command and the CMS VMLINK command.

**Note:** All DASD that do not respond to a sense ID request must be defined in the system configuration file using RDEVICE statements. All DASD that hold minidisks must be attached to SYSTEM, either at system initialization by appearing in the system configuration file using CP\_OWNED or USER\_VOLUME\_LIST statements, or later by issuing the command `ATTACH rdev TO SYSTEM`.

For more information about these system configuration file statements, see "RDEVICE Statement" on page 216, "CP\_OWNED Statement" on page 74, and "USER\_VOLUME\_LIST Statement" on page 299.

3. Specify that the DASD will not be shared with another operating system. The default setting of the SHARED operand of the RDEVICE system configuration file statement (SHARED NO) takes care of this for you. A NO setting means this volume cannot be shared with an operating system running on another processor. You can also use the CP SET SHARED command to accomplish this. For example, if you enter:

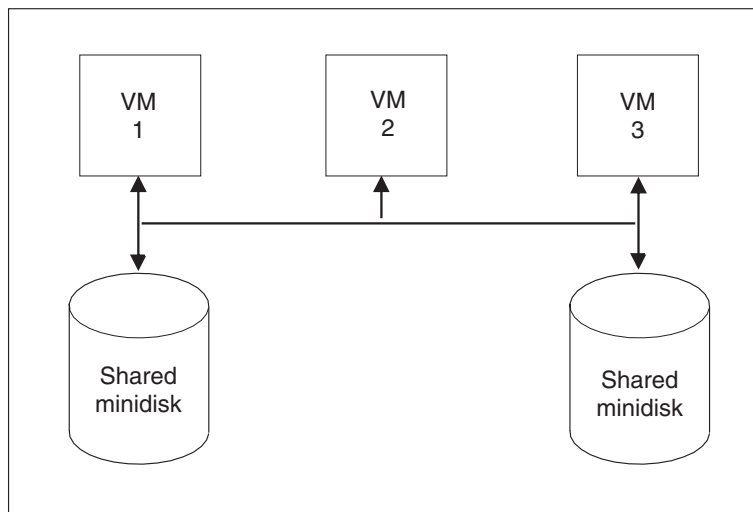
set shared off for 197

the device at real device number 197 cannot be shared with other operating systems. However, you should enter SET SHARED OFF only after careful consideration. See the *z/VM: CP Commands and Utilities Reference* for more information about the SET SHARED OFF command.

**Note:** This method is for sharing a minidisk between virtual systems on the same real system—not for sharing with another real system. Therefore, set the SHARED operand to NO (the default). Setting the SHARED operand to YES applies only to sharing full-pack minidisks between multiple real systems. Sharing is managed by CP simulation of the guest reserve/release request through the MDISK block. Note that to invoke this support, the access mode must include V (for example, MWV for shared multiwrite mode). For information on sharing a dedicated device with another system running native on another processor, see “Sharing DASD between One Virtual Machine and Other Systems Using Real Reserve/Release” on page 669. For information on sharing a full-pack minidisk among multiple virtual systems and other systems running native, see “Sharing DASD among Multiple Virtual Machines and Other Systems Using Concurrent Virtual and Real Reserve/Release” on page 671.

Figure 23 shows three virtual machines sharing a minidisk defined on a DASD through virtual reserve/release.

#### Real Machine



Three virtual machines sharing two different minidisks through virtual reserve/release support and one channel path

Figure 23. Virtual Reserve/Release

### When to Use Virtual Reserve/Release

In general, you should use virtual reserve/release when you need to share DASD among virtual machines running under VM but do not need to share the DASD



with other systems and the guest operating system is not CMS. If the operating system is CMS, use the Shared File System. Note that the operating system running in a virtual machine must support reserve/release CCWs for you to use virtual reserve/release.

**Note:** The \*BLOCKIO IUCV system service and DIAGNOSE code X'250' do not honor DASD reserves managed by VM's virtual reserve/release function. Therefore, do not use these I/O interfaces if a minidisk is shared by multiple guests on the same VM image where another guest is expecting to use reserve/release I/O to serialize its data access. Also, \*BLOCKIO and DIAGNOSE code X'250' do not use reserve/release. Therefore, do not use these interfaces for any DASD (CP-attached or full-pack minidisk) that is shared with other LPARs where another LPAR expects to use reserve/release to serialize its data.

---

### Sharing DASD without Using Virtual Reserve/Release

If the guest operating systems do not support reserve/release CCWs, you can still share DASD between virtual machines. However, no write protection is provided using this method. To do this, define a minidisk for one virtual machine and have other virtual machines link to that minidisk. The process is similar to that described for virtual reserve/release with the following exceptions:

1. You do not have to specify a V as part of the access mode on the MDISK directory statement.
2. You do not have to be concerned with the SHARED setting.

The major difference between this method of sharing DASD and virtual reserve/release is best illustrated by the case where you have included an access mode of MW (multiple write) on the MDISK definition. With virtual reserve/release, although many virtual machines can obtain write access to the minidisk, only one virtual machine can write to it at any one time if it uses virtual reserve/release. If you do not use virtual reserve/release, two virtual machines can both obtain write access to the minidisk at the same time. To ensure data integrity, you should use virtual reserve/release when you need to give multiple virtual machines write access to a minidisk.

**Note:** Sharing DASD without using virtual reserve/release is not recommended. You could read incomplete data or have an abend.

The SET WRKALLEG command supports the MVS Sysplex Environment. SET WRKALLEG allows MVS guests running in a single virtual machine to share minidisks without using reserve and release CCWs. For more information, see the SET command in the *z/VM: CP Commands and Utilities Reference*.

---

### Sharing DASD Using the CMS Shared File System

The CMS Shared File System allows users to organize their files into groups called directories and selectively share those files and directories with other users. To do this, a collection of minidisks is assigned to a single virtual machine called a file pool server machine. The collection of minidisks is called a file pool. A file pool contains the files for many users, not just one. The file pool server virtual machine manages all the files in the file pool.

For additional information on the Shared File System, see the *z/VM: CMS File Pool Planning, Administration, and Operation* book and the *z/VM: CMS User's Guide*.



---

## Sharing DASD between One Virtual Machine and Other Systems Using Real Reserve/Release

This method of sharing DASD with other systems, called real reserve/release, involves the use of dedicated devices. A dedicated device is exclusively owned by a single virtual machine. For example, suppose you want VM1 to have sole ownership of the 3390 DASD with volume ID SYSPK. Assume that this 3390 was defined at real device number 872 in the RDEVICE system configuration file statement. The DEDICATE directory statement gives a virtual machine exclusive use of a device. For example, the statement:

```
DEDICATE 872 872
```

in VM1's directory gives VM1 ownership of the device at real device number 872, and defines the DASD at VM1's 872 virtual device number. (It is generally a good idea to keep real and virtual device numbers the same.)

You can also use the ATTACH command to dedicate a device to a virtual machine. The command:

```
attach 872 to vm1 as 872
```

is equivalent to the previous DEDICATE directory statement.

Then define DASD that are accessible from more than one processor as shared in the system configuration file. (Define the DASD as shareable to CP by coding SHARED YES in the system configuration file.) Hardware and software are then prepared for the sharing environment and reserve/release commands are handled by the control unit.

VM1 can now share this dedicated DASD with another system, as shown in Figure 24 on page 670.

## DASD Sharing

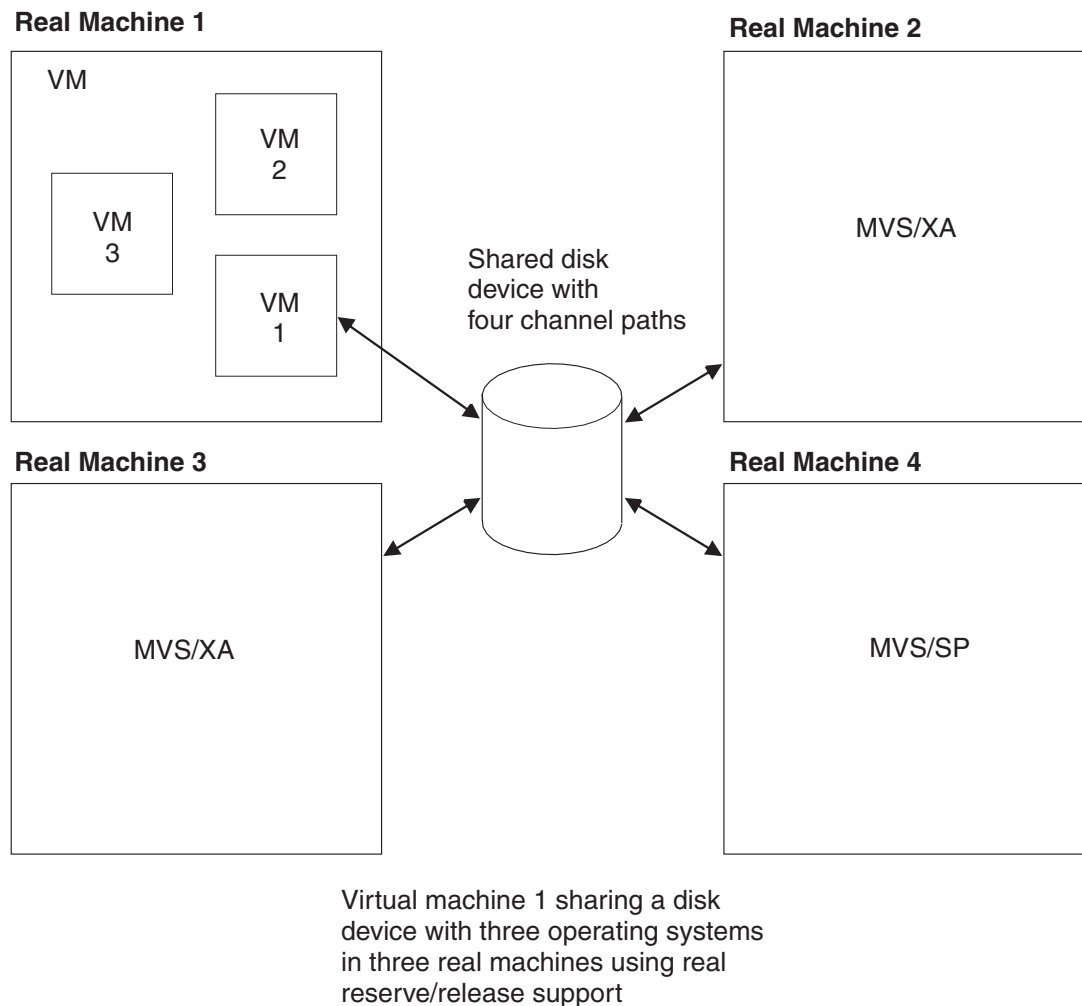


Figure 24. Real Reserve/Release

### When to Use Real Reserve/Release

In general, you should use real reserve/release when you need to share a DASD among one virtual machine and other systems. Note, a dedicated DASD cannot be shared among virtual machines but can be shared among one virtual machine and other systems.

**Note:** The \*BLOCKIO IUCV system service and DIAGNOSE code X'250' do not honor DASD reserves managed by VM's virtual reserve/release function. Therefore, do not use these I/O interfaces if a minidisk is shared by multiple guests on the same VM image where another guest is expecting to use reserve/release I/O to serialize its data access. Also, \*BLOCKIO and DIAGNOSE code X'250' do not use reserve/release. Therefore, do not use these interfaces for any DASD (CP-attached or full-pack minidisk) that is shared with other LPARs where another LPAR expects to use reserve/release to serialize its data.

## Sharing DASD among Multiple Virtual Machines and Other Systems Using Concurrent Virtual and Real Reserve/Release

The third method of sharing DASD, concurrent virtual and real reserve/release, combines virtual reserve/release and real reserve/release. It allows DASD to be shared among multiple virtual machines and operating systems running on other processors. Figure 25 shows VM sharing a DASD between two virtual machines and a native system.

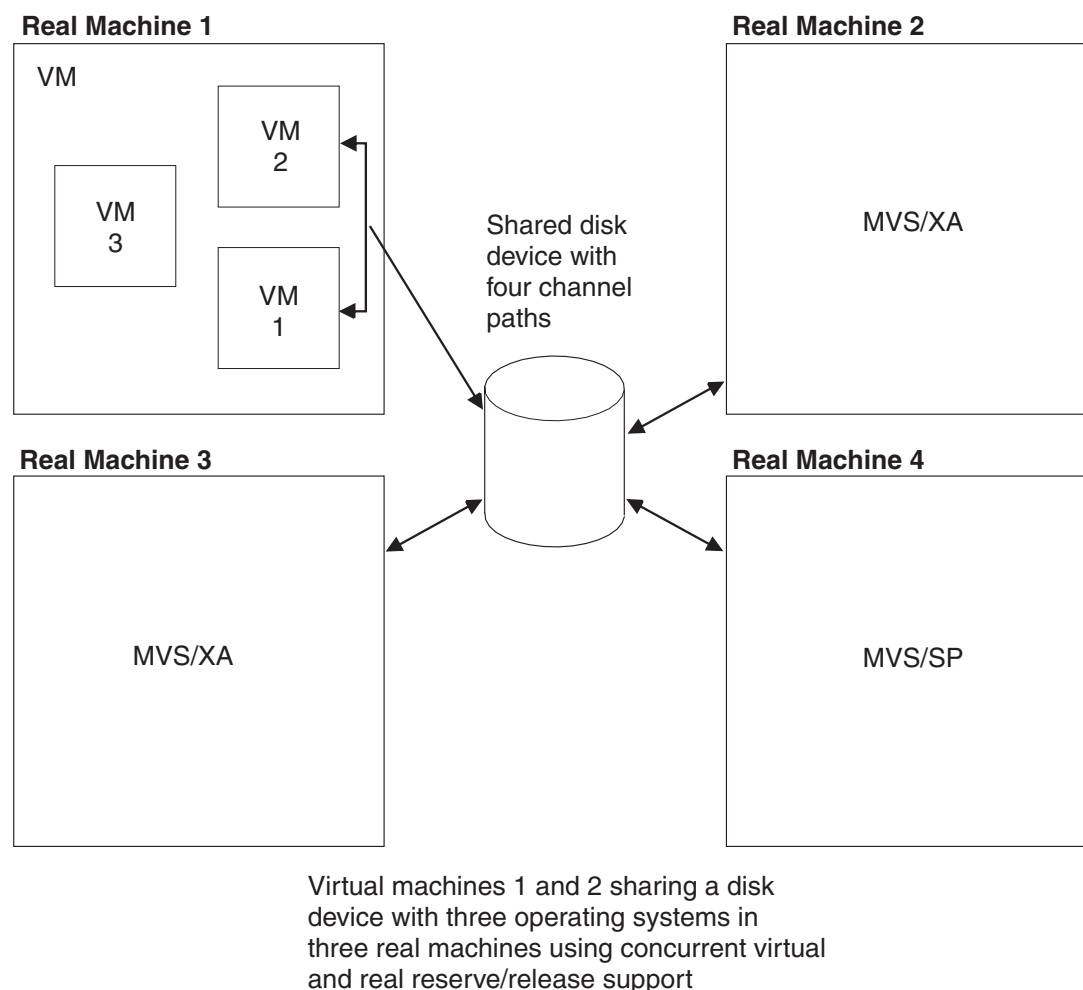


Figure 25. Concurrent Virtual and Real Reserve/Release

Concurrent virtual and real reserve/release involves the use of full-pack minidisks. A full-pack minidisk is a single minidisk allocated on an entire DASD volume. A full-pack minidisk encompasses all the primary (or addressable) tracks of the volume. In the example under “Sharing DASD among Multiple Virtual Machines by Using Virtual Reserve/Release” on page 665, VM1 defined a minidisk on a portion of the volume called WORKPK. You need to do the following to use concurrent virtual and real reserve/release:

1. Define the DASD as a shareable full-pack minidisk. The following MDISK directory statement defines a full-pack minidisk:

```
MDISK 199 3390 000 END SYSPK MWV FULLP1
```

This statement allocates all addressable cylinders of the 3390 called SYSPK as minidisk space, thus making SYSPK a full-pack minidisk. (This method is the

preferred way of defining a full-pack minidisk because the number of cylinders does not need to be known when writing the MDISK statement.) The V at the end of the statement indicates that this DASD can be shared between virtual machines. To access the DASD, another virtual machine must use the LINK directory statement or the LINK command. The procedure is the same as described for virtual reserve/release under “Sharing DASD among Multiple Virtual Machines by Using Virtual Reserve/Release” on page 665.

2. Define the DASD as shareable to CP by coding SHARED YES in the system configuration file. As an alternative, you can use the CP SET SHARED ON command. For example, if you enter:

```
set shared on for 199
```

CP recognizes the full-pack minidisk at real device number 199 as a shared DASD.

### When to Use Concurrent Virtual and Real Reserve/Release

In general, you should use concurrent virtual and real reserve/release when you need to share DASD among many virtual machines and other systems. Do not use this method when you need to share DASD only among virtual machines, because the CP overhead is much greater than if you use virtual reserve/release.

**Note:** The \*BLOCKIO IUCV system service and DIAGNOSE code X'250' do not honor DASD reserves managed by VM's virtual reserve/release function. Therefore, do not use these I/O interfaces if a minidisk is shared by multiple guests on the same VM image where another guest is expecting to use reserve/release I/O to serialize its data access. Also, \*BLOCKIO and DIAGNOSE code X'250' do not use reserve/release. Therefore, do not use these interfaces for any DASD (CP-attached or full-pack minidisk) that is shared with other LPARs where another LPAR expects to use reserve/release to serialize its data.

---

### Restrictions for Using Reserve/Release

To use real reserve/release or concurrent virtual and real reserve/release, all of the following must support reserve/release CCWs:

- The operating system running under VM
- The system with which the guest will be sharing DASD
- The shared DASD

Virtual reserve/release must be enabled for any guest virtual machine reserve to be accepted, even if only one guest is using the device. Virtual reserve/release allows reserve/release CCWs to be issued by the guest. Real reserve/release allows CCWs to reach the device. CP simulates reserve/release if virtual reserve/release is enabled and real reserve/release is not. CP issues the reserve/release CCWs if both are enabled.

Note, concurrent virtual and real reserve/release support should be used only when DASD must be shared among many virtual machines and operating systems on other real machines. When DASD must be shared only among virtual machines, virtual reserve/release support should be used because it requires much less CP overhead.

For information on how link conflicts are handled when virtual reserve/release is authorized, see the LINK command in *z/VM: CP Commands and Utilities Reference*.

With one exception, the unconditional reserve CCW should not be used by any system sharing a DASD due to potential data integrity problems. The one exception is when it is known that the system holding the reserve is down and will be re-ipld.

---

## Reserve/Release Summary

Table 40 summarizes the differences between different settings of SET SHARED and the V attribute of the MDISK directory statement.

*Table 40. Reserve/Release Summary*

| SET SHARED | V Attribute on MDISK | Description                                                                                                                         |
|------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| ON         | No V attribute       | The minidisk cannot be shared between a virtual machine guest and a native system. There is no virtual reserve/release.             |
| ON         | V attribute          | Both real and virtual reserve/release are available. The minidisk can be shared between virtual machine guests and a native system. |
| OFF        | V attribute          | Only virtual reserve/release is available; no real reserves are issued. The minidisk cannot be shared with a native system.         |
| OFF        | No V attribute       | No reserve/release support is available at all.                                                                                     |

In an SSI cluster, virtual reserve/release can be used on only one system at a time for a given minidisk.

---

## Sharing DASD using the Multi-Path Lock Facility

DASD data can be shared between native systems, between VM guests, or between native systems and VM guests through the use of the Multi-Path Lock Facility (MPLF) on IBM DASD subsystems. The MPLF provides locking serialization for data on the DASD, as the operating systems or programs use the MPLF channel commands to control the locks. The Transaction Processing Facility (TPF) is an example of an operating system that can exploit the MPLF.

VM allows guests to use the MPLF for data that resides on dedicated devices or on full-pack minidisks.

For dedicated devices, the real MPLF support is authorized by the LKFAC option of the directory statement. Authorizing a guest for LKFAC automatically enables all of that guest's dedicated devices to use the real MPLF. The guest must then issue the appropriate MPLF channel programs to exploit the function.

For full-pack minidisks, the real MPLF support is also authorized by the LKFAC option of the directory statement. In addition, the SET LKFACR ON command must be issued to enable each full-pack minidisk to use the real MPLF. Again, once the device is enabled, the guest must then issue the appropriate MPLF channel programs to exploit the function.

Unlike dedicated devices where guest authorization enables all dedicated guest devices, full-pack minidisks are enabled on a device-by-device basis. This allows

## DASD Sharing

one guest to use the real MPLF for some full-pack minidisks while at the same time using VM's simulated MPLF for other full-pack minidisks in the virtual configuration.

VM's simulation of the MPLF can be used to share data between VM guests when the real hardware is unavailable. Simulation is available for both full-pack and non-full-pack minidisks. Simulation is based on the original IBM D/T3990 model 3 MPLF RPQ, while real MPLF support is based on the function in the original IBM D/T3990 model 6 controller.

Like the real MPLF, simulated MPLF requires the user to be authorized by the LKFAC option of the OPTION directory statement. In addition, the user must issue the SET LKFAC command to create the simulated MPLF environment. Then the guest must issue the appropriate MPLF channel programs to utilize the function.

The SET LKFAC command assumes that all full-pack minidisks and all non-full-pack minidisks in the configuration are part of the simulated MPLF. However, no action is taken until the first MPLF-related I/O request is issued to a device. At that time, the device and the 31 associated device addresses are considered to be 'active' in the simulated configuration. For example, I/O to device 191 would cause devices 180 through 19F to be part of one simulated partition (simulating the 32 device addresses on a real DASD subsystem).

Even with the global nature of simulated MPLF, real MPLF can coexist. For example, if device 180 had been enabled for real MPLF (SET LKFACR ON) before the simulated MPLF was enabled or 'active', then the real MPLF would override the simulation for device 180.

**Note:** Real MPLF and Simulated MPLF are mutually exclusive. It is recommended that the choice be made for each device range before the guest is IPL'd. If, after the guest is IPL'd, you decide to change a device from simulated to real or real to simulated, then the change will cause a SYSTEM RESET and the guest will have to be re-ipl'd. It is also recommended that all the devices within one 32-address range use the same type of MPLF—either all using real MPLF, or all using simulated MPLF.

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## Cached DASD

Virtual machines can use cached DASD as high-speed storage devices. The term cached DASD refers to a DASD with a control unit that contains a cache. A cache is a high-performance, random-access, electronic storage device. Frequently used pages are kept in the cache where the processor can quickly access them without going to the DASD itself. See the *z/VM: General Information* book for a list of supported cached DASD control units and a description of which DASD can be connected to them.

A cached DASD control unit provides the high-speed cache as a connection between the processor channels and certain DASD. Figure 26 on page 675 shows a storage control unit logically attached to a string of 3390 DASD.

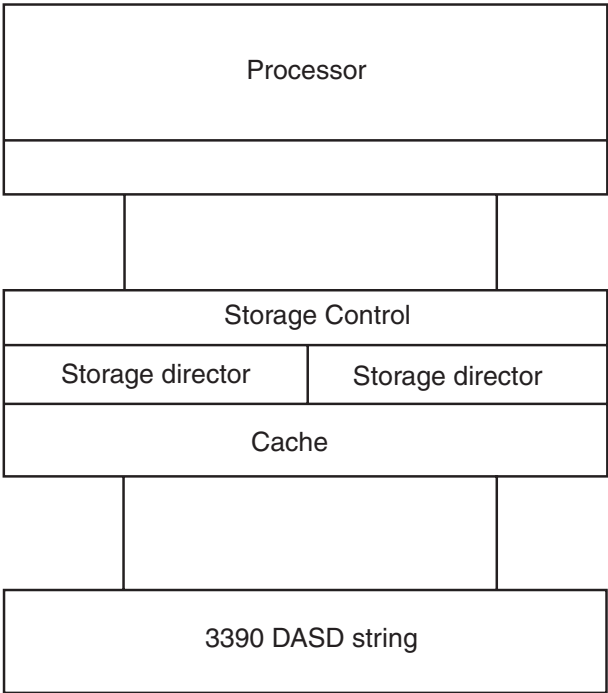


Figure 26. 3390 Cached DASD

I/O to and from the cache is performed electronically. This is faster than normal DASD access, which involves seeking and rotational delays.

**Note:** CP limits the channel command support to the basic device support. Therefore, CP does not support the speed-matching buffer.

### Cache Control

There are three levels of cache control for storage controllers with 3390 DASD: the subsystem level, the device level, and the extent level. To enable caching at a given level means to enable a DASD to accept CCWs that activate or deactivate caching at that level: the Define Extent CCW for extent-level caching and the Set Subsystem Mode CCW for device- and subsystem-level caching.

Cache control is hierarchical. If subsystem caching is not enabled, then device- and extent-level caching can be enabled for DASD using that storage control, but no caching can be performed. If device-level caching is not enabled, then extent-level caching can be enabled for that DASD, but it cannot be performed.

#### Cache Control at the Subsystem Level

Caching at the subsystem level is controlled with the DASDOPT directory statement, the ATTACH command, and the SET CACHE command.

The DASDOPT statement with the SYSCTL operand, the ATTACH command with the SYSCTL operand, and the SET CACHE command with the SUBSYSTEM operand enable devices using the storage control to accept CCWs that activate and deactivate caching at the subsystem level.

The SET CACHE SUBSYSTEM command can also turn caching off for devices using the storage control.

### Cache Control at the Device Level

Device-level caching is controlled with the DASDOPT directory statement, the ATTACH command, and the SET CACHE command.

The DASDOPT statement with the DEVCTL operand, the ATTACH command with the DEVCTL operand, and the SET CACHE command with the DEVICE option enable a device to accept CCWs that activate and deactivate caching for a device.

When two users have full-pack minidisks on the same volume, both enabled for caching, their choices to activate or deactivate caching can conflict. The conflict can be moderated by using reserve/release (see “Sharing DASD among Multiple Virtual Machines and Other Systems Using Concurrent Virtual and Real Reserve/Release” on page 671).

The SET CACHE DEVICE command can also turn off caching that was enabled by the DASDOPT DEVCTL directory statement or the ATTACH DEVCTL command.

### Cache Control at the Extent Level

Caching at the extent level is controlled through the MINIOPT directory statement. The MINIOPT CACHE statement enables a device to accept CCWs that activate and deactivate extent-level caching for a device. MINIOPT CACHE is the default.

Extent-level caching is not available for full-pack minidisks. MINIOPT NOCACHE turns off extent-level caching. Setting NOTRAN on can invalidate MINIOPT CACHE.

## Defining a Minidisk on a Cached DASD

You can define a minidisk on a 3390 DASD attached to an IBM DASD subsystem.

The previous sections of this chapter told you how to define a minidisk on DASD other than cached DASD. To define a minidisk on a 3390 DASD attached to a storage control unit (with a cache), you must first define your 3390s by coding an RDEVICE system configuration file statement. For example, you would code the RDEVICE system configuration file statement as:

```
RDEVICE 197-19A TYPE DASD SHARED YES
```

This statement defines real devices 197, 198, 199, and 19A.

Next, you must decide whether you want to define a full-pack minidisk. Minidisks other than full-packs are discussed first.

**Non-Full-pack Minidisk:** To define a 3390 as a minidisk for a virtual machine, code an MDISK directory statement (and, optionally, a MINIOPT directory statement) with this format:

```
MDISK 198 3390 0001 0500 XARES MWV ALL
MINIOPT CACHE
```

Notice that not all of the cylinders on this DASD have been allocated; therefore, this is not a full-pack minidisk. The MINIOPT directory statement indicates this 3390 DASD has access to the cache of a storage control unit.

After you define a minidisk on a cached DASD, other virtual machines can link to that minidisk in the same way that they would link to a minidisk on a normal DASD. This procedure is explained in “Sharing DASD among Multiple Virtual Machines by Using Virtual Reserve/Release” on page 665.



**Full-Pack Minidisk:** To define a 3390 Model 3 as a full-pack minidisk, you need in your virtual machine definition an MDISK directory statement and, optionally, a DASDOPT directory statement. For example:

```
MDISK 197 3390 0 END XARES MWV ALL
DASDOPT DEVCTL
```

or

```
MDISK 197 3390 0000 3339 XARES MWV ALL
DASDOPT DEVCTL
```

Because all addressable cylinders of this 3390 (Model 3) have been allocated, this is a full-pack minidisk. The DASDOPT directory statement and its operands (DEVCTL, SYSCTL, and NOCTL) determine which types of CCWs the device can accept. If you do not include a DASDOPT directory statement after the MDISK directory statement, the default is DEVCTL. For more information on the DASDOPT directory statement, see “DASDOPT Directory Statement” on page 486.

## Defining a Cached DASD as a Dedicated Device

You can give your virtual machine exclusive use of a cached DASD with the DEDICATE directory statement. In your virtual machine's directory, code a DEDICATE directory statement and optionally a DASDOPT directory statement. To dedicate a cached DASD at real device number 199 to virtual device number 199, include these statements in your directory:

```
DEDICATE 199 199
DASDOPT SYSCTL
```

If you do not include the DASDOPT directory statement, the default is DEVCTL.

---

## Using IBM Parallel Access Volumes

z/VM provides support for the IBM Parallel Access Volumes (PAV) feature of IBM DASD subsystems. IBM DASD PAV volumes must be defined to z/VM as a 3390 Model 2, 3, or 9 DASD on a 3990 Model 3 or 6, 2105, 2107, or 1750 Storage Controller. 3380 track-compatibility mode for the 3390 Model 2 or 3 DASD is also supported.

Before the introduction of PAV, the terms “volume” and “subchannel” were frequently used interchangeably when discussing DASD architectures. With the introduction of PAV, a “volume” is more narrowly defined as a named collection of DASD cylinders that contain data, and “subchannels” are envisioned as controlling virtual disk access mechanisms for the DASD volume. Each subchannel has a unique subchannel number and device number. With PAV, a real DASD volume is accessed through a base subchannel and one or more alias subchannels. Although sometimes misleading, the base subchannel's device number identifier is used in many contexts to refer to the “volume” as well. This is a holdover from the widely accepted practice of referring to volumes with a six-character volume serial number and a “subchannel device number” interchangeably when a one-to-one correspondence existed. Today, a PAV volume has one volume serial number and multiple subchannels.

The PAV hardware feature allows you to configure one or more logical DASD volumes, each with a base and one or more alias subchannels. Figure 27 on page 678 illustrates the relationship between base and alias subchannels for a volume. The base subchannel represents the real (physical) DASD volume space. Alias subchannels (X and Y in this example) map to the same physical volume space as

accessed by the base. The alias subchannels do not have their own data space; they are “shadows” of the base. This architecture allows concurrent accesses to a volume through its base and associated alias subchannels.

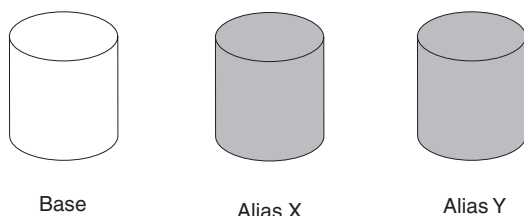


Figure 27. Base and Alias Parallel Access Volumes

Base subchannels are defined in IOCP as UNIT=3990, 2105, 2107, or 1750 on the CNTLUNIT statement and UNIT=3390B (or 3380B) on the IODEVICE statement. Alias subchannels are defined as UNIT=3990, 2105, 2107, or 1750 on the CNTLUNIT statement and UNIT=3390A (or 3380A) on the IODEVICE statement. Each base or alias subchannel can be assigned any available VM real device number. Use the IBM DASD subsystem configuration console to initially define which subchannels are base subchannels, which subchannels are alias subchannels, and which alias subchannels are associated with each base volume. Use the CP QUERY PAV command to view the current allocation of base and alias subchannels.

Base and alias subchannels provide nearly identical functions for the volume. One exception is that “volume-wide” commands such as the Reserve and Release channel commands can only be issued to a base subchannel, but the resulting status applies to all of the alias subchannels as well.

Certain virtual PAV operations require the consistent use of the same real base or alias subchannel. To facilitate this, each virtual PAV base and alias has an “assigned” real device subchannel that can be displayed with the “QUERY VIRTUAL *vdev* DETAILS” and “QUERY VIRTUAL PAV” commands. The assignment is automatic and cannot be changed. One example of this would be the execution of the Read Configuration Data command. The scheduling of I/O to an assigned device is automatically handled by z/VM during its analysis of the virtual channel program. Because each virtual PAV base or alias must have a uniquely assigned real PAV base or alias subchannel, you cannot have more virtual aliases than real aliases for a volume.

The Define Extent channel command specifies if a channel program can read and/or write data from or to a volume. For each volume, read operations are permitted concurrently over multiple base or alias subchannels. However, write operations are serialized on the volume when the cylinder ranges specified in the Define Extent channel command overlap with another active CCW chain in any other subchannel for the volume.

A dedicated PAV volume cannot have its alias subchannels spread among multiple guests. The use of shared minidisks provides that functionality.

### Using PAV Dedicated DASD

To use PAV dedicated devices, the guest must contain support for managing and serializing the volume's data across the subchannels – an “exploiting” operating

system. z/VM acts only as the “pipe” between the guest and the hardware. Once the necessary base and associated alias subchannels are attached to the guest, the guest must manage their use.

In a dedicated environment, the performance benefits of PAV are entirely up to the operating system running in the virtual machine. z/VM will not make any attempt to optimize or alter the I/O flowing through the base and alias subchannels. Note that real volumes cannot be dedicated to multiple guests. Here is a typical example of a guest virtual machine using two dedicated PAV volumes with one base and two alias subchannels for each:

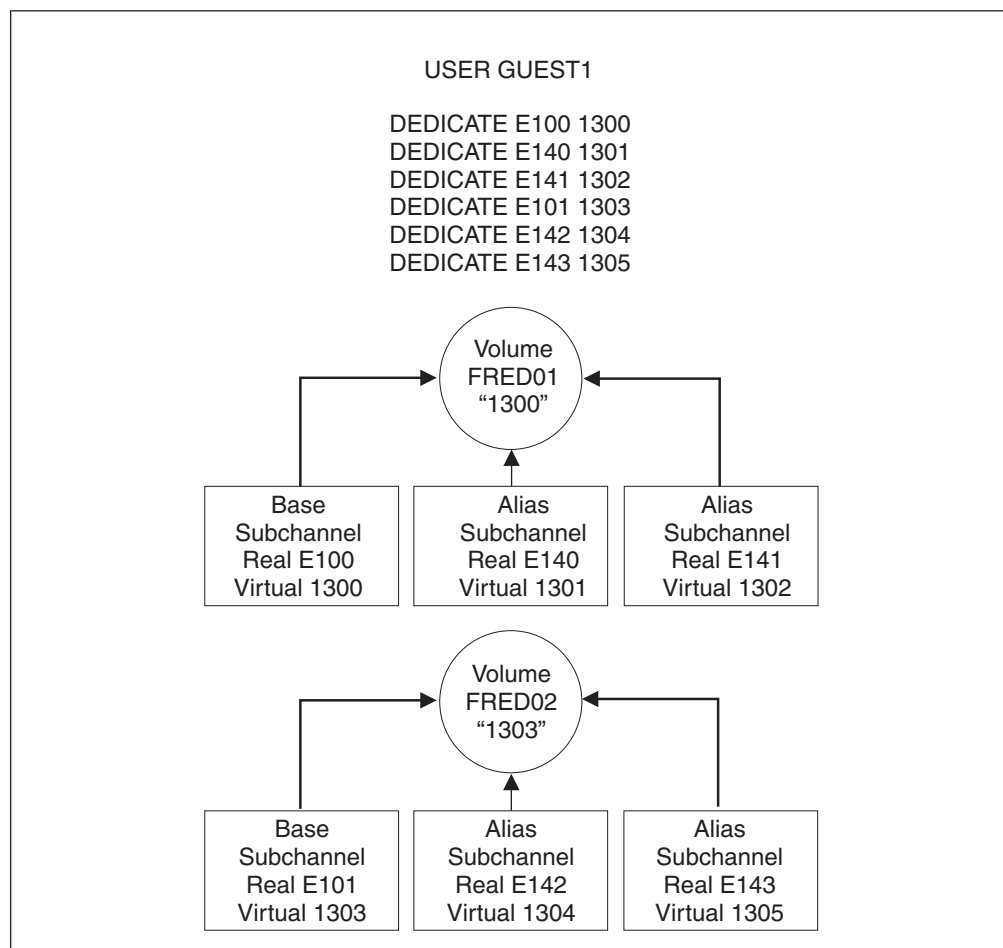


Figure 28. Example: PAV Dedicated Configuration

## Using PAV Minidisks

In the context of PAV, the support for both full-pack and non-full-pack minidisks behaves in the same manner.

A guest virtual machine can define one or more minidisk volumes that exist on a real PAV volume. The real PAV volume has a real base and one or more real PAV alias subchannels. Each minidisk volume has one virtual PAV base and zero or more virtual PAV alias subchannels. These can be displayed with the new QUERY VIRTUAL PAV command. For each minidisk volume, the number of virtual PAV aliases for a guest cannot exceed the number of real PAV aliases defined in the hardware for the underlying real volume.

All I/O operations that are directed to a minidisk volume through either its virtual base or alias subchannels are optimized by z/VM's automatic selection of an appropriate real PAV base or alias subchannel for the underlying real volume. In other words, the scheduling of I/O to a virtual PAV base or alias subchannel will be dynamically scheduled and multiplexed on any real PAV base or alias subchannel that is defined in the hardware. This gives z/VM the flexibility to choose a real PAV base or alias subchannel that is not in use at the time. For example, if users GUEST1 and GUEST2 simultaneously issue an I/O request to two different minidisk volumes that are defined on the same real underlying volume, via their respective virtual base subchannels, the result would be that one I/O would be executed on the real base subchannel and the other, simultaneously, would be executed on a real alias subchannel.

The Minidisk Cache and the SET MDCACHE command are supported for PAV minidisk volumes.

### Using PAV Minidisks with Exploiting Operating Systems

An *exploiting* operating system is one that is capable of controlling the PAV architecture and is configured to control the features of PAV. Such an operating system understands how to control and utilize virtual PAV aliases. Examples might be z/VM, z/OS, or Linux.

To define a full-pack minidisk for an exploiting operating system at virtual E100 with virtual aliases at E101, E102, and E103, you can code the following statements in the user directory:

```
MDISK E100 3390 0 END PAK001
DASDOPT PAVALIAS E101-E103
 or
LINK GUEST1 E100 E100 MW
DASDOPT PAVALIAS E101-E103
```

To define a non-full-pack minidisk for an exploiting operating system at virtual E100 with virtual aliases at E101, E102, and E103, you can code the following statements in the user directory:

```
MDISK E100 3390 100 200 PAK002
MINIOPT PAVALIAS E101-E103
 or
LINK GUEST1 E100 E100 MW
MINIOPT PAVALIAS E101-E103
```

The following is a typical example of several guest virtual machines that exploit PAV volumes. One volume is a full-pack minidisk that is shared among the five guests (E100, PAK001), and there are four non-full-pack minidisk volumes (E200s and E300) that share the same underlying real PAV volume (PAK002). Note that there are more PAV minidisk volumes (5 MDISKS) than real volumes (2). z/VM will multiplex I/O operations on the real base and alias subchannels for each:

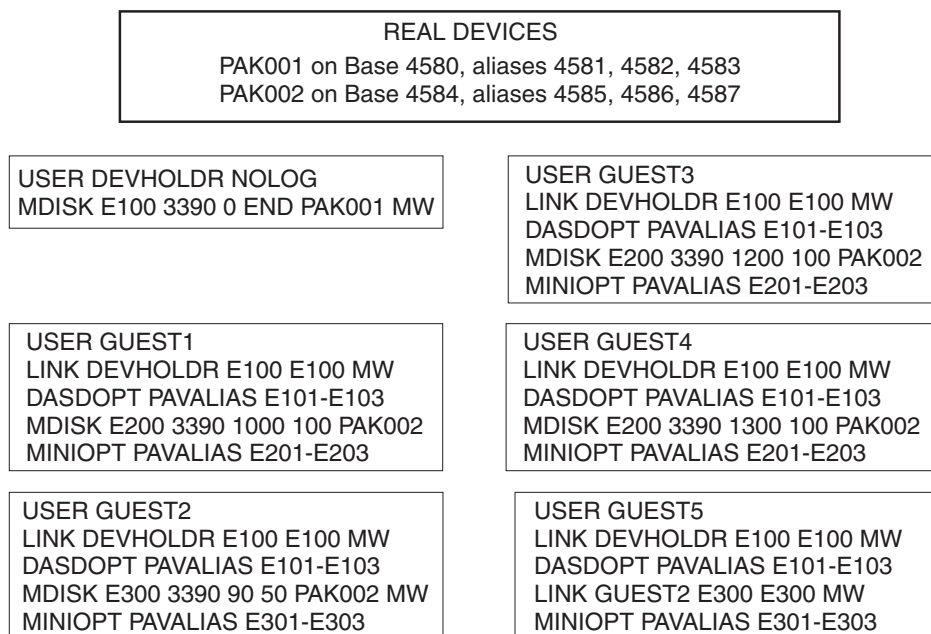


Figure 29. Example: PAV Minidisk Configuration for Exploiting Guests

## Using PAV Minidisks with Non-Exploiting Operating Systems

A *non-exploiting* operating system is one that is not configured to control the features of PAV or has no knowledge of the PAV architecture. Although the guest operating system won't use its minidisk volumes in PAV mode, z/VM will still provide PAV performance optimization across multiple non-exploiting guests. Performance gains can be realized only when full-pack minidisks are shared among guests with multiple LINK statements or when multiple non-full-pack minidisk volumes reside on a real PAV volume. Performance gains are achieved by transparently multiplexing the I/O operations requested on each guest minidisk volume over the appropriate real PAV base and alias subchannels. z/VM V4.4, V5.1, V5.2 without PAV support, VSE, TPF, and CMS are examples of non-exploiting operating systems. z/OS and Linux can also be considered non-exploiting, depending on how they are configured.

To define a full-pack minidisk for a non-exploiting operating system at virtual E100, you can code the following statements in the user directory:

```
MDISK E100 3390 0 END PAK001
or
LINK GUEST1 E100 E100 MW
```

To define a non-full-pack minidisk for a non-exploiting operating system at virtual E100, you can code the following statements in the user directory:

```
MDISK E100 3390 100 200 PAK002
or
LINK GUEST1 E100 E100 MW
```

The following is a typical example of several non-exploiting guest virtual machines using PAV for enhanced performance:

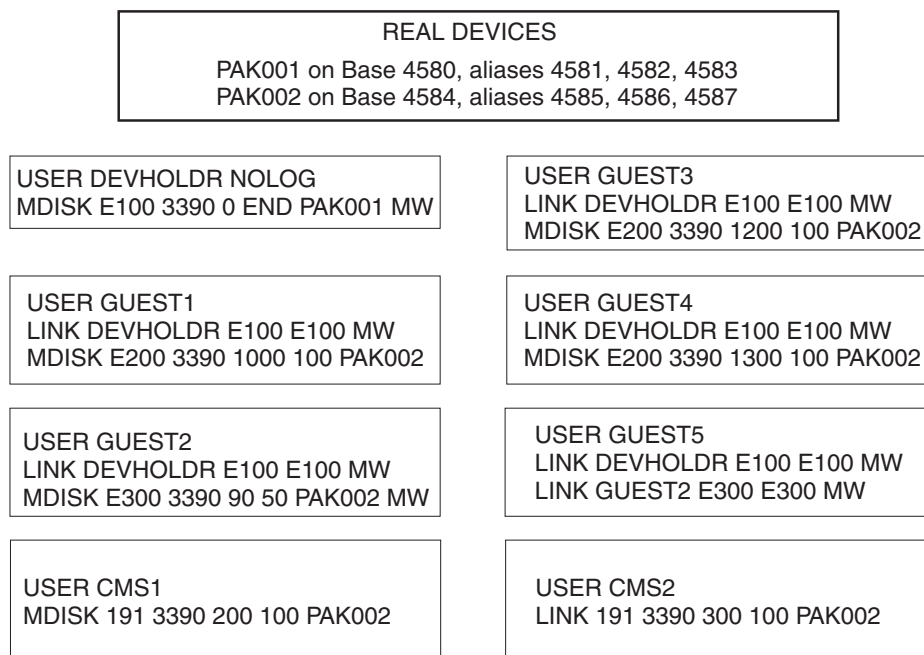


Figure 30. Example: PAV Minidisk Configuration for Non-Exploiting Guests

Note that in the above configuration, there are five links to real volume PAK001. For these five virtual PAV base subchannels, there is one real PAV base and three real PAV alias subchannels that will be used to perform the I/O. z/VM will concurrently multiplex the I/O from the GUEST1-GUEST5 E100 virtual bases onto the real 4580, 4581, 4582, and 4583 subchannels as they are available. Using this strategy, it is possible to have many guest virtual machines sharing a real DASD volume with z/VM dynamically handling the selection of real PAV base and alias subchannels.

I/O operations to the minidisks defined on PAK002 will likewise be optimized by z/VM's dynamic selection of real PAV base and alias subchannels 4584, 4585, 4586, and 4587.

**Note:** CMS is a non-exploiting operating system, and therefore the use the DASDOPT PAVALIAS and MINIOPT PAVALIAS user directory statements is not recommended. Additionally, the use of the Class G DEFINE PAVALIAS command by CMS users should be discouraged. It is possible to write a CMS application that can take advantage of PAV volumes, but CMS itself is not PAV-aware. When multiple CMS volumes are defined on a real PAV volume, I/O operations by CMS can be concurrently scheduled on any real PAV base or alias subchannel by z/VM. The CMS user does not need to take any action for this to occur.

## z/VM Restrictions on Using PAV

1. A virtual alias subchannel cannot be IPLed.
2. You should not use PAV alias volumes as z/VM installation volumes (for example, do not use for the 520RES volume).
3. z/VM Paging and SPOOLing operations do not take advantage of PAV. It is recommended that PAGE and SPOOL areas be placed on DASD devices dedicated to this purpose.

4. A real alias subchannel can be attached to a guest or SYSTEM only after its associated real base subchannel has been attached to the same guest or SYSTEM.
5. A real base subchannel can be detached from a guest or SYSTEM only if all of its associated alias subchannels are already free.
6. A real alias subchannel will not come online to z/VM without an associated real base subchannel. Also, a real base subchannel must have at least one associated real alias subchannel for z/VM (for example, the QUERY PAV command) to recognize the device as a Parallel Access Subchannel.
7. A real base subchannel cannot be changed or deleted with the SET RDEVICE, DELETE RDEVICE, DELETE DEVICE, or MODIFY DEVICE command unless all associated real alias subchannels have been deleted with the DELETE RDEVICE command..
8. CMS does not support virtual alias subchannels. Under CMS, you can for example issue a Class G "DEFINE PAVALIAS 291 FOR BASE 191" command followed by an "ACCESS 291 B". If you use "FILELIST \* \* B", you will see the contents of the 191 disk, but CMS does not understand that 191-A and 291-B are actually the same volume and corruption will occur if changes are made to either 191 or 291. This is similar to the damage that can be caused by issuing "LINK \* 191 291 MW".
9. Virtual PAV devices should not be used if any system sharing the DASD uses the unconditional reserve CCW. This includes both dedicated and DEFINE PAVALIAS devices.

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## Using IBM HyperParallel Access Volumes

Read the above section, "Using IBM Parallel Access Volumes" on page 677, before reading this section.

z/VM provides support for the IBM HyperParallel Access Volumes (HyperPAV) feature of IBM DASD subsystems. IBM DASD HyperPAV volumes must be defined to z/VM as a 3390 Model 2, 3, or 9 DASD on a 3990 Model 3 or 6, 2105, or 2107 Storage Controller. 3380 track-compatibility mode for the 3390 Model 2 or 3 DASD is also supported.

Traditional PAV support operates on statically assigning one or more PAV alias subchannels to a specific PAV base device. The DASD Administrator is able to manually reassign PAV aliases from one PAV base to another using the DASD subsystem's configuration menus and certain software can "dynamically" reassign PAV aliases as well. When there are many PAV bases and aliases, it is possible to begin to exhaust the supply of subchannels that are available. This potential for exhausting the supply of available subchannels and easier system operation has led to the creation of HyperPAV.

A Logical Subsystem (LSS) can operate in one of the Non-PAV, PAV, or HyperPAV modes. When an LSS is in HyperPAV mode, there is one pool of HyperPAV bases and aliases that are shared within the LSS. Any HyperPAV alias in a pool can service I/O requests for any HyperPAV base in the same pool. Thus, the PAV concept of an alias being assigned to a particular base is no longer appropriate. Instead, the HyperPAV base-alias association exists only for the duration of each I/O operation on a HyperPAV alias. This pooling of HyperPAV bases and aliases can greatly reduce the number of aliases that can be required. Now, with HyperPAV, only the number of aliases required to obtain a desired I/O performance objective for the LSS are required — performance tuning is now moved from the volume level to the LSS level.



Within the HyperPAV content, the concept of a “volume” becomes a bit more “natural” in the sense that a HyperPAV alias subchannel no longer has a fixed association with a particular volume. With PAV, an alias subchannel was associated with a particular volume, and this led to some confusion. In the HyperPAV world, there is no such association.

HyperPAV devices are defined within a Storage Controller when the proper Licensed Internal Codes (LICs) are installed and enabled. The LSS is configured as a PAV environment, and when the HyperPAV feature is enabled by z/VM, the static PAV aliases are converted to HyperPAV aliases and they are joined together to form the pool for the LSS. z/VM can be configured to operate each LSS in Non-PAV, PAV, or HyperPAV mode by using the new CU DASD statement in its configuration file and/or the new SET CU command.

PAV base subchannels are defined in IOCP as UNIT=3990, 2105, or 2107 on the CNTLUNIT statement and UNIT=3390B (or 3380B) on the IODEVICE statement. Alias subchannels are defined as UNIT=3990, 2105, or 2107 on the CNTLUNIT statement and UNIT=3390A (or 3380A) on the IODEVICE statement. Each base or alias subchannel can be assigned any available z/VM real device number. Use the IBM DASD subsystem configuration console to initially define which subchannels are base subchannels, which subchannels are alias subchannels, and which alias subchannels are associated with each base volume. Use the CP QUERY PAV command to view the current allocation of base and alias subchannels.

Base and alias subchannels provide nearly identical functions for a volume. One exception is that “volume-wide” commands such as the Reserve and Release channel commands can only be issued to a base subchannel, but the resulting status applies to the associated alias subchannels as well.

Certain virtual HyperPAV operations require the consistent use of the same real base or alias subchannel. To facilitate this, each virtual HyperPAV base and alias has an “assigned” real device subchannel that can be displayed with the QUERY VIRTUAL *vdev* DETAILS and QUERY VIRTUAL PAV commands. The assignment is automatic and cannot be changed. One example of this would be the execution of the Read Configuration Data command. The scheduling of I/O to an assigned device is automatically handled by z/VM during its analysis of the virtual channel program. Because each virtual HyperPAV base or alias must have a uniquely assigned real HyperPAV base or alias subchannel, you cannot have more virtual HyperPAV aliases than real HyperPAV aliases for an LSS.

The Define Extent channel command specifies if a channel program can read and/or write data from or to a volume. For each volume, read operations are permitted concurrently over multiple base or alias subchannels. However, write operations are serialized on the volume when the cylinder ranges specified in the Define Extent channel command overlap with another active CCW chain in any other subchannel for the volume.

A dedicated HyperPAV base volume or alias can only be assigned to one guest. I/O operations initiated through a HyperPAV alias can only be directed to base volumes that are ATTACHED or LINKED to the issuing virtual machine.

## HyperPAV Pools

New with HyperPAV support is the concept of a pool. A pool consists of a collection of HyperPAV bases and the alias subchannels that can refer to them. A



typical PAV configuration can be defined as in the figure below:

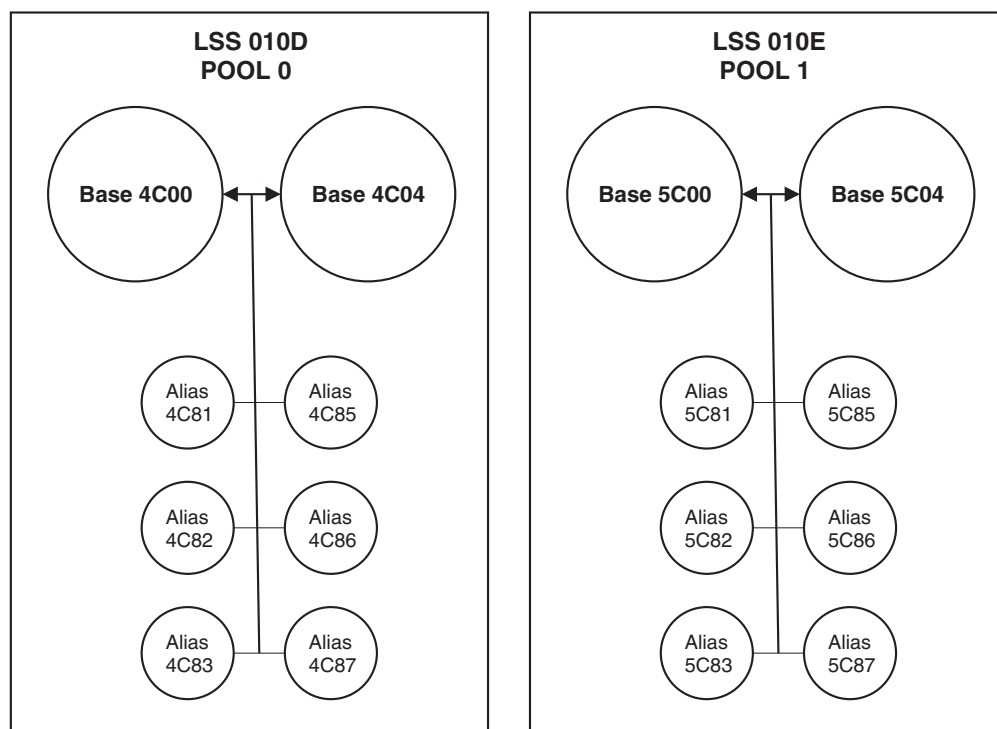


Figure 31. Example: DASD Logical Subsystems and Pools

A pool can contain up to 254 HyperPAV alias devices, and there is a limit of 16,000 pools in a z/VM configuration.

Currently, there is a one-to-one correspondence of pools and LSSs. Base disks are assigned to a specific pool and aliases within the same pool can be used to access the base.

## Using HyperPAV Dedicated DASD

Dedicated HyperPAV bases operate in the traditional z/VM manner. To use dedicated HyperPAV alias devices, the guest must contain support for managing and serializing the volume's data across the subchannels — an “exploiting” operating system. z/VM acts only as the “pipe” between the guest and the hardware. Once the necessary base and associated alias subchannels are attached to the guest, the guest must manage their use. Dedicated HyperPAV alias I/O operations are restricted by z/VM to be able to access only HyperPAV bases that are attached to the guest.

In a dedicated environment, the performance benefits of HyperPAV are entirely up to the operating system running in the virtual machine. z/VM will not make any attempt to optimize or alter the I/O flowing through the base and alias subchannels.

## Using HyperPAV Minidisks

In the context of HyperPAV, the real I/O scheduling algorithms for full-pack and non-full-pack minidisks behave in the same manner.

A guest virtual machine can define one or more minidisk volumes that exist on a real HyperPAV volume. The real HyperPAV volume has a real base and is associated with a pool that also contains zero or more HyperPAV aliases.

All HyperPAV I/O operations that are directed to a minidisk volume are optimized by z/VM's automatic selection of an appropriate real HyperPAV base or alias subchannel for the underlying real volume. In other words, the scheduling of I/O to a virtual device will be dynamically scheduled and multiplexed on any real HyperPAV base or alias subchannel that is defined in the hardware. This gives z/VM the flexibility to choose a real HyperPAV base or alias subchannel that is not in use at the time. For example, if users GUEST1 and GUEST2 simultaneously issue an I/O request to two different minidisk volumes that are defined on the same real underlying volume, via their respective virtual subchannels, the result would be that one I/O would be executed on the real base subchannel and the other, simultaneously, would be executed on a real alias subchannel.

### Using HyperPAV Minidisks with Exploiting Operating Systems

An exploiting operating system is one that is capable of controlling the HyperPAV architecture and is configured to control the features of HyperPAV. Such an operating system understands how to control and utilize virtual HyperPAV aliases. Examples might be z/VM and z/OS.

Virtual HyperPAV base devices are those defined as full-pack minidisks on real HyperPAV base devices. Associated virtual HyperPAV alias devices can be subsequently defined using the DEFINE HYPERPAVALIAS command (either in the user directory or after the user is logged on). Virtual HyperPAV devices can be displayed using the QUERY VIRTUAL PAV command. For each LSS, the number of virtual HyperPAV aliases for a guest cannot exceed the number of real HyperPAV aliases defined in the hardware for the underlying real LSS. Virtual HyperPAV devices cannot be defined for non-full-pack minidisks.

The SET MDCACHE command is not valid for an alias HyperPAV minidisk volume. Cache settings are only applicable for base HyperPAV minidisk volumes.

To define a full-pack minidisk for an exploiting operating system at virtual E100 with virtual aliases at E101, E102, and E103, you can code the following statements in the user directory:

```
COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100
COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100
COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100
MDISK E100 3390 0 END PAK001
```

or

```
COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100
COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100
COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100
LINK GUEST1 E100 E100 MW
```

The following is a typical example of several virtual machines that exploit HyperPAV volumes. Both volumes are full-pack minidisks that are shared among the five guests (E100, PAK001 and E200, PAK002). Note that there are more HyperPAV minidisk volumes (5 MDISKs) than real volumes (2). z/VM will multiplex I/O operations on the real base and alias subchannels for each:

|                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>REAL DEVICES</p> <p>PAK001 on Base 4580, aliases 4581, 4582, 4583<br/>PAK002 on Base 4584, aliases 4585, 4586, 4587</p>                                                                                                                                                                                                                                                                               |
| <p>USER DEVHOLDR NOLOG<br/>MDISK E100 3390 0 END PAK001 MW<br/>MDISK E200 3390 0 END PAK002 MW</p>                                                                                                                                                                                                                                                                                                       |
| <p>USER GUEST1<br/>COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100<br/>LINK DEVHOLDR E100 E100 MW<br/>COMMAND DEFINE HYPERPAVALIAS E201 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E202 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E203 FOR BASE E200<br/>LINK DEVHOLDR E200 E200 MW</p> |
| <p>USER GUEST2<br/>COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100<br/>LINK DEVHOLDR E100 E100 MW<br/>COMMAND DEFINE HYPERPAVALIAS E201 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E202 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E203 FOR BASE E200<br/>LINK DEVHOLDR E200 E200 MW</p> |
| <p>USER GUEST3<br/>COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100<br/>LINK DEVHOLDR E100 E100 MW<br/>COMMAND DEFINE HYPERPAVALIAS E201 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E202 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E203 FOR BASE E200<br/>LINK DEVHOLDR E200 E200 MW</p> |
| <p>USER GUEST4<br/>COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100<br/>LINK DEVHOLDR E100 E100 MW<br/>COMMAND DEFINE HYPERPAVALIAS E201 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E202 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E203 FOR BASE E200<br/>LINK DEVHOLDR E200 E200 MW</p> |
| <p>USER GUEST5<br/>COMMAND DEFINE HYPERPAVALIAS E101 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E102 FOR BASE E100<br/>COMMAND DEFINE HYPERPAVALIAS E103 FOR BASE E100<br/>LINK DEVHOLDR E100 E100 MW<br/>COMMAND DEFINE HYPERPAVALIAS E201 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E202 FOR BASE E200<br/>COMMAND DEFINE HYPERPAVALIAS E203 FOR BASE E200<br/>LINK DEVHOLDR E200 E200 MW</p> |

Figure 32. Example: HyperPAV Minidisk Configuration for Exploiting Guests

Note that in the above example, there is no reference to pool numbers. The purpose of the “FOR BASE nnnn” option on the DEFINE HYPERPAVALIAS command is to ensure that the virtual alias is assigned to an appropriate real alias

in the same pool as the base. If in the above example PAK001 and PAK002 are in the same real LSS, then all the devices are assigned to the same pool and the E1xx and E2xx aliases can be used to issue I/O requested to PAK001 and/or PAK002. If PAK001 and PAK002 are in different LSSs, then the E1xx aliases are in a unique pool and can only access PAK001 and likewise the E2xx aliases can only access PAK002.

### Using HyperPAV Minidisks with Non-Exploiting Operating Systems

A non-exploiting operating system is one that is not configured to control the features of HyperPAV or has no knowledge of the HyperPAV architecture. Although the guest operating system will not use its minidisk volumes in HyperPAV mode, z/VM will still provide HyperPAV performance optimization across multiple non-exploiting guests. Performance gains can be realized only when full-pack minidisks are shared among guests with multiple LINK statements or when multiple non-full-pack minidisk volumes reside on a real HyperPAV volume. Performance gains are achieved by transparently multiplexing the I/O operations requested on each guest minidisk volume over the appropriate real HyperPAV base and alias subchannels. z/VM V4.4, V5.1, V5.2, VSE, TPF, and CMS are examples of non-exploiting operating systems. z/OS can also be considered non-exploiting, depending on how it is configured.

To define a full-pack minidisk for a non-exploiting operating system at virtual E100, you can code the following statements in the user directory:

```
MDISK E100 3390 0 END PAK001
 or
LINK GUEST1 E100 E100 MW
```

To define a non-full-pack minidisk for a non-exploiting operating system at virtual E100, you can code the following statements in the user directory:

```
MDISK E100 3390 100 200 PAK002
 or
LINK GUEST1 E100 3100 MW
```

The following is a typical example of several non-exploiting guest virtual machines using HyperPAV for enhanced performance:

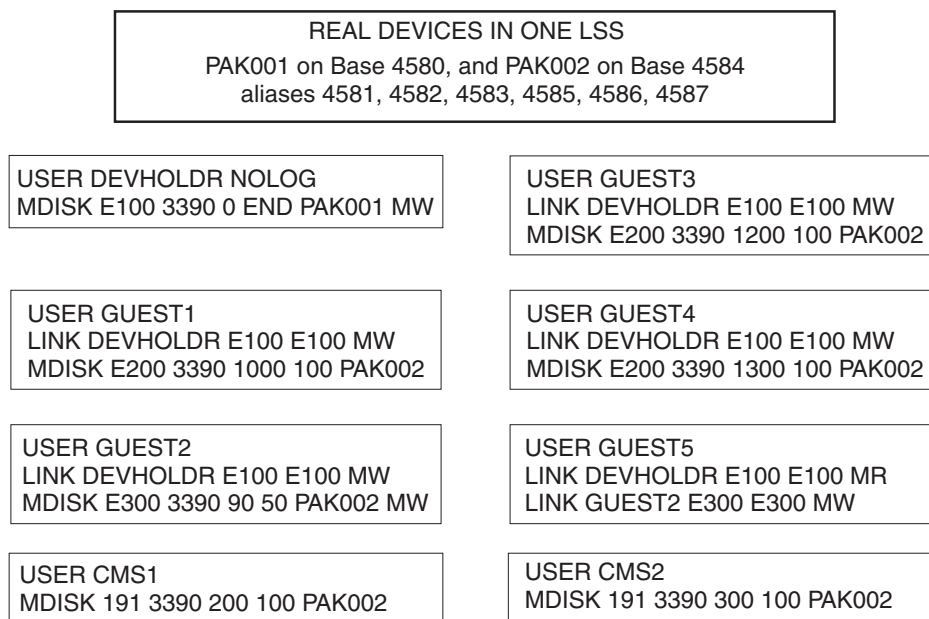


Figure 33. Example: HyperPAV Minidisk Configuration for Non-Exploiting Guests

Note that in the above configuration, there are five links to real volume PAK001. For these five virtual HyperPAV base subchannels, there is one real HyperPAV base and six real HyperPAV alias subchannels that will be used to perform the I/O. z/VM will concurrently multiplex the I/O from the GUEST1-GUEST5 E100 virtual bases onto the real 4580, 4581, 4582, 4583, 4585, 4586, and 4587 subchannels as they are available. Using this strategy, it is possible to have many guest virtual machines sharing a real DASD volume with z/VM dynamically handling the selection of real HyperPAV base and alias subchannels.

I/O operations to the minidisks defined on PAK002 will likewise be optimized by z/VM's dynamic selection of real HyperPAV base and alias subchannels 4584, 4581, 4582, 4583, 4585, 4586, and 4587.

Due to their dynamic nature, HyperPAV aliases have additional CCW controls that are not present for PAV aliases. For example, under CMS it is possible (but not recommended) to use the DDR program to access a PAV alias since there is a fixed association of the PAV alias to a specific PAV base. Since DDR does not understand (that is, is non-exploiting) how to control a HyperPAV alias, any attempt to access a HyperPAV alias will result in an I/O error because it is unclear which base is intended.

**Note:** CMS is a non-exploiting operating system, and therefore the use of the class G DEFINE HYPERPAVALIAS command is not recommended. CMS itself is not HyperPAV-aware. When multiple CMS volumes are defined on a real HyperPAV volume, I/O operations by CMS can be concurrently scheduled on any real HyperPAV base or alias subchannel by z/VM. The CMS user does not need to take any action for this to occur.

## z/VM Restrictions on Using HyperPAV

A virtual alias subchannel cannot be IPLed.

You should not use HyperPAV alias volumes as z/VM installation volumes (for example, do not use for the 520RES volume).

z/VM Paging and SPOOLing operations do not take advantage of HyperPAV. It is recommended that PAGE and SPOOL areas be placed on DASD devices dedicated to this purpose.

Virtual HyperPAV devices can only be defined for full-pack minidisks. They cannot be defined for non-full-pack minidisks.

For a HyperPAV exploiting guest, it is recommended to avoid defining a mixture of dedicated HyperPAV alias devices and full-pack HyperPAV alias devices for the same underlying real LSS. Dedicated HyperPAV aliases can only be associated with dedicated HyperPAV bases and full-pack HyperPAV aliases can only be associated with full-pack HyperPAV aliases. If a mixture is defined for an LSS, the full complement of alias devices cannot be exploited for each base device.

CMS does not support virtual HyperPAV alias subchannels.

DIAGNOSE codes X'18', X'20', X'A4', X'250', and the \*BLOCKIO System Service do not support HyperPAV alias devices. I/O issued to a HyperPAV alias via one of these interfaces will be rejected because a means for specification of the associated base device is not provided.

Virtual HyperPAV devices should not be used if any system sharing the DASD uses the unconditional reserve CCW. This includes both dedicated and DEFINE HYPERPAVALIAS devices.

---

## Using Persistent FlashCopy

The IBM System Storage DASD Subsystem has introduced the concept of a Persistent FlashCopy Relationship, available with Licensed Internal Code. This feature enables the creation of instant point-in-time copies of dedicated devices, full-pack minidisks, and ordinary minidisks.

The various features of the FLASHCOPY ESTABLISH and related commands provide several options for data backup and test data replication scenarios.

When a persistent relationship between a source and one to twelve targets is created with the FLASHCOPY ESTABLISH command, a copy of the source is *logically* created on the target and the command completes within a few seconds, regardless of the amount of data involved. When the FLASHCOPY ESTABLISH command has completed, the DASD subsystem has remembered the current state of the source and target extents and can begin physically copying the data from the source to the target(s) with a background copy process that is executed within the DASD subsystem. The decision to start the copying and at what speed to do it are based on available resources within the DASD subsystem.

### How and Where Does the Hardware Read and Write to the Source and Target(s) During a Persistent Relationship?

There are four possible ways to access the source and target data tracks during a persistent FlashCopy relationship:

- Read from Source
  - Read source track and return it.
- Write to Source

- If the source track has not yet been copied to the target (by either a prior write-to-source or background copy), read the original source track and write it onto the target.
- After the source track has been copied to the target, replace the original source track with the new data.
- Read from Target
  - If the target track has been copied (by write-to-source or background copy) or modified (by write-to-target), read the target track and return it.
  - Otherwise, read the source track and return it.
- Write to Target
  - Mark the source track as no longer needing to be copied.
  - Write the data to the target track.

One key feature of this logic is background copy processing. When a persistent relationship is established with the FLASHCOPY ESTABLISH command, the normal action for the DASD subsystem is to begin copying all of the source tracks to all of the targets by executing a background copy process within the DASD subsystem. After some period of time, the source tracks will have been copied to the target(s) and the *logical* copy is now a *physical* copy as well. However, for applications such as instant point-in-time backups and test data replication scenarios, this is not what we want. In these cases, what we want to do is to preserve the original version of the data. This is accomplished with the NOCOPY option of the FLASHCOPY ESTABLISH command which prevents the initiation of the background copying process.

## Instant Point-in-Time Backups (disk-to-disk)

In this scenario, we want to create a complete instantaneous copy of a source disk onto a target disk. This is accomplished by executing:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 NOSETARGET
```

Immediately after this command has completed, we have a logical copy (*vdev2*) that can be read or written without affecting the source (*vdev1*) and vice versa. You do not have to wait for the background copy to complete before you can access the copy on *vdev2*. The physical copying will be performed by the background copy process in the DASD subsystem, and its completion will be indicated by the remaining field showing a zero in the QUERY FLASHCOPY HARDWARE's response.

```
q flashcopy hardware 5101
-----SOURCE----- -----TARGET-----
SEQUENCE FLGS RDEV VOLSER CCCCCCCC/HH RDEV VOLSER CCCCCCCC/HH REMAINING/TOTAL
4A20BAC2 8800 5100 PACK01 100/00 5101 PACK02 100/00 0/150
4A20BAC2 8800 5100 PACK01 120/00 5101 PACK02 120/00 309/450
4A20BAC2 8800 5100 PACK01 150/00 5101 PACK02 170/00 0/150
```

Also, the FLASHCOPY WITHDRAW command will not execute successfully until the remaining count is zero:

```
FLASHCOPY WITHDRAW TARGET vdev2
HCPNFC2469E WITHDRAW failed because 309 tracks remain to be copied to vdev2.
Ready(2469);
```

The NOSETARGET option specifies that the target device cannot be a space-efficient device.



### Instant Point-in-Time Backups (disk-to-tape)

In this scenario, we want to create an instantaneous copy of a source disk onto a tape. The advantage of this is the DASD subsystem will only copy source tracks that have been modified onto the target, thus reducing the load on the DASD subsystem. Using this feature while performing many concurrent disk-to-tape copies will help prevent storage controller overload errors. This is accomplished by executing:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 NOCOPY
```

The NOCOPY option requests that the background copy operation not be initiated. Therefore, we have a logical copy that can be read or written, but not a physical copy.

Typically at this point the target (*vdev2*) would be copied to tape with your favorite disk-to-tape backup program, such as DDR or the CMS TAPE command.

After the tape backup has completed, you can destroy the target by issuing:

```
FLASHCOPY WITHDRAW TARGET vdev2 FORCE
```

The FORCE option specifies that you want to destroy the target — specifying FORCE will render the contents of the target unpredictable.

### Test Data Replication

Another use of FlashCopy is to be able to create test data. An example is to make a copy of a production database for testing purposes. CHANGE RECORDING and RESYNC are only available on dedicated devices or full-pack minidisks.

To establish the copy, you would execute:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 CHGRECORD NOCOPY
```

If you decide you want to synchronize the target with the current source, you would issue:

```
FLASHCOPY RESYNC SOURCE vdev1 TARGET vdev2
```

If you decide not to retain the resulting target DASD, you can issue:

```
FLASHCOPY WITHDRAW TARGET vdev2 FORCE
```

The target DASD will not be usable.

If you decide you want to retain the resulting target DASD, you can issue:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 CHGRECORD NOCOPY NOSETARGET
FLASHCOPY BACKGNDCOPY SOURCE vdev1
FLASHCOPY WITHDRAW TARGET vdev2
```

### Multiple LPAR FlashCopy Considerations

Persistent FlashCopy relationships can be created by z/VM or any other operating system running in any LPAR attached to the DASD subsystem. These relationships are visible to z/VM and persist until they are WITHDRAWN, even surviving system IPLs, DASD subsystem power-down/power-up, and DASD subsystem microcode loads.



## CP-Owned Areas and FlashCopy

If a persistent FlashCopy relationship source extent is detected on a CP-owned volume during system IPL that is allocated as non-PERM space, warning message HCP2462I will be issued to the system operator's console.

If a persistent FlashCopy relationship target extent is detected on a CP-owned volume during system IPL that is allocated as non-PERM space, warning message HCP2463E will be issued to the system operator's console.

The ATTACH TO SYSTEM command will allow the attachment of volumes with persistent FlashCopy relationships if the relationships include non-PERM extents. However, messages HCP2462I and HCP2463E will be issued to the user issuing the command.

No further actions will be performed by z/VM on these extents, but care should be taken with these configurations to ensure that the FlashCopy relationship is not withdrawn or resynchronized while z/VM is using these extents, especially if the extent is the target of a FlashCopy relationship. Otherwise, system instability could occur as a result of the changes made to the volume by an external source.

The Class B QUERY FLASHCOPY HARDWARE command exists to facilitate the management of persistent FlashCopy relationships.

To remove all the target relationships on a volume you can use the ATTACH *rdev* TO \* AS *vdev* command to attach the volume, or use DEFINE MDISK *vdev* 0 END *volser* (if the volume is attached to SYSTEM). Then, issue a FLASHCOPY WITHDRAW TARGET *vdev* command.

---

## Space-Efficient Volumes

The IBM System Storage DASD Subsystem has introduced the concept of space-efficient volumes, available with Licensed Internal Code. This feature enables the partial provisioning of DASD devices by only allocating physical DASD subsystem resources to DASD cylinders that actually contain data. Commands such as QUERY DASD SPACE-EFFICIENT and QUERY CU DASD SELC exist to assist with the configuration and maintenance of the space-efficient pools and repositories.

Space-efficient volumes are only supported as the targets for persistent FlashCopy relationships.

## Space-Efficient Volumes with CP Areas Are Not Allowed

The use of space-efficient volumes that contain PAGE, SPOOL, TDISK, Directory, Warmstart, Checkpoint, and PARM extents is not allowed because when a space-efficient volume exhausts its allocated space, all I/O operations stop on the device. For PAGE and SPOOL, this would be very harmful to system stability.

When a CP-owned volume is detected on a space-efficient DASD during system IPL, message HCP9050W is issued and the SYSTEM IPL stops.

### HCP9050W

CP-OWNED volume is on a Space-Efficient DASD.

The ATTACH TO SYSTEM command will not allow space-efficient volumes to be attached to the system. Message HCP2467E is issued.

### HCP2467E

The CP-OWNED volume *volser* is allocated on Space-Efficient device *rdev*. Space-Efficient volumes are not allowed as CP-OWNED volumes.

## Space-Efficient Volumes and FlashCopy Backups

The IBM System Storage DASD Subsystem has introduced the concept of space-efficient persistent FlashCopy relationships, available with Licensed Internal Code. This feature enables the use of space-efficient DASD for FlashCopy targets.

Background copy processing is not available with space-efficient targets because it would defeat the purpose of space-efficient DASD which is to copy as little data as possible. By implication, disk-to-disk backups do not make sense and are not possible with space-efficient targets. On the other hand, disk-to-tape backups work very well because the minimum necessary DASD cylinders are provisioned.

Because background copying is not available, the NOCOPY option is assumed. To establish a persistent FlashCopy relationship on a space-efficient target, you can specify:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2
```

or

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 NOCOPY
```

When you have completed backing up *vdev2* to tape, you can destroy the target by issuing:

```
FLASHCOPY WITHDRAW TARGET vdev2 FORCE RELEASE
```

The FORCE option specifies that you are willing to destroy the target, and the RELEASE option tells the DASD subsystem to return the allocated tracks back to the repository for allocation to another device. If the optional RELEASE is not specified, the cylinders will continue to be provisioned to the target volume, which is probably not what you want to do.

The FLASHCOPY BACKGNDCOPY command is not available.

## Space-Efficient Volumes and FlashCopy Test Data Replication

To establish the copy, you would execute:

```
FLASHCOPY ESTABLISH SOURCE vdev1 TARGET vdev2 CHGRECORD NOCOPY
```

This operates the same way as discussed in “Test Data Replication” on page 692, with the exception that you are not able to make changes to the target with the FLASHCOPY BACKGNDCOPY command and the FLASHCOPY WITHDRAW FORCE option is required. The test data will be available until the persistent relationship is withdrawn by issuing:

```
FLASHCOPY WITHDRAW TARGET vdev2 FORCE RELEASE
```

The FORCE option specifies that you want to destroy the target — specifying FORCE will render the contents of the target unpredictable.

---

## Chapter 23. Defining and Managing SCSI FCP Disks

---

### Overview

z/VM supports SCSI FCP disk logical units (SCSI disks) for both system and guest use. SCSI disks can be used directly by a guest operating system when an FCP subchannel is dedicated to a guest. Such a guest must contain its own SCSI device driver – Linux on System z is one such guest.

SCSI disks can also be used as emulated 9336 model 20 fixed-block-architecture (FBA) disks. CMS and CP rely almost exclusively on this emulated-FBA support for their SCSI usage. Specifically, this usage includes system paging, spooling, directory services, minidisks, and all other system functions and programming services that support FBA disks. Guests that support FBA disks (such as CMS, GCS, RSCS, Linux, and VSE) also can use SCSI disks through the emulated-FBA support, without requiring any specific SCSI support in the guests.

z/VM supports emulated FBA disks and their underlying SCSI disks up to 1 terabyte minus 1 page (2,147,483,640 512-byte blocks) in size, without regard to the capacity of real 9336 disks. When CP uses FBA disks, space is allocated by 4096-byte pages. FBA DASD space allocated for use as directory, paging, and spooling must reside within the first 16,777,215 pages (64 GB minus 1 page) of the volume. Other types of CP allocations (TDSK, PERM, and PARM) can exist beyond the first 64 GB.

**Note:** Because the CMS file system requires file status and control information to reside below 16 MB in virtual storage, there is a practical limitation on the size of CMS minidisks. As a minidisk increases in size, or more files reside on the disk, the amount of virtual storage associated with the disk for CMS file system status and control increases in storage below 16 MB. The current ECKD DASD limitation for CMS is 65520 cylinders for a 3390 disk on an IBM TotalStorage DASD subsystem, or about 45 GB of data. The maximum size for FBA SCSI disks supported for use by CMS or GCS is 381 GB. IBM suggests that customers defining disks for use by CMS should set a practical limit of about 22 GB. If larger disks are defined, they should be limited to contain very few files, or the CMS file system may not be able to obtain enough virtual storage below 16 MB to format or access those disks. For more information, see the ACCESS command in the *z/VM: CMS Commands and Utilities Reference*.

An emulated FBA disk requires the following elements within its configuration definition:

**FCP device number**

A real device number for a subchannel associated with an FCP channel, providing access to the fibre-channel fabric.

**Target worldwide port name (WWPN)**

The unique worldwide port name associated with a target port on a SCSI controller.

**Logical unit number (LUN)**

The number of a specific logical unit (i.e. logical device) associated with the target port.

## Defining and Managing SCSI FCP Disks

Refer to Figure 34 for an illustration of these required elements.

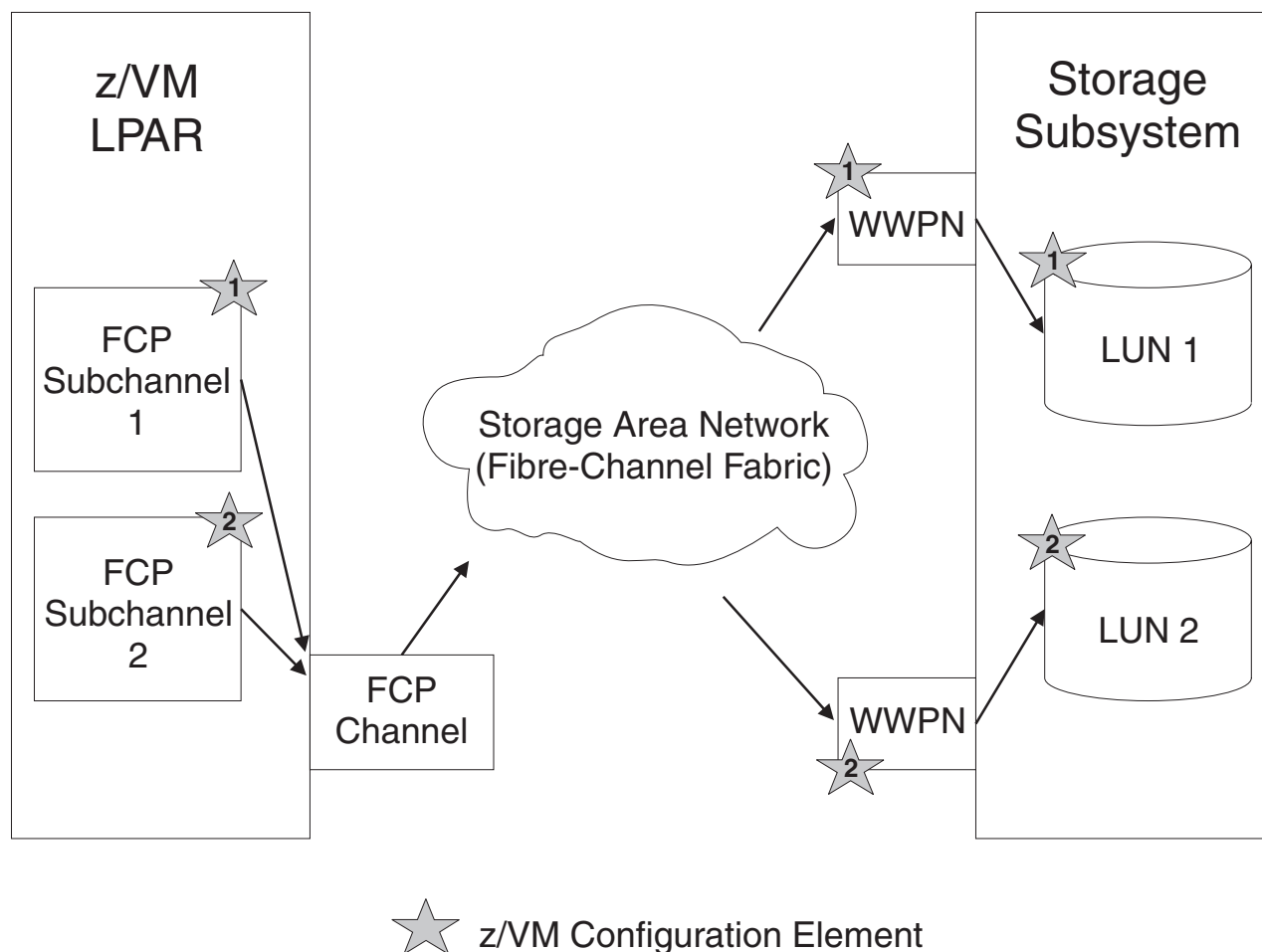


Figure 34. Required Elements for SCSI FCP definition

Figure 35 on page 697 illustrates the overall system architecture related to z/VM's SCSI support. The figure shows how channel programs for emulated FBA disks are processed through an emulation layer and a SCSI driver into the fibre-channel fabric. The figure also shows how guests with their own SCSI support can use a dedicated FCP subchannel to access the fabric directly. Note that the elements described above in Figure 34 are contained in the FCP Channel and Storage Area Network portions of Figure 35 on page 697.

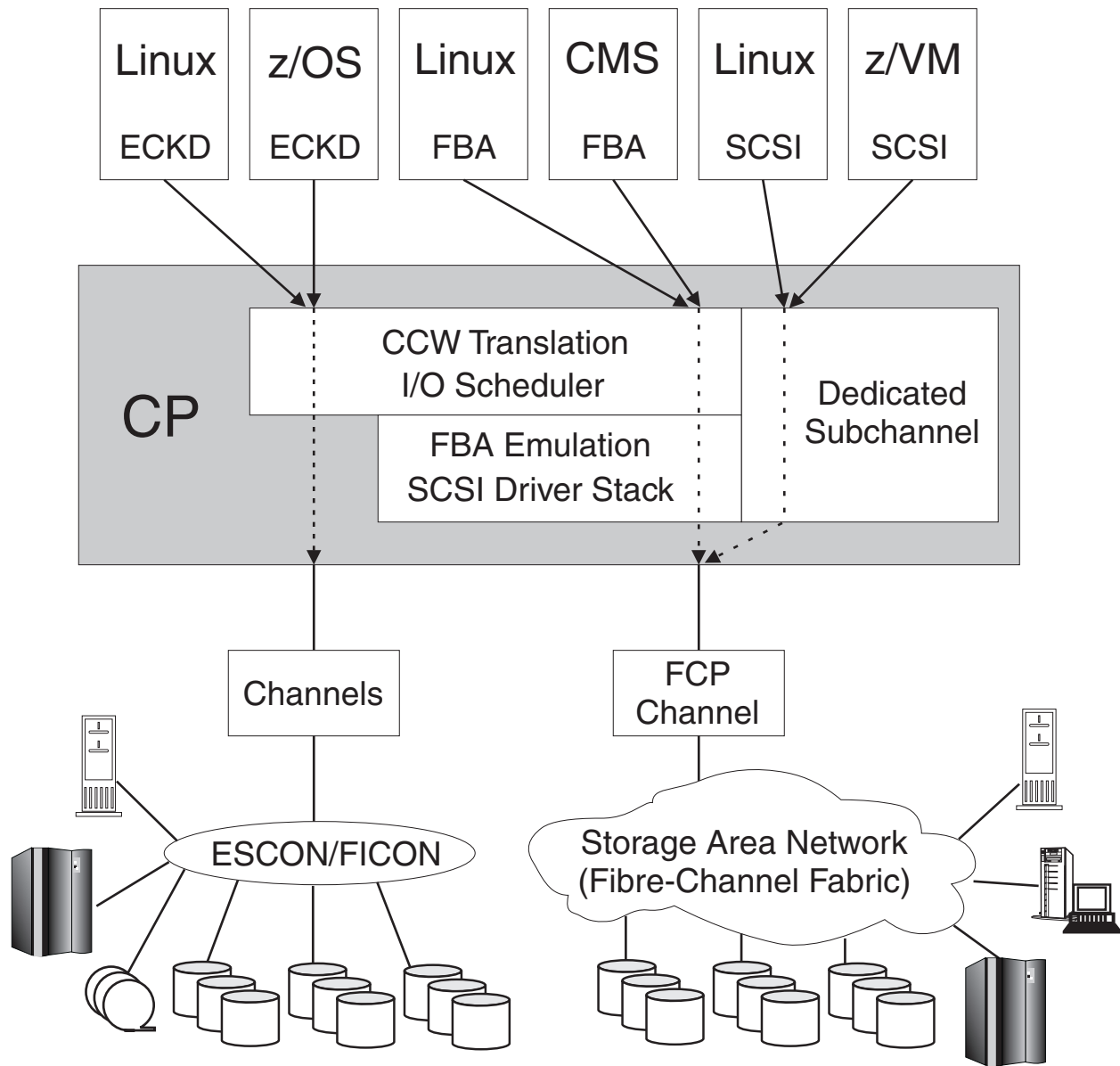


Figure 35. SCSI System Architecture

## Defining SCSI Devices

### Emulated FBA Disks on SCSI Disks

A SCSI device is defined to the z/VM system by specifying an EDEVICE statement in the system configuration file (see *z/VM: CP Planning and Administration*), by issuing a CP SET EDEVICE command (see *z/VM: CP Commands and Utilities Reference*), or by using z/VM's HCM and HCD support (see *z/OS and z/VM: Hardware Configuration Manager User's Guide* and *z/VM: I/O Configuration*). The EDEVICE statement, SET EDEVICE command, and the HCM and HCD programs all provide the parameters to identify the SCSI device (FCP device number, target WWPN, and LUN) to CP. The emulated FBA disk is assigned a real device number and becomes associated with a SCSI disk through an FCP device, which also has a

## Defining and Managing SCSI FCP Disks

real device number. The device number of an emulated FBA disk must not conflict with the device number of any real device in the z/VM system. That is, all emulated FBA disks and all real devices must have unique real device numbers, even though the emulated FBA disks are not real devices.

When defining emulated FBA disks to represent SCSI disks, there must be a one-to-one relationship between each FBA disk and its underlying SCSI disk. A path to a specific SCSI disk comprises the three elements described in “Overview” on page 695: the FCP device number, target WWPN, and LUN. You can define multiple paths to the SCSI disk associated with an emulated FBA disk – these paths should be routed through different network components to achieve the greatest availability for the disk. In other words, the different paths must use different FCP channels, the channels should be connected to different switches, and the paths should end at different target ports of the SCSI controller. You might want to keep the paths completely separate by means of appropriate zoning within your fabric.

All paths defined for an emulated FBA disk should represent physical paths through the fabric to the same real SCSI disk. If you define multiple paths for an emulated FBA disk but the paths go to different SCSI disks, or if you define more than one emulated FBA disk with the same underlying real SCSI disk, or if you define multiple paths to the same SCSI disk using the same FCP channel, then unpredictable results and/or data-integrity problems could occur.

Once the emulated FBA disk is defined, it is managed on z/VM like a real 9336 FBA disk. CP commands such as VARY, ATTACH, and QUERY execute as if the emulated disk were a real FBA disk. This also applies to user-directory and system-configuration-file statements.

The following commands can be used to manage emulated FBA disks:

- SET EDEVICE, to create, modify, or clear an emulated-device definition
- DELETE EDEVICE, to delete an emulated-device definition
- QUERY EDEVICE, to query an emulated-device definition.

The SCSIDISC utility can be used to dynamically discover all SCSI disks, and their associated paths, accessible by a virtual FCP device.

See the *z/VM: CP Commands and Utilities Reference* for more information on these commands and the SCSIDISC utility.

**Note:** The SET EDEVICE and DELETE EDEVICE commands are not allowed when HCM and HCD are controlling z/VM's software configuration.

## Real SCSI Disks

The following commands can be used to manage an FCP device dedicated to a guest for direct access to SCSI disks through a SCSI device driver:

- ATTACH
- DETACH
- QUERY FCP
- SET LOADDEV
- QUERY LOADDEV

See the *z/VM: CP Commands and Utilities Reference* for more information on these commands.

---

### Additional Considerations for SCSI Devices

The following are restrictions for emulated SCSI devices:

- For CP volumes (formatted with CPFMTXA), space allocated by CP for use as directory, paging, and spooling must reside within the first 16,777,215 pages (64 GB minus 1 page) of the volume.
- As with all FBA minidisks, Reserve and Release CCW commands issued to an emulated FBA disk are supported only among guests within the same z/VM system image. If a guest operating system has access to either a dedicated FBA disk or to an emulated FBA full-pack minidisk that has been defined as shared among multiple z/VM images, then Reserve and Release CCW commands will be rejected.
- A single FCP channel can be shared by multiple logical partitions and multiple virtual machines, but the operating systems in those logical partitions and virtual machines must not attempt to share a real SCSI device (as specified by a WWPN and LUN pair). All such operating systems will appear to the SCSI controller as being the same host system (or SCSI initiator), potentially leading to problems with concurrent-write access to the disk and with error-recovery procedures. A real SCSI device can be shared (if it makes sense for the particular device) if each operating system has its own path through separate FCP channels to the SCSI device.
- IBM strongly recommends that you never assign different logical unit numbers (LUNs) to the same logical device within a SCSI controller. Otherwise, shared access to a device may happen without being detected, and unpredictable results can occur.

---

### Using N\_Port Identifier Virtualization (NPIV) for FCP Channels

NPIV is supported by System z FICON channel cards in FCP mode. Additionally, NPIV requires support in the entry switch used to attach the channel to the SAN fabric. No support is required in any other switches or devices attached to the SAN.

z/VM exploits the adapter capability to define multiple virtual FCP channels, each with its own unique fibre channel port name and fibre channel identifier (FC\_ID). By assigning distinct virtual port names to different guests, the guests can use the virtual FCP channels as if they were using dedicated physical FCP channels. Access controls based on the virtual port names may be applied in the SAN fabric using standard mechanisms like zoning in the switches and logical unit number (LUN) masking in the storage controllers, thereby providing access control at the FCP *subchannel* level.

Previously, all FCP subchannels shared the common WWPN burned into the associated FCP adapter. Within the SAN fabric, therefore, the actual I/O initiator (a specific subchannel) could not be determined because the initiator was always the WWPN of the FCP adapter. Access control could only be managed at the *adapter* level.

z/VM support of NPIV-enabled hardware is automatic and transparent. No special initialization or command is required. The QUERY command will display the hardware-assigned WWPN of NPIV-enabled FCP subchannels. See the *z/VM: CP Commands and Utilities Reference* for more information on this command.

## Defining and Managing SCSI FCP Disks

The procedure for enabling NPIV support on the FICON adapter can be found in *System z10: Support Element Operations Guide*, Version 2.10.1, SC28-6878. Refer to the associated product documentation to enable NPIV support on a switch.



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## Chapter 24. Device Encryption Planning

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### Using Tape Encryption

Guest operating systems, such as CMS, that are not capable of enabling the hardware encryption available with the 3592 Model E05 tape drive are able to use new z/VM facilities that enable the encryption on behalf of the guest. Guest operating systems that do support tape encryption, such as z/OS with proper service, will be able to do so without interference from z/VM.

There are other components necessary besides z/VM and an encryption-capable 3592 Model E05 tape drive. The control unit needs to be able to communicate with an encryption key manager (EKM) <sup>1</sup> and an associated key store(s). z/VM expects the EKM communication to take place via TCP/IP, referred to as an “out-of-band” connection. The EKM and associated key store(s) will maintain a list of Key Encrypting Key (KEK) Labels, where each KEK Label is up to 64 characters long (including spaces) and represents an RSA public/private key pair. Typically, the public key is used for encryption, while the private key is used for decryption.

The KEK Labels are written to the tape cartridge to facilitate the decryption process later on. A KEK Label can either be written directly or as a hash of the associated public key. The former will require the decryption process to have an identical KEK Label in the key store that represents the necessary keys, while the latter will allow for more flexibility in transporting encrypted tapes to other parties by allowing different KEK Labels to point to the same RSA key pair.

Data is sent to the tape drive as plain text, where a symmetric Data Key (DK) is generated by the EKM to perform a high-speed encryption of the data before it is written to the cartridge. The DK itself is encrypted with the public key of the specified KEK, creating what is known as an Externally Encrypted Data Key (EEDK). Two EEDKs are created out of specified KEK Labels and written to the tape cartridge. If only one KEK Label is specified when enabling the encryption environment, it is used to create both EEDKs. In order to decrypt the data, the recipient must hold the correct private key necessary to decrypt the EEDK, and thus be able to extract the DK that is used to decrypt the rest of the cartridge. It should be noted that the volume label for the cartridge will be written with a key that is known to the tape drive, permitting decryption of the label to take place without conversing with the EKM. This will allow cartridges to be identified and help determine what keys were used for the encryption, without compromising the security that protects the rest of the data.

The use of KEK Labels for the creation of EEDKs is only necessary when first creating an encrypted tape. Upon mounting a previously encrypted tape cartridge, the tape drive initiates communication with the EKM in hopes that the necessary keys are present to decrypt the EEDKs and thus the entire cartridge. If the required keys are not present, the cartridge cannot be decrypted and an encryption key failure will be presented upon a read operation. If the required keys are present in the EKM, then the cartridge will be decrypted and presented to the host as a regular tape.

---

1. See IBM System Storage Tape Enterprise Key Manager, Introduction, Planning and User Guide, GA76-0418.

If a newly mounted tape cartridge is moved past the load point in order to append additional data, that data will be written in the same format as the existing data on the cartridge. This helps provide consistency of the data set on the cartridge, as the cartridge will remain entirely encrypted or plaintext. Only when the tape is written to at the load point will the specified KEK Labels (or lack thereof) be used to change how the data exists on a cartridge.

## z/VM Support

**Note:** The information provided below is only to be used in conjunction with those guest operating systems that are not able to enable the hardware encryption environment themselves. Attempts to combine them are likely to create hardware problems such as missing interrupts.

z/VM maintains a list of key aliases, defined via the SET KEYALIAS command, that represent the EKM's KEK Labels to be used by z/VM. Each key alias is up to 32 characters long (including spaces) and contains the KEK Label as well as an encoding mechanism of how that KEK Label will be used to create an EEDK. A KEK Label can be used directly ("LABEL") or hashed ("HASH") when creating the EEDKs. The latter may be more convenient if the recipient of the encrypted cartridge has a different KEK Label string defined to represent the matching keys.

This information can be recalled with the QUERY KEYALIAS command for either a single alias, or for the entire list of known aliases.

```
set keyalias cow label keylabel 'moo moo moo'
set keyalias duck hash keylabel 'quack quack'
set keyalias 'old macdonald' label keylabel 'Had a Farm'

q keyalias
KEYALIAS: (L) COW
 = MOO MOO MOO
KEYALIAS: (H) DUCK
 = QUACK QUACK
KEYALIAS: (L) OLD MACDONALD
 = HAD A FARM
Ready; T=0.01/0.01 15:56:39
q keyalias 'old macdonald'
KEYALIAS: (L) OLD MACDONALD
 = HAD A FARM
Ready; T=0.01/0.01 15:57:19
```

*Figure 36. SET/QUERY KEYALIAS*

When dedicating a tape to a guest, the key aliases can be specified on the ATTACH command in order to select the KEK Labels to use when creating the EEDKs. If an alias is not recognized, an error will be presented and the ATTACH command will fail. If no key aliases are specified a set of default KEK Labels, defined in the EKM, will be used to create the EEDKs.

At the time of the ATTACH, the tape drive must be either unloaded or at beginning-of-tape in order to establish the encryption environment. Thus, a tape cartridge is guaranteed to have a consistent set of data that is either completely encrypted with a unique set of EEDKs, or completely unencrypted. Attempts to ATTACH a tape drive with encryption settings that do not meet these criteria will fail with an error message.

Guest operating systems that use the z/VM facilities to enable encryption are able to use the MULTIUSER option on ATTACH. However, all guests using the shared tape device need to use the same encryption settings, in order to provide a consistent environment for enabling the encryption.

The encryption settings specified on an ATTACH will persist until the drive is detached and unloaded. If a DETACH is issued with the LEAVE option, the encryption settings will remain in place along with the mounted cartridge. This will allow a subsequent ATTACH to be issued without any encryption settings, but allowing the encryption environment to be passed to a target user. In the case of the ATTACH of shared tape, the encryption settings persist until all instances are DETACHED, and the device is marked as free again.

```
att 181 * key
TAPE 0181 ATTACHED TO JOEC00L 0181
Ready; T=0.01/0.01 16:46:29

det 181
TAPE 0181 DETACHED
Ready; T=0.01/0.01 16:46:32

att 181 * multi key cow duck
TAPE 0181 ATTACHED TO JOEC00L 0181
Ready; T=0.01/0.01 16:46:35

att 181 * multi key cow pig
HCPATR1128E Device 0181 not attached; a mismatch in hardware encryption settings
was detected.
Ready(01128); T=0.01/0.01 16:47:04
```

Figure 37. ATTACH

The SET RDEVICE FEATURE command can be used to enable the encryption environment without making changes to the ATTACH command. As with ATTACH this command must also be issued when the drive is unloaded or at beginning-of-tape, but also must be issued before it is dedicated to a guest. This will permit the encryption environment to be enabled through the use of library or tape managers that issue a regular, unmodified, ATTACH command. Up to two aliases can be specified per SET RDEVICE FEATURE command, as defined by the SET KEYALIAS command. If none are specified, the EKM's default keys will be used.

```
set rdev 7e2 feature key
HCPZRP6722I Characteristics of device 07E2 were set as requested.
1 RDEV(s) specified; 1 RDEV(s) changed; 0 RDEV(s) created
Ready; T=0.01/0.01 08:34:04

set rdev 7e2 feature key cow duck
HCPZRP6722I Characteristics of device 07E2 were set as requested.
1 RDEV(s) specified; 1 RDEV(s) changed; 0 RDEV(s) created
Ready; T=0.01/0.01 08:37:21
```

Figure 38. SET RDEVICE FEATURE

There is new information available with different QUERY responses that will provide encryption-related information to the issuer. This includes the Class B QUERY TAPES DETAILS <rdev>, and the Class G QUERY VIRTUAL TAPES and QUERY VIRTUAL <rdev> DETAILS commands.

All three variations will include text that indicates which drives are capable of encryption. The two commands with DETAILS options will provide additional information regarding the KEK Labels in use on the tape device. If any encryption settings were defined with the SET RDEVICE FEATURE command, those settings will be displayed under the heading "INACTIVE KEY LABELS." Once an ATTACH command is issued, those same settings will reside under the heading "ACTIVE KEY LABELS" if ATTACH was performed unmodified. Otherwise, the active heading will contain the encryption information specified on the ATTACH command. If either heading indicates "DEFAULT," the default keys defined in the EKM are being used.

The above statement is true when a tape is written to immediately after being mounted and attached with encryption information. If, however, the first operation to the mounted tape is a read, any EEDKs that were stored on the tape are decrypted and the resulting Data Key is used to read the contents of the tape or to append additional data. Issuing a QUERY command with a DETAILS option at this point will display the KEK Labels and encoding mechanism that were present on the tape cartridge under the "ACTIVE KEY LABEL(S)" heading, and the information specified through ATTACH will instead be listed under an "ATTACHED KEY LABEL(S)" heading. This distinction is only displayed when what is currently in use and what was specified on ATTACH are found to be different. If the mounted tape cartridge is not encrypted, the "ACTIVE KEY LABEL(S)" will indicate "NONE."

If you are careful, you can use this information to identify what KEK Labels are actually used when the EKM default keys are requested by ATTACH. Unfortunately, no indication is returned that a given KEK Label is marked as a default, so you might get different KEK Label information as a "default" key if the tape was not initially written after mounting with the default keys option.

```
q v tapes
TAPE 0181 ON DEV 07E2 3590 R/W SUBCHANNEL = 0008 ENCRYPTION CAPABLE
Ready; T=0.01/0.01 16:42:02

q v 181 details
TAPE 0181 ON DEV 07E2 3590 R/W SUBCHANNEL = 0008 ENCRYPTION CAPABLE
ACTIVE KEY LABEL(S):
 (H) the first mighty key label
 (L) the second mighty key label
INACTIVE KEY LABEL(S): DEFAULT

q tapes details 7e2
TAPE 07E2 SEQUENCE NUMBER E0010 LIBPORT 1 ENCRYPTION CAPABLE
ACTIVE KEY LABEL(S):
 (H) the first mighty key label
 (L) the second mighty key label
INACTIVE KEY LABEL(S): DEFAULT

q tapes details 7e3
TAPE 07E2 SEQUENCE NUMBER E0010 LIBPORT 1 ENCRYPTION CAPABLE
INACTIVE KEY LABEL(S):
 (H) the first mighty key label
 (L) the second mighty key label
```

Figure 39. Variations of QUERY output

The z/VM DASD Dump Restore (DDR) utility also supports Tape Encryption for 3592 drives, but utilizes its own unique externals in order to run in the absence of an underlying z/VM system. The Input/Output control statement includes a new

option, "KEY," that will cause the output device to be enabled for device encryption. This option is only valid on the output statement, as it has no meaning on an input device. A new HASH/LABEL control statement has been added to define the encoding mechanism used on the tape. These statements (up to two can be specified) determine what key labels are to be used for encrypting the tape, and how they will be used (as a label, or as a hash of the public key). These control statements are optional, and if not included, the default keys in the EKM will be utilized for encryption. The following example dumps all data from the volume labeled SYSRES onto the tape mounted on unit 181 and the data is encrypted using key e3rw33rsesyqypsftqqpx0539.

```
input 191 3390 sysres
label1 e3rw33rsesyqypsftqqpx0539
output 181 3592 (key
dump all
```

*Figure 40. Encrypted data dump*

## Tape Rekey

An extension to the tape encryption support, known as a tape rekey operation, has been made available with newer levels of Control Unit microcode for the 3592 Model E05 tape drive. This operation will decrypt the EEDKs stored on an encrypted tape cartridge, and encrypt them with a different set of KEK Labels before storing them back on the tape. The result is a different set of access rights being given to a tape cartridge, without requiring a time-consuming tape-to-tape copy operation that would otherwise be required.

The CP SET TAPE command is used to initiate the rekey operation against an encrypted tape and accepts one or two key aliases as input. Obviously, the affected Control Unit needs to be able to access both the old and new KEK Labels in order for the rekey operation to complete successfully. However, it also needs to be issued to an encrypted tape cartridge that is mounted and positioned at Beginning of Tape. The QUERY responses that contain detailed information about the KEK Labels will reflect this change after one has been made. It should be noted that in this case, the aforementioned KEK Labels that fall under the "ATTACHED KEY LABEL(S)" heading will likely not be used until a new tape is mounted in the drive.

The EEDKs are the only pieces that are actually changing on the tape, so the actual format of the tape does not matter to z/VM. Therefore, if you want, z/VM can rekey a tape on behalf of its guest.



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## **Part 5. Single System Image Clusters Planning and Administration**





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## Chapter 25. Setting Up z/VM Single System Image Clusters

A z/VM single system image (SSI) cluster is a multisystem environment in which the z/VM systems can be managed as a single resource pool and running virtual servers can be moved from one system to another.

This chapter describes:

- “z/VM SSI Environment”
- “Major Attributes of a z/VM SSI Cluster” on page 710
- “Planning for a z/VM SSI Cluster” on page 724
- “Creating a z/VM SSI Cluster” on page 730
- “z/VM SSI Cluster Operation” on page 731
- “Implications for Vendor Products and Customer Applications” on page 736
- “System Configuration File for a z/VM SSI Cluster” on page 737

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### z/VM SSI Environment

A z/VM SSI cluster consists of up to four z/VM systems (*members*) in an Inter-System Facility for Communications (ISFC) collection. Figure 41 on page 710 shows the basic structure of a cluster with four members. The cluster is self-managed by CP using ISFC messages that flow across channel-to-channel connections between the members. All members can access shared DASD volumes, the same Ethernet LAN segments, and the same storage area networks (SANs). For requirements and restrictions, see “Planning for a z/VM SSI Cluster” on page 724.

### What a z/VM SSI Cluster Provides

A z/VM SSI cluster can provide several benefits:

- Facilitates the horizontal growth of z/VM workloads.
- Allows running virtual servers (guest virtual machines) to be moved from one member to another, a process known as *live guest relocation*.

**Note:** This function is currently supported for Linux guests only.

- Allows z/VM and hardware maintenance to be less disruptive to workloads.
- Allows less disruptive workload balancing.
- Eases the deployment and maintenance of multiple z/VM images.

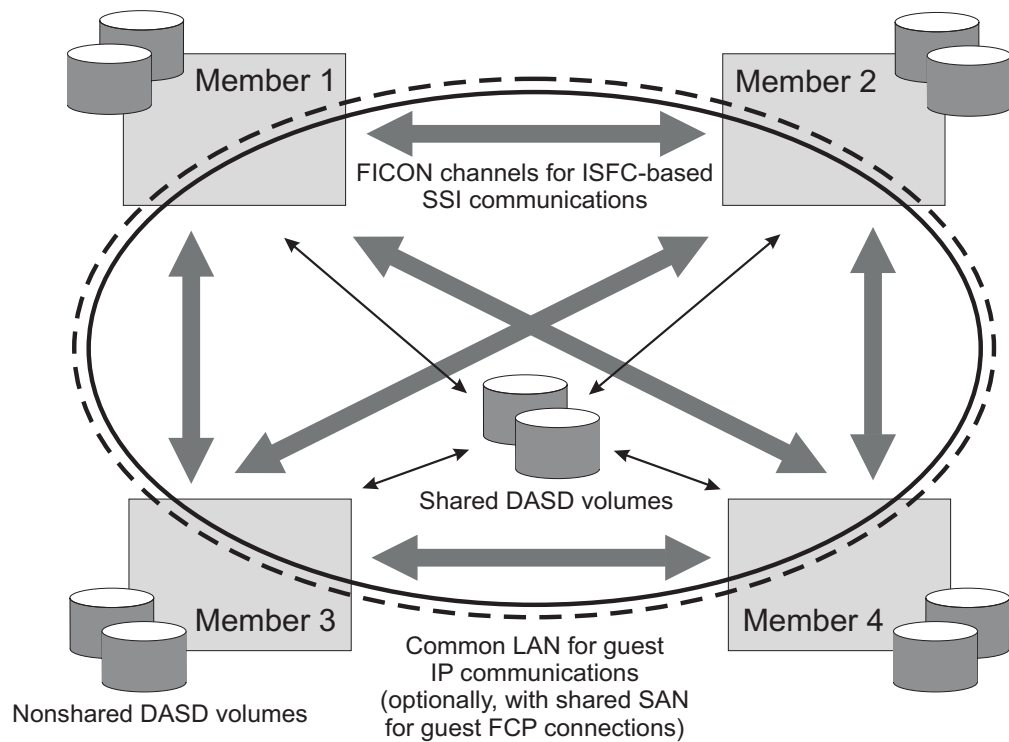


Figure 41. A Four-Member z/VM SSI Cluster

## Major Attributes of a z/VM SSI Cluster

The major attributes of an SSI cluster are:

- “Multisystem Installation”
- “Single Maintenance Stream” on page 711
- “Cross-System Highest Release Level Programs” on page 713
- “Common System Configuration File” on page 714
- “Persistent Data Record” on page 715
- “Ownership Checking of CP-Owned Volumes” on page 715
- “Virtual Machine Definition Management” on page 716
- “Cross-System Spool” on page 719
- “Cross-System SCIF, Observer, and CP Commands” on page 719
- “Cross-System Minidisk Management” on page 720
- “Real Device Management” on page 722
- “Virtual Networking Management” on page 723
- “Live Guest Relocation” on page 723

## Multisystem Installation

When you install z/VM, you can select an installation procedure that creates an SSI cluster. You do not need to do multiple system installations. On the installation panels you supply information about the SSI cluster, such as the name of the cluster, the number of members and their system names, the name of the logical partition (LPAR) in which each member will be IPLed, and information about the DASD volumes and channel-to-channel connections. The installation program will

install the z/VM images as an SSI cluster and provide a common system configuration file and a common source directory.

The process provides additional flexibility:

- You can create an SSI cluster with more members than you need right now. The installation program will install and customize the z/VM images and create the cluster structure for the “extra” members, and you can activate them when you need them.
- You can create a single-member SSI cluster as the first step in moving to a multimember SSI cluster. At a later time you can clone the single member to add other members to the cluster.
- You can select a non-SSI installation procedure and convert that z/VM system to the initial member of an SSI cluster at a later time. The SSI and non-SSI installations construct the system configuration file, the source directory, and the layout of DASD resources in the same way, to facilitate this conversion.

## Single Maintenance Stream

Figure 42 on page 712 shows the basic organization of DASD volumes and minidisks in an SSI cluster (consisting of two members in this example):

- One set of cluster-wide volumes (shared)

The common volume (default label VMCOM1) contains shared data files for the SSI cluster, such as the SSI persistent data record (PDR). This volume also contains the cluster-wide minidisks, which are owned by the PMAINT user ID. These minidisks include (but are not limited to):

### Minidisk

#### Purpose

#### **PMAINT CF0**

Common system configuration file

#### **PMAINT 2CC**

Common source directory

#### **PMAINT 41D**

VMSES/E production inventory disk

#### **PMAINT 551**

SSI cluster common disk (contains common utilities, such as CPFMTXA, DIRECTXA, DIRMAP, and DISKMAP)

- One set of release volumes for each z/VM release in the cluster (shared)

Service for release *vrn* (where *vrn* is a 3-digit string that identifies the z/VM version, release, and modification level) is loaded to minidisks on one or two release-specific volumes (default labels *vrn*RL1 and *vrn*RL2). The minidisks on these volumes are owned by a release-specific user ID, MAINT*vrn*. These minidisks include (but are not limited to):

### Minidisk

#### Purpose

#### **MAINT*vrn* 490**

Test CMS system disk

#### **MAINT*vrn* 493**

Test system tools disk

#### **MAINT*vrn* 51D**

VMSES/E software inventory disk

## Setting Up an SSI Cluster

### MAINT<sub>vr $m$</sub> CF2

Test parm disk

- One set of system volumes for each member (nonshared and shared)

The system residence volume is member-specific and therefore nonshared. The default volume label is M0 $m$ RES, where  $m$  is the number of the member in the member list on the SSI configuration statement (for example, M01RES for member 1). This volume contains member-specific data such as the warm start and checkpoint areas, the object directory, and the standard system minidisks owned by the MAINT user ID, such as MAINT 190 and MAINT 193.

The CP-owned volumes for paging and temporary disks are also member-specific and nonshared. The default volume labels are M0 $m$ P $nn$  and M0 $m$ T $nn$ , respectively (for example, M01P01 and M01T01 for member 1).

The spool volumes owned by each member are shared with the other members. The default volume labels are M0 $m$ S $nn$  (for example, M01S01 for member 1 and M02S01 for member 2).

PARM or PERM extents on other CP-owned volumes owned by each member are sharable.

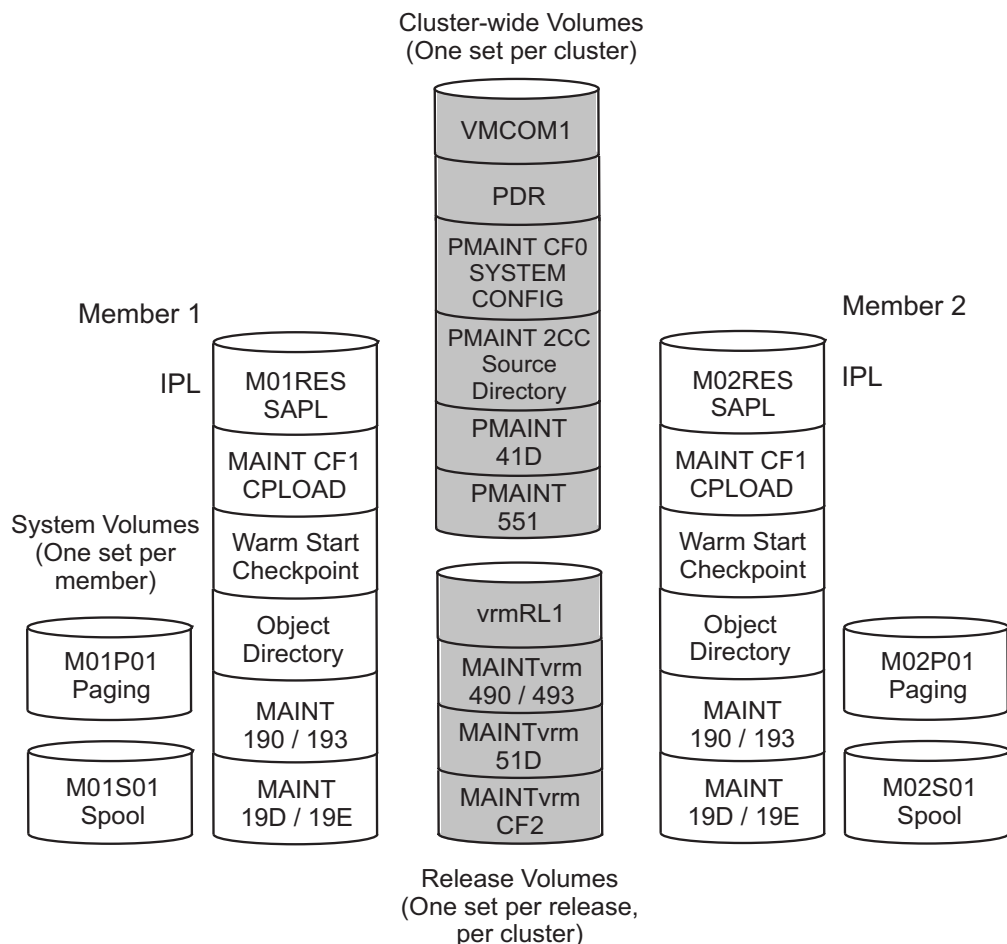


Figure 42. Organization of DASD Volumes and Minidisks in an SSI Cluster

For each z/VM release in an SSI cluster, there is:

- One maintenance user ID (MAINT<sub>vr $m$</sub> )
- One set of shared service inventory minidisks:

- Local/Sample, APPLY, DELTA, and test build disks
- One minidisk for local modifications to CP

Each member of an SSI cluster has a separate set of production minidisks. This allows service to be put into production independently on each member.

As shown in Figure 43, the process for applying service for release *vrml* in an SSI cluster consists of the following steps:

1. Log on to MAINT<sub>vrml</sub> on any member of the cluster (running any release).
2. Issue the SERVICE command to install the *vrml* Recommended Service Upgrade (RSU) or corrective service (COR) to the minidisks on volume *vrmlRL1*.
3. Log on to MAINT<sub>vrml</sub> on a member running release *vrml* that you want to update.
4. Issue the PUT2PROD command to put the serviced products into production on the system residence volume for that member.
5. When you are ready to put the service into production on another member, repeat steps 3 and 4.

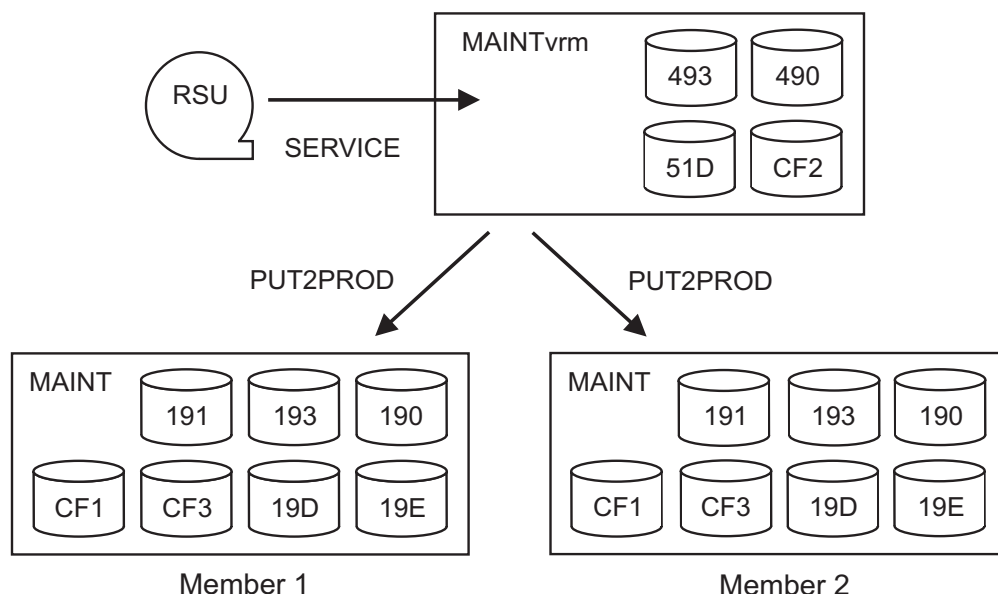


Figure 43. Applying Service to the Members of an SSI Cluster

## Cross-System Highest Release Level Programs

In an SSI cluster, certain resources – for example, the user directory, the system configuration file, the permanent data record (PDR) and shared DASD devices – are shared and managed by all members in the cluster. If the members in an SSI cluster are running different release levels of z/VM, certain programs which manage shared resources are required to be at the highest release level that is running in the cluster. These programs must be on all members in the cluster regardless of the release level running on each member. These *highest release level programs* reside on the SSI system common disk (PMAINT 551, by default).

When a z/VM release which supersedes all other releases running on the members in an SSI cluster is installed on a member of the cluster, z/VM installation processing places these programs from the superseding release on the SSI system common disk, replacing all programs from the superseded release. When these

programs are serviced on the highest release level running in the cluster, the programs are serviced as normal, being built and copied to the SSI system common disk. However, for all members running a lower-level, superseded z/VM release, these programs cannot be built during the service process because this would back-level the parts on the SSI system common disk. Instead, when these programs are serviced on any superseded release running in the cluster, the service process bypasses the building of these parts so that the parts from the highest release level installed in the cluster remain on the SSI system common disk.

### Common System Configuration File

The system definition statements for all of the members of an SSI cluster are contained in a common system configuration file. The file resides on the common parm minidisk (PMAINT CF0) on the common DASD volume (VMCOM1).

Because some statements in the common system configuration file apply to all members of the SSI cluster, while others are member-specific, record qualifiers are used to identify the member-specific statements. Qualified BEGIN and END statements can be used to identify blocks of member-specific statements.

The file begins with a `SYSTEM_IDENTIFIER` statement for each member of the SSI cluster, as shown in Figure 44. This statement defines the unique system name (system ID) for the z/VM system to be run in a specified logical partition (LPAR). The system name is used as the record qualifier parameter on other configuration statements that apply only to that member of the cluster. When a member system is initialized in an LPAR, CP locates the `SYSTEM_IDENTIFIER` statement with that LPAR name, then uses the defined system name to select the configuration statements to be processed for that member — all statements qualified with that system name and all statements with no qualifier.

```
System_Identifier LPAR LP01 VMSYS01
System_Identifier LPAR LP02 VMSYS02
System_Identifier LPAR LP03 VMSYS03
System_Identifier LPAR LP04 VMSYS04
```

Figure 44. Example of `SYSTEM_IDENTIFIER` Configuration Statements for an SSI Cluster

After the system names are defined, the SSI statement indicates this system configuration file defines an SSI cluster. As shown in Figure 45, the SSI statement specifies the name of the cluster, the label of the DASD volume that contains the SSI persistent data record (PDR), and the system names of the members.

```
SSI CLUSTERA PDR_Volume VMCOM1 ,
 Slot 1 VMSYS01,
 Slot 2 VMSYS02,
 Slot 3 VMSYS03,
 Slot 4 VMSYS04
```

Figure 45. Example of the SSI Configuration Statement

`ACTIVATE ISLINK` statements identify channel-to-channel adapters (CTCAs) for ISFC links between the members of the cluster. Each member must have at least one direct link to each of the other members. For example, the statements for member VMSYS01 shown in Figure 46 on page 715 identify devices for two links to member VMSYS02, two links to member VMSYS03, and two links to member VMSYS04. Each of the other members of the cluster would require a similar set of

statements.

```
VMSYS01: BEGIN
 Activate ISLINK rdev1 rdev2 Node VMSYS02
 Activate ISLINK rdev3 rdev4 Node VMSYS03
 Activate ISLINK rdev5 rdev6 Node VMSYS04
VMSYS01: END
```

Figure 46. Example of *ACTIVATE ISLINK* Statements for an SSI Cluster

For an example of the file, see “System Configuration File for a z/VM SSI Cluster” on page 737.

## Persistent Data Record

Information about the state of each member of an SSI cluster is maintained in the SSI persistent data record (PDR). The PDR provides a cross-system serialization point on disk, which assists in member state tracking. The PDR is used to provide a *heartbeat* mechanism, which ensures that a stalled or stopped member can be detected.

The FORMSSI utility is used to create or display the PDR. The PDR is created on cylinder 0 of the shared 3390 volume identified on the SSI configuration statement. The PDR can be located on the volume that also contains the common parm disk and the common source directory.

Each active member periodically:

- Updates the PDR with a heartbeat timestamp and sends the same heartbeat to the other members
- Monitors the heartbeat timestamps received from the other members and compares them with the timestamps in the PDR

## Ownership Checking of CP-Owned Volumes

To ensure that CP on one member of an SSI cluster will not allocate warm start, checkpoint, spool, paging, temporary disk, or directory data on a volume owned by another member, each CP-owned volume in an SSI cluster must be marked with ownership information. The ownership information consists of the name of the cluster and the system name of the member that owns the volume. Ownership information can be recorded on a DASD volume by using the OWNER operand of the CPFMTXA utility.

When the CP-owned list is processed for a member of an SSI cluster, the volume extents to be brought online are determined by the ownership information recorded on each volume. (The OWN and SHARED operands of the CP\_OWNED system configuration statement and the DEFINE CPOWNED command are ignored.) For more information about how the CP-owned list is processed, and how the volume extents are determined by the ownership information, see Chapter 21, “How the CP-Owned List Is Processed,” on page 661.

Ownership information for CP-owned volumes can be viewed by issuing the QUERY CPOWNED command. In the following examples, an SSI cluster named CLUSTERA has two members, VMSYS01 and VMSYS02. Issuing the QUERY CPOWNED command from a user ID logged on to member VMSYS01 results in the following response:



## Setting Up an SSI Cluster

| SLOT | VOL-ID | RDEV | TYPE  | STATUS              | SSIOWNER | SYSOWNER |
|------|--------|------|-------|---------------------|----------|----------|
| 1    | M01RES | C4A0 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 2    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 3    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 4    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 5    | VMCOM1 | C4FF | OWN   | ONLINE AND ATTACHED | CLUSTERA | -----    |
| 6    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 7    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 8    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 9    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 10   | M01S01 | C4A8 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 11   | M02S01 | C4B8 | SHARE | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 12   | M01S02 | C4A9 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 13   | M02S02 | C4B9 | SHARE | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 14   | M01S03 | C4AA | DUMP  | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 15   | M02S03 | C4BA | DUMP  | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 16   | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| :    |        |      |       |                     |          |          |
| 253  | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 254  | M01P02 | C4C1 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 255  | M01P01 | C4C0 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |

READY;

Issuing the QUERY CPOWNER command from a user ID logged on to member VMSYS02 results in the following response:

| SLOT | VOL-ID | RDEV | TYPE  | STATUS              | SSIOWNER | SYSOWNER |
|------|--------|------|-------|---------------------|----------|----------|
| 1    | M02RES | C4B0 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 2    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 3    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 4    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 5    | VMCOM1 | C4FF | OWN   | ONLINE AND ATTACHED | CLUSTERA | -----    |
| 6    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 7    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 8    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 9    | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 10   | M01S01 | C4A8 | SHARE | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 11   | M02S01 | C4B8 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 12   | M01S02 | C4A9 | SHARE | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 13   | M02S02 | C4B9 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 14   | M01S03 | C4AA | DUMP  | ONLINE AND ATTACHED | CLUSTERA | VMSYS01  |
| 15   | M02S03 | C4BA | DUMP  | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 16   | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| :    |        |      |       |                     |          |          |
| 253  | -----  | ---- | ----- | RESERVED            | -----    | -----    |
| 254  | M02P02 | C4D1 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |
| 255  | M02P01 | C4D0 | OWN   | ONLINE AND ATTACHED | CLUSTERA | VMSYS02  |

READY;

## Virtual Machine Definition Management

All of the virtual machines in an SSI cluster are defined in a single source directory, from which the object directory for each member is created. There are two types of virtual machine definitions:

### Single-configuration virtual machine definition

A user ID defined by a single-configuration virtual machine definition (the traditional type of definition) can be logged on to any member of the SSI cluster, one member at a time. The definition begins with a USER statement and consists of the user entry and any included profile entry.

Use this type of virtual machine definition for general workload (users and applications), platforms for running guest operating systems, and service



virtual machines (SVMs) and servers that require only one logon in the SSI cluster (that is, those which provide cluster-wide services).

### **Multiconfiguration virtual machine definition**

A user ID defined by a multiconfiguration virtual machine definition can be logged on concurrently to multiple members of the SSI cluster. The *instances* of the user ID on the members have common attributes but can also be configured to access different resources.

The definition begins with an IDENTITY statement and consists of the identity entry, any included profile entry, and the associated subconfiguration entries. Authorization information (such as privilege classes) and authentication information (such as a password) must be the same for all instances of the user ID, and therefore must be included in the identity entry. Resources available to all instances of the user ID are defined in the identity entry. The identity entry can also include a BUILD statement for each cluster member that points to a corresponding subconfiguration entry. Each subconfiguration entry contains member-specific information, such as MDISK statements for minidisks that are defined on a different volume for each member. When the user ID logs on to a member of the cluster, the statements from the identity entry, any included profile entry, and the appropriate subconfiguration entry are merged to create the instance of the user ID on that member.

Use this type of virtual machine definition for system support user IDs. The ability to be logged on to multiple members of an SSI cluster at the same time allows the user (such as the IBM-supplied MAINT user ID) to perform tasks on various members without having to log off one member before logging on to another. This type of definition can also be used for SVMs and servers (such as the IBM-supplied TCPIP server) that require an instance to be running on each member of the SSI cluster. Each instance supports only that member of the cluster.

Figure 47 on page 718 shows a sample multiconfiguration virtual machine definition for the TCPIP user ID.

## Setting Up an SSI Cluster

```
IDENTITY TCPIP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
BUILD ON VMSYS02 USING SUBCONFIG TCPIP-2
BUILD ON VMSYS03 USING SUBCONFIG TCPIP-3
BUILD ON VMSYS04 USING SUBCONFIG TCPIP-4
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCPIP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M01W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-2
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M02W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-3
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M03W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-4
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M04W01 MR RTCPIP WTCPIP MTCPIP
```

Figure 47. Example of a Multiconfiguration Virtual Machine Definition

When z/VM is installed, an *SSI-enabled* or *SSI-ready* source directory is created, depending on the installation procedure:

### SSI-enabled

An SSI-enabled source directory is created when an SSI installation is performed. The source directory for an SSI cluster must be SSI-enabled, and an SSI-enabled source directory can be used only for an SSI cluster.

This type of source directory contains a single DIRECTORY statement that specifies the SSI operand and identifies the DASD volumes where the object directory for each member will be created. The source directory can contain both single-configuration virtual machine definitions and multiconfiguration virtual machine definitions.

### SSI-ready

An SSI-ready source directory is created when a non-SSI installation is performed. This type of source directory can be used only for a single

non-SSI system or a single-member SSI cluster. An SSI-ready source directory can easily be converted to an SSI-enabled source directory.

In this type of source directory, the SSI operand is not specified on the DIRECTORY statement. The source directory can contain both single-configuration virtual machine definitions and multiconfiguration virtual machine definitions. However, a multiconfiguration virtual machine definition can include at most one BUILD statement and its associated subconfiguration entry. On the BUILD statement the system name must be specified as an asterisk (\*) to default to the IPLed system. Only one instance of the user ID can be created from this multiconfiguration virtual machine definition. The definition is functionally equivalent to a single-configuration virtual machine definition but is ready for conversion as part of an SSI-enabled source directory.

### Cross-System Spool

Cross-system spool enables the CP spooling functions on each member of an SSI cluster to create, manage, and share spool files cooperatively with the other members and enables spool files to be shared among the members. Each member creates spool files only on its own spool volumes, but has access to the spool volumes owned by the other members.

Users defined by single-configuration virtual machine definitions (beginning with a USER statement) have a single logical view of all their spool files. Users can log on to any member of the cluster and access all of their spool files, regardless of the member on which the files were created. (For a spool file to be accessible, the member on which it was created must be joined to the cluster.) Users can manipulate their spool files in the same ways as on a non-SSI system.

Users defined by multiconfiguration virtual machines definitions (beginning with an IDENTITY statement) do not participate in cross-system spool. Each virtual machine instance can view only the spool files created on the member where the instance is logged on. A spool file created on one member of the cluster is not visible to an instance of that multiconfiguration virtual machine on another member. Spool file transfer services, such as RSCS, can be used to move spool files to the member where the intended instance of the multiconfiguration virtual machine resides.

For more information, see Chapter 26, “Cross-System Spool in a z/VM SSI Cluster,” on page 743.

### Cross-System SCIF, Observer, and CP Commands

The SSI cluster environment supports cross-system use of the single console image facility (SCIF), the observer function, and many CP commands.

#### Cross-System SCIF and Observer

Cross-system SCIF and observer functions allow a secondary user or observer and the primary or observed user to be logged on to different members of the SSI cluster.

If either user in the relationship is a multiconfiguration virtual machine, the secondary user or observer will function in that capacity only when it is local (logged on to the same member as the primary or observed user). If the primary or observed user is a multiconfiguration virtual machine, the secondary user or

## Setting Up an SSI Cluster

observer must be logged on to the same member as the instance of the primary or observed user for which the secondary user or observer setting was established. If the secondary user is remote:

- The secondary user can issue SEND commands to the primary user. The AT *sysname* operands are required if the primary user is a multiconfiguration virtual machine instance.
- The secondary user will not receive responses to SEND commands or any other output from the primary user.

### Cross-System CP Commands

Some CP commands are enabled for cluster use through the AT *sysname* operands, which allow you to specify the target member. Examples are:

- INDICATE LOAD
- MESSAGE (MSG)
- MSGNOH
- QUERY NAMES
- QUERY USERS
- SMSG
- WARNING

In addition, most privileged CP commands (that is, not class Any or G) can be issued remotely on another active member of the SSI cluster by specifying the command and the remote member on the AT command on the local member:

AT *sysname* CMD *command*

**Note:** When executed with the AT command, a command that provides a system or user ID specification might have additional syntax requirements or restrictions. For more information, see the AT command in *z/VM: CP Commands and Utilities Reference*.

When the HOLD LOGON or FREE LOGON command is issued on a member of an SSI cluster for a user ID defined as a single-configuration virtual machine, the command is propagated to all the other members of the SSI cluster. If the user ID is defined as a multiconfiguration virtual machine, the command is executed only on the member where it is issued.

**Note:** If another member of the SSI cluster is specified by the AT *node* operands on a CMS productivity aid (such as the TELL or SENDFILE command), CMS views the specified system as a remote node and will attempt to route the associated message or file through RSCS. In most cases it is best to avoid using the AT *node* operands on these commands. For more information, see “How the CMS Productivity Aids Process Spool Files in an SSI Cluster” on page 747.

## Cross-System Minidisk Management

Users on different members of an SSI cluster can use the LINK command and the LINK directory statement to share minidisks. The members of the cluster exchange information about minidisk links to determine who has access to a minidisk. When a minidisk link is requested, CP checks for link conflicts on all members. The QUERY LINKS command displays information about links by users on all members of the cluster.

**Notes:**

1. XLINK system configuration statements and commands are not required or accepted in an SSI cluster.
2. Do not share minidisks between an SSI cluster and a CSE complex. CP does not analyze link conflicts between an SSI cluster and CSE.
3. Sharing minidisks between two SSI clusters or between an SSI cluster and a non-SSI system is not recommended. If such links are defined, the DASD volume should be defined as SHARED YES. CP does not analyze link conflicts beyond the scope of a single SSI cluster.

The SHARED operand on the RDEVICE (DASD) system configuration statement or the SET RDEVICE (DASD) command specifies whether the DASD volume is shared outside the SSI cluster:

### SHARED NO

The volume is not shared outside the SSI cluster. This is the default. Minidisks defined on this volume are eligible for minidisk cache, which is managed autonomically as write links are established and released.

### SHARED YES

The volume is shared with a system outside the SSI cluster. Minidisks defined on this volume are not eligible for minidisk cache. Link conflicts must be managed manually by the system administrator.

The scope of a minidisk in an SSI cluster can be *global* or *local*, which refers to the accessibility of the minidisk from the members of the cluster:

### Global

The minidisk is accessible from all members of the SSI cluster.

**Local** The minidisk is accessible from only one member of the SSI cluster. A local minidisk is exempt from cross-system minidisk management. A guest with a link to a local minidisk cannot be relocated.

In addition to its scope, a minidisk is either *shareable* or *private* (nonshareable), which refers to the accessibility of the minidisk from other virtual machines. The scope and shareability of a minidisk in an SSI cluster are determined by the type of minidisk and how it is defined, as shown in Table 41.

Table 41. Minidisk Scope and Shareability in an SSI Cluster

| Minidisk Type and Definition                                                                                              | Scope  | Shareability |
|---------------------------------------------------------------------------------------------------------------------------|--------|--------------|
| Permanent minidisk defined by an MDISK directory statement in a user or identity entry                                    | Global | Shareable    |
| Permanent minidisk defined by an MDISK directory statement in a subconfiguration entry                                    | Local  | Shareable    |
| Minidisk defined by a DEFINE MDISK command                                                                                | Local  | Private      |
| Virtual disk in storage defined by an MDISK...V-DISK directory statement in a user or subconfiguration entry <sup>1</sup> | Local  | Shareable    |
| Virtual disk in storage defined by a DEFINE VFB-512 command                                                               | Local  | Private      |
| Temporary minidisk defined by an MDISK...T-DISK directory statement <sup>2</sup>                                          | Local  | Private      |
| Temporary minidisk defined by a DEFINE (Temporary Disk) command                                                           | Local  | Private      |

## Setting Up an SSI Cluster

### Notes:

1. An MDISK statement for a virtual disk in storage is not permitted in an identity entry. If a virtual disk in storage is defined in a user entry, the minidisk can be created on any member of the cluster (when the owner logs on or when the first user links to it), but subsequently can be shared only by other users on that member until the last user detaches it or logs off.
2. If a temporary minidisk is defined in an identity entry, a separate temporary minidisk is created for each logon instance of the virtual machine.

If a write link is established to a minidisk eligible for minidisk cache, the other members of the SSI cluster will stop using minidisk cache for that minidisk and discard the cache, in order to avoid providing obsolete data to any guest with read-only links to the minidisk. If only one member has write links to the minidisk, minidisk cache can remain active on that member. When the write link is released, the other members will reinstate the minidisk cache.

Virtual reserve/release for full-pack minidisks is implemented as real reserve/release and is supported on multiple members of the SSI cluster. A non-full-pack minidisk authorized for virtual reserve/release can be linked by users on only one member of the SSI cluster at any given time.

For information about how minidisk link conflicts are resolved, see the LINK command in *z/VM: CP Commands and Utilities Reference*.

## Real Device Management

z/VM provides a mechanism for uniquely identifying real devices within an SSI cluster, to ensure that the members of the cluster are using the same physical devices. For devices that identify themselves uniquely, such as FICON-attached DASD and tape devices, CP generates an equivalency identifier (EQID) that is unique on a member of the cluster (because no other device has the same EQID) but the same from member to member (because each member is accessing the same device).

Adapters, such as channel-to-channel (CTC), Fiber-Channel-Protocol (FCP), HiperSockets, and Open Systems Adapter (OSA) devices, require additional information to establish equivalence, such as the fabric to which the adapter is connected and the access rights of the individual device. For these device classes and for devices that do not provide a unique identifier, the system administrator can use the RDEVICE system configuration statement or the SET RDEVICE command to assign EQIDs that tell CP which devices are equivalent. This manual setting indicates that the devices have equivalent connectivity capability. An administrator-assigned EQID must be unique or be shared only by other devices of the same type and with the same access rights.

The EQID is used instead of the real device number to determine device eligibility for guest relocation. Within a virtual configuration, a device that has been assigned an EQID is considered to be a candidate for use in a relocation. These real devices are associated with the relocating guest's virtual devices. The relocation process searches the real devices on the destination member for the specific device with the same CP-generated EQID or an available device with the same administrator-assigned EQID. If a match is found, the real device can be associated with the guest's virtual I/O configuration on the destination member. If a device does not have an EQID or if no match is found, it cannot be added to the guest's

virtual I/O configuration on the destination member, and therefore the relocation should not be attempted. If it is attempted, it might lead to a failure of the guest operating system.

## Virtual Networking Management

The assignment of Ethernet Media Access Control (MAC) addresses to virtual network interface cards (NICs) is coordinated within an SSI cluster. The members of the cluster ensure that a MAC address is not already in use by another guest within the cluster. z/VM generates locally administered MAC addresses for network devices using MAC prefixes. These MAC prefixes are set to CP-defined defaults or can be configured by the system administrator. For more information about MAC addresses, see “Planning for Guest LANs and Virtual Switches” in *z/VM: Connectivity*.

Each member of an SSI cluster should have identical network connectivity. To accomplish this, you should:

- Define a virtual switch with the same name and attributes on each member.
- Define the virtual switch to have one or more physical OSA ports connected to the same physical LAN segment.

## Live Guest Relocation

A z/VM SSI cluster provides a virtual server mobility function called live guest relocation. A running virtual server (guest virtual machine) can be relocated from one member to another. Relocating guests can be useful for load balancing and for moving workload off a physical server or member system that requires maintenance.

Use the VMRELOCATE command to initiate and manage guest relocations. Both the guest to be relocated and the destination environment must meet eligibility requirements, such as:

- The destination member and physical server must provide an architecturally and functionally comparable environment.
- The relocation must meet any policy requirements that have been established. Relocation domains can be defined to identify sets of eligible members among which guests can be relocated freely.
- The destination member must have sufficient capacity to accommodate the guest.
- The devices and resources needed by the guest must be shared, so they are also available on the destination member.

When a relocation is initiated, the guest continues to run on the source member until the destination environment is completely prepared. At that point the guest is briefly quiesced on the source member and then resumed on the destination member.

For additional information about relocation eligibility and options, see Chapter 27, “Preparing for Guest Relocations in a z/VM SSI Cluster,” on page 749.



### Planning for a z/VM SSI Cluster

Before you create a z/VM SSI cluster, ensure that your configuration conforms to the requirements and restrictions.

**Attention:** Also ensure that you have allocated enough system resources to account for the necessary synchronization and communication among the members of the SSI cluster. Independent systems that are not formally clustered do not require this synchronization overhead. For example, two independent systems that run satisfactorily at peak utilization close to 100%, when joined in a cluster might fail.

### SSI Cluster Requirements

The following items are required to define and run a z/VM SSI cluster:

- Servers must be IBM System z10 or later.
- Shared and nonshared DASD:
  - Shared 3390 volume for the PDR.
  - Shared spool volumes.
  - If RACF is used, the RACF database must be on shared 3390 DASD.
  - All DASD volumes should be cabled to all members of the cluster. This allows volumes containing nonshared disks (for example, minidisks owned by multiconfiguration virtual machines) to be accessed by members other than the owning member when IPLed with the REPAIR parameter to fix configuration problems.

For normal operations, only the owning member should include a volume containing nonshared minidisks on a CP\_OWNED or USER\_VOLUME\_INCLUDE statement. All other members should configure the volume as OFFLINE\_AT\_IPL on a DEVICES statement. In the event repair is required, the volume can be manually varied online and attached to the system.
- See *z/VM: Installation Guide* for installation requirements.
- See *z/VM: General Information* for information about the DASD supported by z/VM.
- Connectivity:
  - A direct ISFC connection from each member of the SSI cluster to each of the other members. See “Planning the ISFC Network in an SSI Cluster” on page 726.
  - FICON channels to the shared DASD.
  - OSA access to the same LAN segments.
  - (If needed) FCP access to the same storage area networks (SANs) with the same storage access rights.
  - Shared access to any devices required by relocatable guests.
- IBM z/VM Single System Image Feature (VMSSI), appropriately licensed for the server processors that will host the members of the SSI cluster. For more information, see *z/VM: License Information*.
- Single system configuration file for all members of the SSI cluster (created when the SSI cluster is installed).
- Common source directory for all members of the SSI cluster (created when the SSI cluster is installed).



- Capacity planning for the SSI cluster, as well as for the individual members, to ensure that sufficient resources are available for guests that relocate from one member to another or that log on to different members of the cluster.
- If you are using an external security manager (ESM), such as RACF, the ESM database must be shared by the members of the SSI cluster. For information about sharing RACF databases in an SSI cluster, see *z/VM: RACF Security Server System Programmer's Guide*.

### SSI Cluster Restrictions

An SSI cluster has the following restrictions:

- The physical systems must be close enough to allow FICON CTCs, shared DASD, and common network and disk fabric connections.
- Installation on SCSI devices is not supported; however, post-installation use of SCSI devices by guests is permitted.
- The live guest relocation function is currently supported only for Linux on System z guests.

### Suggested Practices for Setting Up an SSI Cluster

You also might find it beneficial to follow these practices:

- To simplify the references in the system configuration file and the source directory, use common real device numbers across the LPARs. For example:
  - Use the same real device number to reference a DASD.
  - Use the same real device numbers for FICON CTCs between pairs of member systems.
  - Use the same range of real device numbers for the OSA or HiperSockets subchannels connected to the same network.
  - Use the same range of real device numbers for the FCP subchannels connected to the same fabric.
- For availability reasons, install no more than two members of an SSI cluster on the same server.
- Maintain a parallel volume layout (minidisk definitions) on the corresponding nonshared DASD volumes for each member of the cluster.
- For each member of the cluster, allocate object directory extents only on the system residence volume.
- To simplify release-to-release migration, do not place user data on the installation volumes.
- To simplify expansion of an SSI cluster (by cloning an existing member), keep member-specific data and SSI cluster data on separate volumes.
- If the members of the SSI cluster will not have the same hardware features and architectural enhancements, consider the effect on a guest virtual machine should you want to relocate it. This consideration could affect the relocation domains that you define and which guests you assign to those domains. You might want to record the hardware features or architectural enhancements that are important for each guest that might be relocated. For example, a guest might need a particular type of cryptographic feature or High Performance FICON for System z (zHPF). For additional details see “Using Relocation Domains” on page 750.

For additional information on topics related to setting up and running an SSI cluster, see IBM z/VM Single System Image and Live Guest Relocation ([www.ibm.com/vm/ssi/](http://www.ibm.com/vm/ssi/)).

### Planning the ISFC Network in an SSI Cluster

Each member in the SSI cluster must have a direct ISFC connection to every other member in the SSI cluster. SSI traffic from one member to another never flows through an intermediate member. Figure 48 illustrates this topology with no intermediaries, sometimes called “fully connected.”

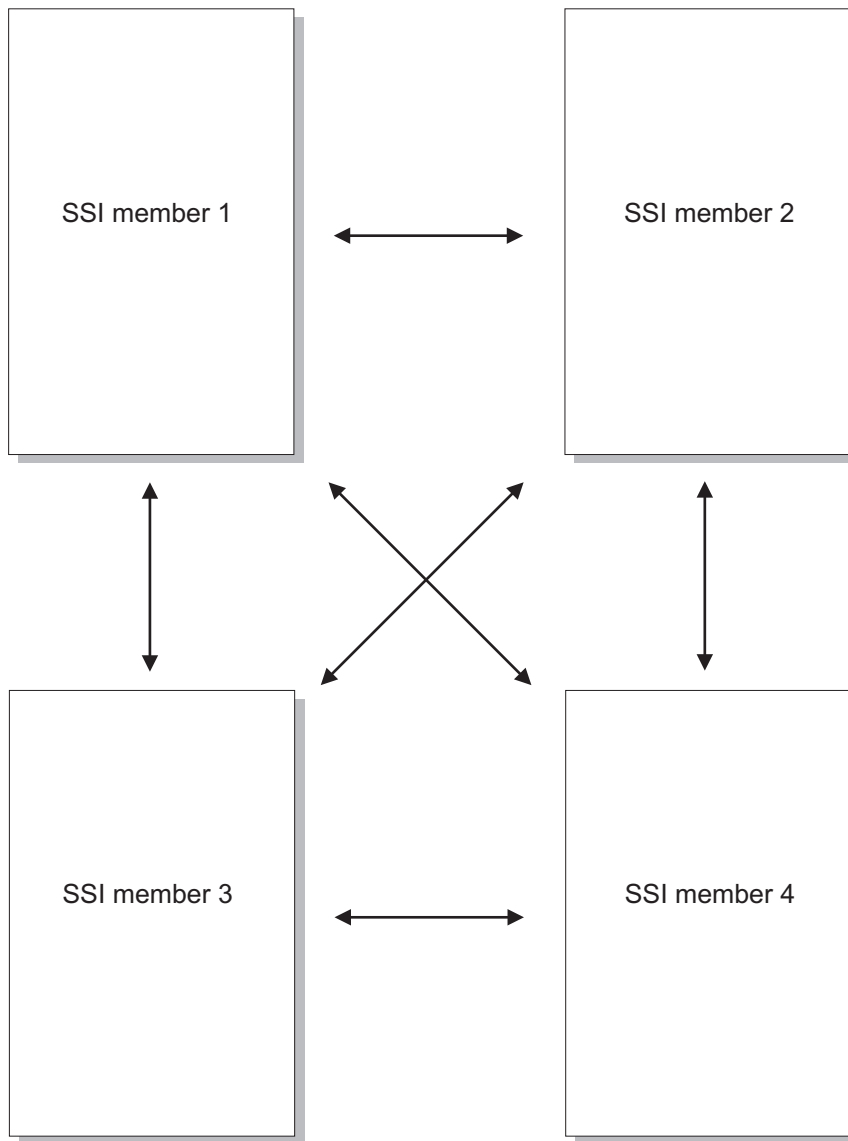


Figure 48. Fully Connected ISFC Topology

The ISFC connection from one member to another is called an *ISFC logical link*, or simply a *logical link*. There is always exactly one ISFC logical link between two members. Figure 49 on page 727 illustrates that there is exactly one ISFC logical link connecting member 1 to member 2.

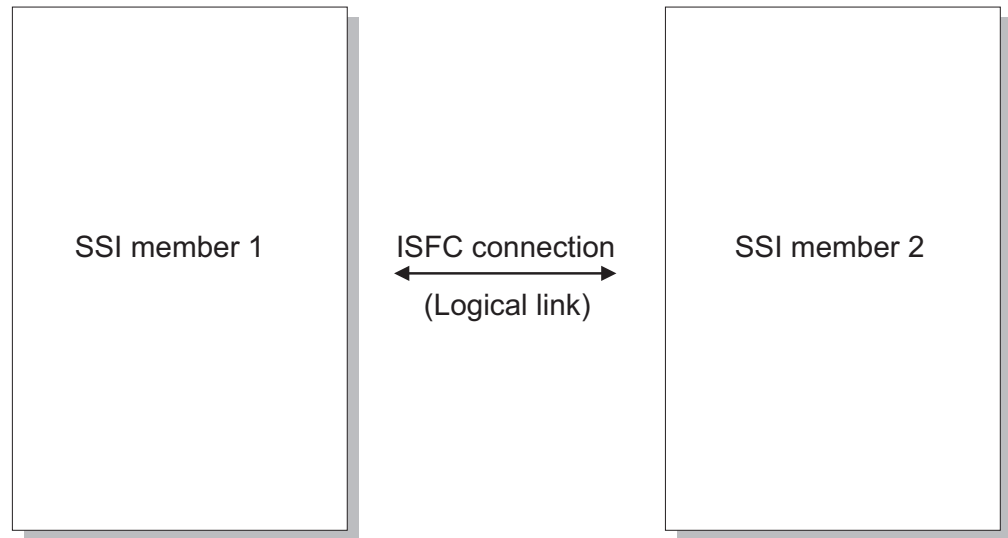


Figure 49. Logical Link

A logical link is composed of 1 - 16 channel-to-channel (CTC) devices. The channel paths on which these CTCs reside can be either unswitched channel paths or switched channel paths. For example, the logical link might be composed of eight CTCs spread among two unswitched FICON channel paths. Figure 50 illustrates the example, depicting four CTCs on one FICON channel path and four more CTCs on another FICON channel path. Together these eight CTCs compose the logical link.

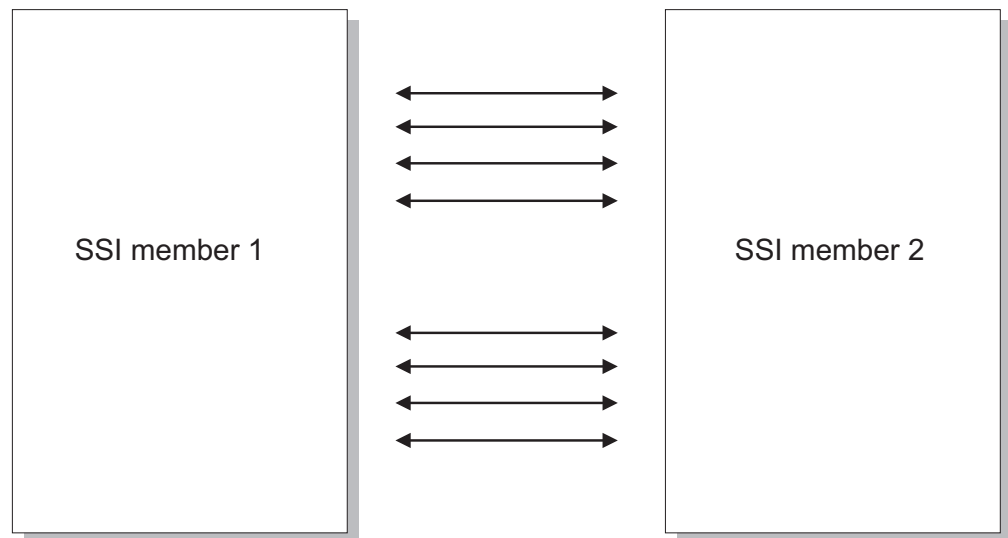


Figure 50. One Logical Link Composed of Multiple CTC Devices

For best operation, follow these guidelines for configuring logical links:

- Compose the logical link with more than one CTC. Having more than one CTC lets the two members avoid a CTC phenomenon called *write collisions*. A write collision happens when the two members both try to transmit data on the same CTC at the same instant in time. Write collisions have a severe negative impact on the performance of the logical link. When the logical link is composed of more than one CTC, write collisions rarely occur.

## Setting Up an SSI Cluster

- Distribute the logical link CTCs among multiple FICON channel paths. For example, if you were going to use six CTCs for your logical link, place three of the CTCs on one FICON channel path and three on another. Using multiple channel paths helps protect the logical link from becoming severed in the event that a fiber is inadvertently disconnected or damaged.
- Performance measurements of guest relocation workloads suggest that ISFC is able to use the entire data-carrying capacity of a FICON channel path's optical fiber when only four CTCs are configured on that channel path. Thus, it is generally advised not to put more than four CTCs onto any one FICON channel path.
- As a preferred practice, make sure that for each CTC you use, the real device number of the CTC is the same on the two members. For example, CTC 6000 on member 1 would connect to CTC 6000 on member 2. Using different device numbers on the two ends of a CTC leads to confusion.
- If possible, use blocks of contiguous device numbers for the CTCs of a logical link. For example, CTCs 6000 - 6003 on member 1 would connect to CTCs 6000 - 6003 on member 2.
- Configure your logical link so that it exhibits *symmetric performance*. Symmetric performance means that a given virtual server relocates from member 1 to member 2 with the same performance as when the virtual server relocates from member 2 to member 1.
  - Whether a logical link exhibits symmetric performance is determined by the speeds of the FICON channel paths on which the logical link's CTCs reside.
  - Keep in mind that the speed of a FICON channel path is determined by the types of FICON Express adapters used on the two ends, and by the type of Gigabit Interface Converter (GBIC) installed into each of the two FICON channel adapters; and, if the FICON channel is switched, then also by the GBICs installed into the FICON switch and by any management or tuning selections made in the FICON switch.
  - A logical link composed of FICON channel paths of all the same speed always has symmetric performance.
  - A logical link composed of FICON channel paths of differing speeds must be built very carefully to assure symmetric performance.
  - If the FICON channel paths have differing speeds, symmetric performance is achieved by carefully choosing the relationship between CTCs, their device numbers, and their FICON channel path speeds, *on the end of the logical link whose z/VM member name comes first in the alphabet*.

On the end whose z/VM member name comes first in the alphabet, make sure that you arrange the CTCs and channel paths so that when you sort the device numbers of the CTCs in ascending order, the CTCs in the middle of the sorted list are on the slow FICON channel paths and the CTCs on the ends of the sorted list are on the fast FICON channel paths.

For example, if you have:

- z/VM members NYORKVM and BOSTONVM connected by a logical link
- The logical link is composed of sixteen CTCs spread among four FICON channel paths
- Two of those FICON channel paths are 2 Gb/sec links and two others are 4 Gb/sec links

you could assure symmetric performance by configuring the relationship between CTC device numbers and FICON channel path speeds on the BOSTONVM side to look like Figure 51 on page 729:

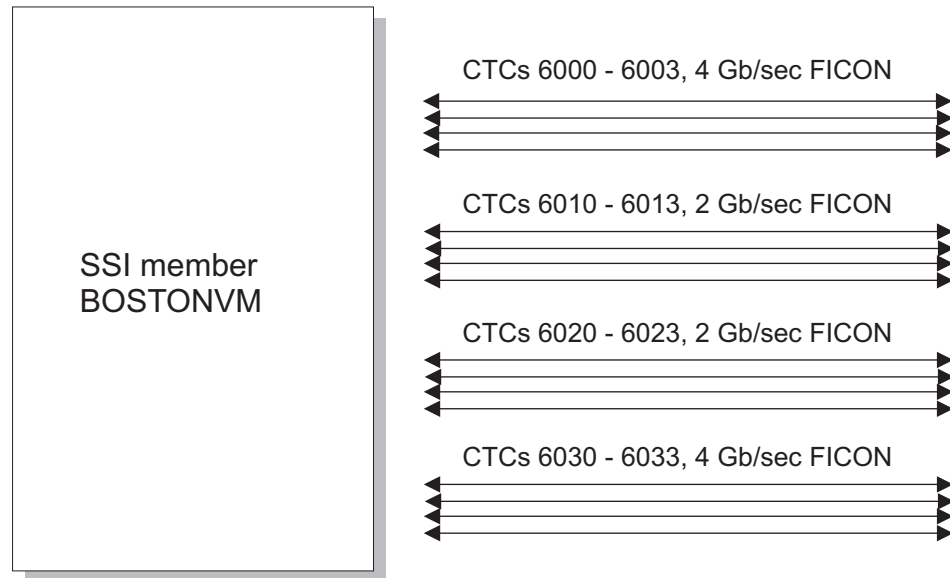


Figure 51. Example of Symmetric Performance with FICON Channel Paths of Differing Speeds

For symmetric performance, it makes no difference what the CTC device numbers are on the NYORKVM side. However, for manageability purposes and to avoid confusion, it is a preferred practice that CTC device numbers match on the two ends of the logical link.

- You can build the logical link out of more CTCs and faster FICON channel paths than you think your relocation workload can saturate. There is no negative performance consequence for having over-designed or over-provisioned the logical link.

## Including an SSI Cluster in a Larger ISFC Collection

The members of an SSI cluster are more tightly connected than typical nodes in an ISFC collection and are subject to more stringent timing constraints. If an SSI cluster is included in a larger ISFC collection, you should avoid creating a connectivity structure that requires the members of the SSI cluster to carry traffic for the collection that might interfere with critical communications within the cluster. As shown in Figure 52 on page 730, the communication links should be designed so that the members of the SSI cluster do not have to act as intermediate nodes for ISFC nodes that are not members of the same SSI cluster.

## Setting Up an SSI Cluster

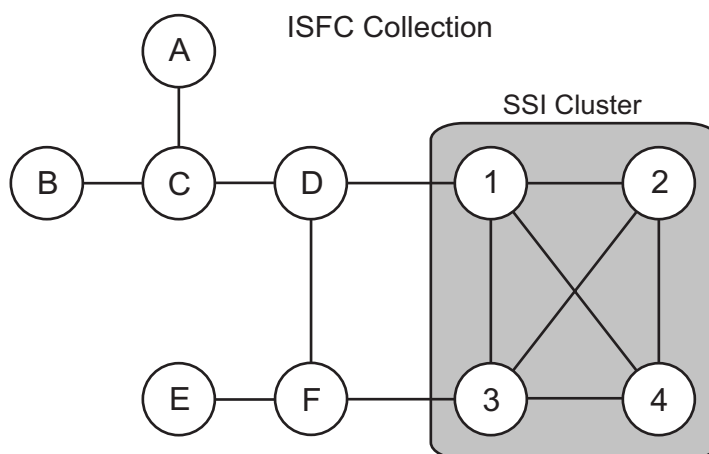


Figure 52. Example of an SSI Cluster within a Larger ISFC Collection

## Creating a z/VM SSI Cluster

A z/VM SSI cluster can be created all at once or member by member. Table 42 identifies tasks for creating an SSI cluster and adding or removing members and indicates where you can find the corresponding information and procedures.

**Note:** Creating a single-member SSI cluster is intended to be the first step in moving to a multimember SSI cluster. At a later date the single member can be cloned to add other members to the cluster.

Table 42. Creating an SSI Cluster and Adding or Removing Members

| Task                                                                                                                                   | Information and procedures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Migrate</b> a pre-z/VM V6.2 system (not part of a CSE complex) to z/VM V6.3 and convert it to the initial member of an SSI cluster. | <p>This process has three phases:</p> <ol style="list-style-type: none"> <li>1. Install a z/VM V6.3 system using one of the non-SSI installation procedures documented in <i>z/VM: Installation Guide</i>.</li> <li>2. Transfer the files, applications, and other information you need from your old system to the new system. To ensure a smooth upgrade to the new release, follow the z/VM migration procedure documented in <i>z/VM: Installation Guide</i>.</li> <li>3. Convert the new system to a single-member SSI cluster. Follow the instructions in Chapter 28, "Converting a z/VM System to a Single-Member z/VM SSI Cluster," on page 759.</li> </ol> |

Table 42. Creating an SSI Cluster and Adding or Removing Members (continued)

| Task                                                                                                                                                                    | Information and procedures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Install</b> an SSI cluster consisting of up to four z/VM images.                                                                                                     | Use one of the SSI installation procedures documented in <i>z/VM: Installation Guide</i> .<br><b>Note:</b><br><ol style="list-style-type: none"> <li>1. You can install an SSI cluster with more members than you need right now. The installation program will install the z/VM images and create the cluster structure for the “extra” members, and you can activate them when you need them.</li> <li>2. You can install the SSI cluster first-level (where the members will be IPLed in logical partitions) or second-level (where the members will be IPLed in virtual machines). A second-level SSI cluster can be moved to first-level at a later date.</li> </ol> |
| <b>Convert</b> a non-SSI z/VM V6.2 or later system to a single-member SSI cluster.                                                                                      | Follow the instructions in Chapter 28, “Converting a z/VM System to a Single-Member z/VM SSI Cluster,” on page 759.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Add</b> a new member to an SSI cluster by cloning an existing member.                                                                                                | Follow the instructions in Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Move</b> an SSI cluster installed second-level (where the members are IPLed in virtual machines) to first-level (where the members are IPLed in logical partitions). | Follow the instructions in Chapter 31, “Moving a Second-Level z/VM SSI Cluster to First-Level,” on page 821.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Combine</b> two non-SSI z/VM V6.2 or later systems to create an SSI cluster with two members.                                                                        | Follow the instructions in Chapter 32, “Combining Two Non-SSI z/VM Systems to Create a z/VM SSI Cluster,” on page 827.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Remove</b> a member from an SSI cluster permanently.                                                                                                                 | Follow the instructions in Chapter 30, “Decommissioning a Member of a z/VM SSI Cluster,” on page 803.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Convert</b> a CSE complex to an SSI cluster.                                                                                                                         | See Chapter 33, “Converting a CSE Complex to a z/VM SSI Cluster,” on page 835.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## z/VM SSI Cluster Operation

A z/VM system that is configured as a member of an SSI cluster joins the cluster when the system is IPLed. To successfully join the cluster, the member:

- Verifies that its configuration is compatible with the cluster
- Establishes communication with other members
- Verifies compatible definitions with the other members

A member leaves the cluster when it shuts down.

The state of each member and the operating mode of the cluster determine the degree of communication, resource sharing, and data sharing among the members. The operating mode is determined by the states of all the members at any point in time.

## Cluster Modes

The operating modes of an SSI cluster are:

## Setting Up an SSI Cluster

**Stable** The SSI cluster is fully operational.

**Influx** A member is joining or leaving the SSI cluster.

The cross-system functions of the SSI cluster are temporarily suspended, and negotiations on access to shared resources are deferred. Accesses already negotiated are not affected.

This is a transient condition. No intervention is required unless a problem occurs.

**Safe** A member of the SSI cluster is in an unknown state.

Communication with a member has been lost or has timed out without the member formally leaving the cluster. To preserve data integrity, new attempts to access shared resources will fail until the situation is resolved. Accesses already negotiated are not affected.

This mode is automatically corrected if communication is restored or if the member is recognized as being in the Down state. If necessary, this mode can be corrected manually by an operator who confirms that the system is down and declares it so with the SET SSI command.

### Normal Member States

Typically, each member of an SSI cluster will be in one of the following states:

**Down** A member is in the Down state when:

- The member has not been IPLed.
- The member has been IPLed but has not yet joined the cluster.
- The member has been shut down.
- The member has abended but has not yet restarted.
- The SET SSI command has been issued from another member to declare this member is down.

**Joined** Usually, all active (IPLed) members are in the Joined state and are fully participating in SSI cluster operations. When all active members are in the Joined state, the cluster is in the Stable mode.

#### Joining

When a member is in the Joining state, it is in the process of exchanging information and verifying compatible definitions with the Joined members. A member is in the Joining state during IPL or when it is recovering from an error state (see “Member Error States” on page 733). When a member being IPLed is in the Joining state, the cluster is in the Influx mode. When a member recovering from an error condition is in the Joining state, the cluster can be in either the Safe mode or the Influx mode. This is a transient state and mode combination that lasts only for a short time. The Joining member will transition to the Joined state and the cluster will return to the Stable mode.

#### Leaving

When the SHUTDOWN command is issued on a member that is in the Joined state, that member's state changes to Leaving. When a member is in the Leaving state, the cluster is in the Influx mode. This is a transient state and mode that lasts only for a short time. The Leaving member will transition to the Down state and the cluster will return to the Stable mode.

**Note:** Only one member can be in the Joining state or the Leaving state at any given time.



## Member Error States

When an error condition occurs in the cluster, communication and exchange of information about shared resources that normally occurs among members might be inhibited. This type of error results in one of the following states:

### Suspended

A member enters the Suspended state when it unexpectedly loses connectivity to another member. When a member is in the Suspended state, the cluster is in the Safe mode. Depending on the cause of the error condition, this state and mode might be either transient or long lasting.

When any member enters the Suspended state, all active members must enter the Suspended state before the cluster can recover and return to a normal mode.

Some error conditions that result in the Suspended state will be corrected automatically, but others might require operator intervention. When the error condition no longer exists, each member automatically will go through the Joining process. Eventually all members will return to the Joined state and the cluster will return to the Stable mode.

### Isolated

When an error occurs that prevents a member from joining the cluster during IPL, the member enters the Isolated state. An isolated member does not communicate with the other members and does not participate in SSI cluster operations.

When a member is in the Isolated state, that member sees the cluster mode as Safe. The states of the other members and the overall cluster mode are not affected by the state of the isolated member.

When the error is corrected, the isolated member must be shut down and re-IPLed in order to attempt to join the cluster again.

## Checking the Member States and the Cluster Mode

Each member of the cluster keeps track of the states of all members as well as the mode of the cluster. Normally, all members' views of each member's state are the same. However, in some error conditions, the members' views of the other members' states might not match. Each member's state is also recorded in the persistent data record (PDR).

The QUERY SSI command can be used to check the states of all the members and the mode of the cluster. For example:

```
query ssi
```

```
SSI Name: CLUSTERA
SSI Mode: Influx
Cross-System Timeouts: Enabled
SSI Persistent Data Record (PDR) device: VMCOM1 on EFE0
SLOT SYSTEMID STATE PDR HEARTBEAT RECEIVED HEARTBEAT
1 VMSYS01 Joined 2010-07-11 21:22:00 2010-07-11 21:22:00
2 VMSYS02 Joined 2010-07-11 21:21:40 2010-07-11 21:21:40
3 VMSYS03 Joining 2010-07-11 21:21:57 None
4 VMSYS04 Down (not IPLed)
```

The FORMSSI utility (located on the PMAINT 551 disk) can be used to check the states of all the members (as well as other information) in the PDR. For example:

## Setting Up an SSI Cluster

```
formssi display efe0
```

```
HCPPDF6618I Persistent Data Record on device EFE0 (label VMCOM1) is for CLUSTERA
HCPPDF6619I PDR state: Unlocked
HCPPDF6619I time stamp: 07/11/10 21:22:03
HCPPDF6619I cross-system timeouts: Enabled
HCPPDF6619I PDR slot 1 system: VMSYS01
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 07/11/10 21:22:00
HCPPDF6619I last change: VMSYS01
HCPPDF6619I PDR slot 2 system: VMSYS02
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 07/11/10 21:21:40
HCPPDF6619I last change: VMSYS02
HCPPDF6619I PDR slot 3 system: VMSYS03
HCPPDF6619I state: Joining
HCPPDF6619I time stamp: 07/11/10 21:21:57
HCPPDF6619I last change: VMSYS03
HCPPDF6619I PDR slot 4 system: VMSYS04
HCPPDF6619I state: Down
HCPPDF6619I time stamp: 07/02/10 17:02:25
HCPPDF6619I last change: VMSYS02
```

## SSI Cluster Problem Diagnosis

Problem diagnosis and resolution procedures in an SSI cluster depend on the type of problem and whether the problem occurred during system IPL or normal system operation.

**Tip:** One way to help avoid system IPL problems is to use the CPSYNTAX utility to validate the syntax of the common system configuration file.

*Table 43. Diagnosing and Resolving Problems in an SSI Cluster*

| Problem                                     | Diagnosis and Resolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>During system IPL</b>                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Member is active but in the Isolated state. | The error messages that were written to the operator's console can be used to help determine the cause of the problem.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Member is stopped in a disabled wait.       | <ol style="list-style-type: none"><li>1. The error messages that were written to the operator's console can be used to help determine the cause of the problem.</li><li>2. If the problem occurred before the operator's console was initialized, error messages might have been written to the line mode system console:<ul style="list-style-type: none"><li>• When the member is running in a logical partition (first level), these messages appear in the Operating System Messages window on the Hardware Management Console (HMC).</li><li>• When the member is running as a guest (second level), these message appear on your virtual machine console.<br/><b>Note:</b> If the console screen clears before you are able to read the messages, you can display the messages (and force them to remain on the screen) by setting your console mode to 3215 and IPLing with the LOADPARM CONSSYSC operand. For example:<br/>IPL 1111 CLEAR LOADPARM CONSSYSC</li></ul></li></ol> |

Table 43. Diagnosing and Resolving Problems in an SSI Cluster (continued)

| Problem                                                       | Diagnosis and Resolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Member has a configuration error.                             | <ol style="list-style-type: none"> <li>1. Log on as a privileged user ID on a different active member of the SSI cluster and fix the error.</li> <li>2. If the error occurred on a first level system and no other member is active, you might need to IPL with the REPAIR parameter. For more information, see "Passing IPL Parameters" on page 36.</li> <li>3. If the error occurred when IPLing a guest (second level) system, fix the error from the first level user ID.</li> </ol>                                                                                                     |
| Communication to the other members cannot be established.     | During system IPL, a member must establish communication to all other active members of the cluster. System IPL will not proceed until all necessary communication is established. Ensure that all joined remote members have active ISLINKs (ISFC connections) to the member being IPLed.                                                                                                                                                                                                                                                                                                   |
| <b>During normal operation</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Communication among the members is inhibited.                 | <p>If a hardware or software malfunction causes an unexpected loss of connectivity in the cluster, each member enters the "Suspended" state.</p> <ol style="list-style-type: none"> <li>1. Issue the QUERY SSI CONNECTIVITY and QUERY ISLINK commands. Analyze the responses from these commands to determine which ISFC connection is not working.</li> <li>2. When the error condition is fixed, the members will automatically go through the Joining process.</li> </ol>                                                                                                                 |
| Connectivity has been temporarily lost due to a system abend. | <p>A system abend has caused a loss of connectivity while the member dumps and restarts:</p> <ol style="list-style-type: none"> <li>1. Before dumping, the member specified its state as Down in the PDR.</li> <li>2. Once all of remaining members recognize this state change, after they have all entered the Suspended state they will go through the Joining process, and the cluster will go back to the Stable mode without the member that abended.</li> <li>3. Eventually the member that abended will restart and go through the Joining process to rejoin the cluster.</li> </ol> |

Table 43. Diagnosing and Resolving Problems in an SSI Cluster (continued)

| Problem                       | Diagnosis and Resolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Member is in a disabled loop. | <ol style="list-style-type: none"><li>1. The system operator for that member should invoke the system restart function to cause the member to go through system termination and specify its state as Down in the PDR.</li><li>2. When all of remaining members recognize this state change, after they have all entered the Suspended state they will go through the Joining process, and the cluster will go back to the Stable mode without the member that is down.</li><li>3. In the rare case that a member is not active and has not marked itself as Down in the PDR:<ol style="list-style-type: none"><li>a. A privileged user ID on any active member can issue the following command to specify the member is down.<br/><pre>set ssi member sysname down</pre></li><li>b. When all of remaining members recognize this state change, after they have all entered the Suspended state they will go through the Joining process, and the cluster will go back to the Stable mode without the member that is down.</li></ol></li></ol> |

---

## Implications for Vendor Products and Customer Applications

Setting up an SSI cluster can have implications for vendor products and customer applications, such as those identified in the following topics. For information about how a particular vendor product works with SSI clusters, contact the vendor.

### Service Virtual Machines

Depending on the application, a service virtual machine (SVM) can be defined in one of two ways:

- A single instance within the SSI cluster

An SVM defined by a single-configuration virtual machine definition (USER definition) can log on to any member of the SSI cluster, but can be logged on to only one member at a time. In this case, the SVM will probably be useful only if it can supply services to virtual machines running on any member of the cluster.

- An instance on each member of the SSI cluster

An SVM defined by a multiconfiguration virtual machine definition (IDENTITY definition) can be logged on simultaneously to multiple members of the SSI cluster. Separate identity and subconfiguration entries in the definition can be used to tailor the SVM instance for each member of the cluster. In this situation, it is likely that each instance of the SVM will provide services only to the virtual machines that are running on the same member as that instance.

Using shared configuration files can simplify the deployment of member-specific SVMs. Member-specific configuration files for SVMs can be provided by placing the files on member-specific volumes, on local minidisks owned by multiconfiguration virtual machines, or on shared volumes using member-specific naming conventions.

## Guest Relocation

A key aspect of an SSI cluster is the ability of single-configuration virtual machines to run on any member of the cluster (one member at a time). A guest virtual machine can move between members by simply logging off one member and logging on another. Alternatively, the live guest relocation function can be used to move the guest from one member to another while still running. As a result, there might be implications for products and applications, particularly with respect to guest relocations. When reviewing the level of awareness of guest relocation:

- Products that do entitlement checking based on system name, processor CPUID, and other single-member criteria need to accommodate multiple possibilities if entitlement is for an SSI cluster.
- Products that do internal resource accounting or performance monitoring might need to recognize that different members of a cluster could exist on different physical servers and therefore have different performance characteristics, such as processor speed.
- When the implementation involves client and server virtual machines, the implementation or configuration might need to address communication or authentication requirements.
- Products that monitor other virtual machines for performance, accounting, availability, or other reasons might need to make changes to handle guests on different systems and guest relocations, where virtual machines seem to disappear or appear without logging off or on.
- Products sensitive to time might need to make changes to accommodate time differences between the members of the cluster.

---

## System Configuration File for a z/VM SSI Cluster

Table 44 on page 738 shows examples of some of the statements in a system configuration file for a four-member SSI cluster and provides a brief explanation of how each is used. Depending on the installation configuration, other statements can also be used. For complete information about all system configuration statements, see Chapter 6, “The System Configuration File,” on page 47.

## Setting Up an SSI Cluster

Table 44. Examples of Statements in a System Configuration File for an SSI Cluster

| Extract                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> /***** /*      System_Identifier Information      */ /*****  System_Identifier LPAR LP01 VMSYS01 System_Identifier LPAR LP02 VMSYS02 System_Identifier LPAR LP03 VMSYS03 System_Identifier LPAR LP04 VMSYS04 </pre>                                                                                                                                                                                                                                                                                                                                                                                        | <p>A <b>SYSTEM_IDENTIFIER</b> statement is required for each member of the SSI cluster, to define the unique identifier (system name) for the z/VM system to be run in a specified logical partition (LPAR). The system name on this statement (for example, VMSYS01) is used as the record qualifier parameter on configuration statements that apply only to that member of the cluster. When a member system is initialized in an LPAR, CP locates the <b>SYSTEM_IDENTIFIER</b> statement with that LPAR name (for example, LP01) and uses the system name to select the other configuration statements to be processed for that member — all statements qualified with that identifier and all statements with no qualifier.</p> <p>If the SSI cluster is installed to be IPLed second level, “LPAR <i>name</i>” identifies the first level user ID of the virtual machine in which the second level member will be run.</p> |
| <pre> /***** /*      SSI Statement                      */ /*****  SSI CLUSTERA PDR_Volume VMC0M1 ,     Slot 1 VMSYS01,     Slot 2 VMSYS02,     Slot 3 VMSYS03,     Slot 4 VMSYS04 </pre>                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>The <b>SSI</b> statement indicates this system configuration file defines an SSI cluster. The statement specifies the name of the cluster, the label of the DASD volume that contains the SSI persistent data record (PDR), and the system names of the members.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <pre> /***** /*      Relocation Domains                */ /*****  Relocation_Domain DOMAIN1 Members VMSYS01 VMSYS03 Relocation_Domain DOMAIN2 Members VMSYS02 VMSYS04 </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>RELOCATION_DOMAIN</b> statements are optional and can be used to define subsets of the SSI cluster membership. A domain specifies a set of systems among which a guest that is associated with that domain (by a <b>VMRELOCATE</b> directory statement) may relocate freely. The virtual architecture of the domain ensures that a guest is presented with the same set of architectural facilities in whichever member of the domain the guest runs. For more information, see “Using Relocation Domains” on page 750.</p>                                                                                                                                                                                                                                                                                                                                                                                                |
| <pre> /***** /*      Checkpoint and Warmstart Information      */ /*****  VMSYS01: System_Residence,     Checkpoint Volid M01RES    From CYL 21  For 9,     Warmstart  Volid M01RES    From CYL 30  For 9 VMSYS02: System_Residence,     Checkpoint Volid M02RES    From CYL 21  For 9,     Warmstart  Volid M02RES    From CYL 30  For 9 VMSYS03: System_Residence,     Checkpoint Volid M03RES    From CYL 21  For 9,     Warmstart  Volid M03RES    From CYL 30  For 9 VMSYS04: System_Residence,     Checkpoint Volid M04RES    From CYL 21  For 9,     Warmstart  Volid M04RES    From CYL 30  For 9 </pre> | <p>A <b>SYSTEM_RESIDENCE</b> statement is required for each member to identify its checkpoint and warm start areas.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

Table 44. Examples of Statements in a System Configuration File for an SSI Cluster (continued)

| Extract                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Explanation                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> /***** /*      CP_Owned Volume Statements      */ /***** /*      RES volume                      */ /*****  VMSYS01: CP_Owned   Slot   001   M01RES VMSYS02: CP_Owned   Slot   001   M02RES VMSYS03: CP_Owned   Slot   001   M03RES VMSYS04: CP_Owned   Slot   001   M04RES  /***** /*      COMMON volume                  */ /*****  CP_Owned   Slot   005   VMCOM1  /***** /*      DUMP &amp; SPOOL volumes          */ /*****  CP_Owned   Slot   010   M01S01 CP_Owned   Slot   011   M02S01 CP_Owned   Slot   012   M03S01 CP_Owned   Slot   013   M04S01  /***** /*      PAGE &amp; TDISK volumes          */ /*****  VMSYS01: BEGIN           CP_Owned   Slot 254   M01T01           CP_Owned   Slot 255   M01P01 VMSYS01: END  VMSYS02: BEGIN           CP_Owned   Slot 254   M02T01           CP_Owned   Slot 255   M02P01 VMSYS02: END  VMSYS03: BEGIN           CP_Owned   Slot 254   M03T01           CP_Owned   Slot 255   M03P01 VMSYS03: END  VMSYS04: BEGIN           CP_Owned   Slot 254   M04T01           CP_Owned   Slot 255   M04P01 VMSYS04: END </pre> | <p><b>CP_OWNED</b> statements for the system residence volume and paging and temporary disk volumes must be qualified for each member. CP_OWNED statements for the common (parm disk) volume and dump and spool volumes should not be qualified, so those volumes can be shared.</p> <p><b>Note:</b> The OWN and SHARED operands are ignored when the system configuration file defines an SSI cluster.</p> |

## Setting Up an SSI Cluster

Table 44. Examples of Statements in a System Configuration File for an SSI Cluster (continued)

| Extract                                                                                                                                                                                                                                                                                                                                                                                                              | Explanation                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> /***** /*      User_Volume_List Statements      */ /***** /*      COMMON user volumes      */ /*****  User_Volume_List 620RL1 620RL2 USRVL1  /***** /*      Member-specific user volumes      */ /*****  VMSYS01: User_Volume_List M01W01 M01W02 M01PV1  VMSYS02: User_Volume_List M02W01 M02W02 M02PV1  VMSYS03: User_Volume_List M03W01 M03W02 M03PV1  VMSYS04: User_Volume_List M04W01 M04W02 M04PV1 </pre> | <p>At least one <b>USER_VOLUME_LIST</b> statement should be qualified for each member to identify volumes to be used for member-specific minidisks. <b>USER_VOLUME_LIST</b> statements for common user volumes should not be qualified, so those volumes can be shared.</p>                                                          |
| <pre> /***** /*      DISTRIBUTE Statement      */ /*****  Distribute IUCV NO </pre>                                                                                                                                                                                                                                                                                                                                  | <p>For an SSI cluster, the <b>DISTRIBUTE IUCV</b> statement governs use of this feature beyond the cluster (for example, if the cluster is part of a larger ISFC collection). <b>NO</b> is the default value. However, regardless of the setting, cross-system IUCV is automatically available among the members of the cluster.</p> |



Table 44. Examples of Statements in a System Configuration File for an SSI Cluster (continued)

| Extract                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Explanation                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> /***** /*      Activate ISLINK statements      */ /***** /***** /*      ISFC links for Member 1      */ /*****  VMSYS01: Activate ISLINK m1_rdev1 m1_rdev2 Node VMSYS02 VMSYS01: Activate ISLINK m1_rdev3 m1_rdev4 Node VMSYS03 VMSYS01: Activate ISLINK m1_rdev5 m1_rdev6 Node VMSYS04  /***** /*      ISFC links for Member 2      */ /*****  VMSYS02: Activate ISLINK m2_rdev1 m2_rdev2 Node VMSYS01 VMSYS02: Activate ISLINK m2_rdev3 m2_rdev4 Node VMSYS03 VMSYS02: Activate ISLINK m2_rdev5 m2_rdev6 Node VMSYS04  /***** /*      ISFC links for Member 3      */ /*****  VMSYS03: Activate ISLINK m3_rdev1 m3_rdev2 Node VMSYS01 VMSYS03: Activate ISLINK m3_rdev3 m3_rdev4 Node VMSYS02 VMSYS03: Activate ISLINK m3_rdev5 m3_rdev6 Node VMSYS04  /***** /*      ISFC links for Member 4      */ /*****  VMSYS04: Activate ISLINK m4_rdev1 m4_rdev2 Node VMSYS01 VMSYS04: Activate ISLINK m4_rdev3 m4_rdev4 Node VMSYS02 VMSYS04: Activate ISLINK m4_rdev5 m4_rdev6 Node VMSYS03 </pre> | <p>A set of <b>ACTIVATE ISLINK</b> statements is required for each member of the SSI cluster, to identify channel-to-channel adapters (CTCAs) for ISFC links to the other members. Each member must have at least one direct ISFC link to each of the other members; this example shows devices for two links between members. The node ID specified on each statement is the system name of the member to be linked.</p> |



---

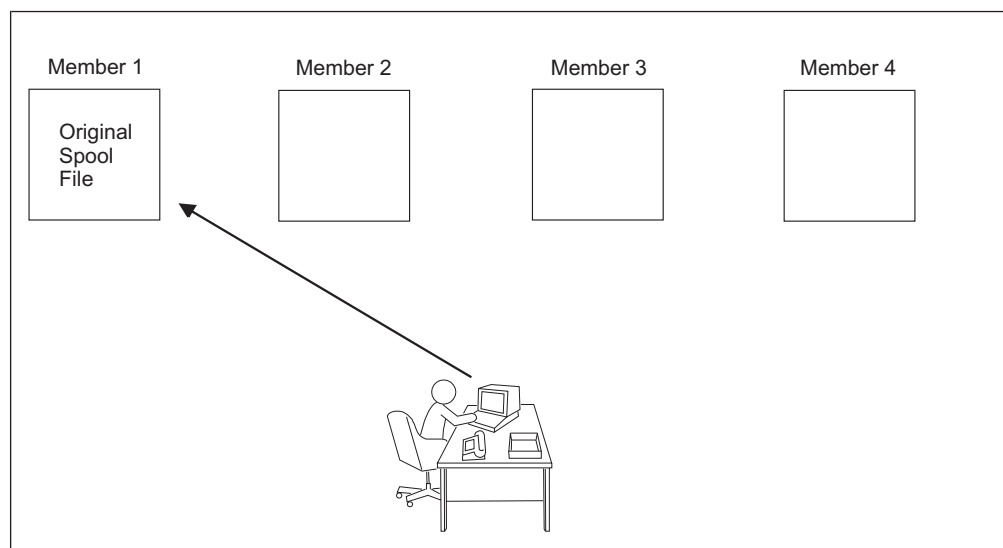
## Chapter 26. Cross-System Spool in a z/VM SSI Cluster

With cross-system spool, the CP spooling system can include up to four z/VM systems connected in an SSI cluster. Spool volumes are shared in an SSI cluster. Each member of the cluster creates spool files only on spool volumes that it owns, but each member has access to the spool volumes owned by the other members.

---

### Example of Cross-System Spooling

The following example shows how cross-system spooling works for a user in a four-member SSI cluster.



*Figure 53. Example of Cross-System Spooling in an SSI Cluster, Part 1*

In Figure 53:

1. The user logs on to member 1.
2. The user creates a reader spool file on member 1.

## Cross-System Spool in an SSI Cluster

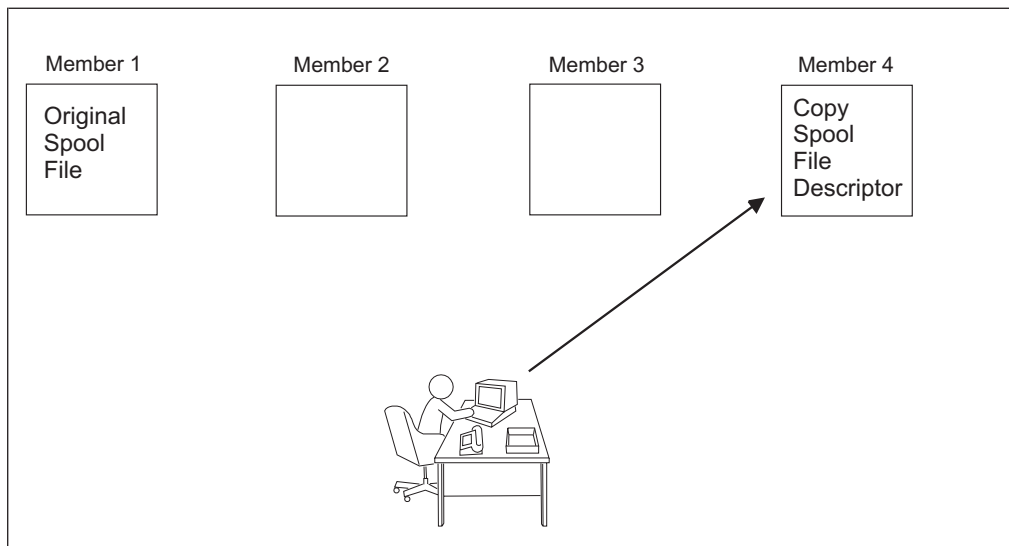


Figure 54. Example of Cross-System Spooling in an SSI Cluster, Part 2

In Figure 54:

1. The user logs off from member 1 and logs on to member 4.
2. Member 1 sends member 4 a copy of the spool file descriptor from the original spool file.
3. The user sees the spool file as being on member 4 and can process the reader spool file there.

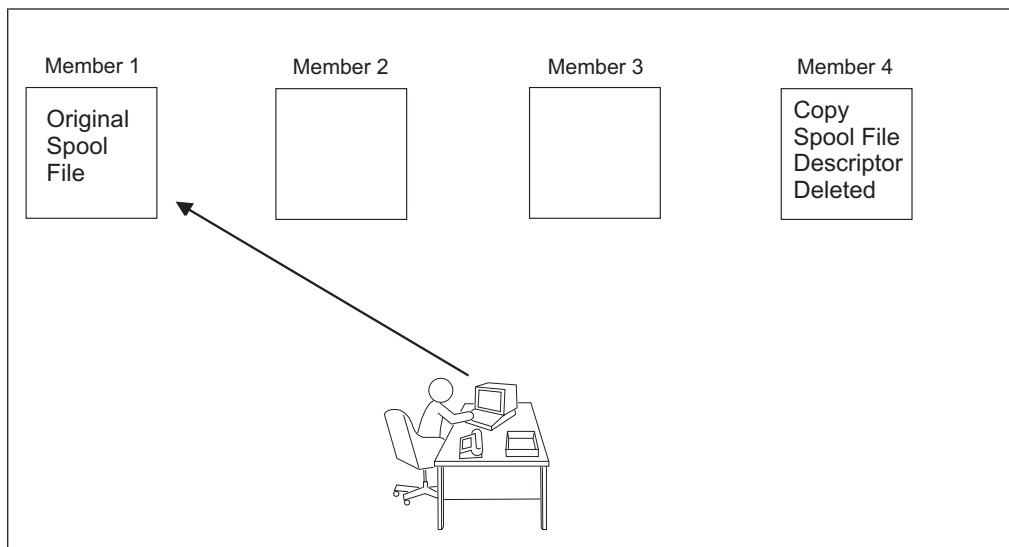


Figure 55. Example of Cross-System Spooling in an SSI Cluster, Part 3

In Figure 55:

1. The user logs off from member 4 and logs on to member 1.
2. The user can process the reader spool file on member 1.
3. The copy of the spool file descriptor on member 4 is deleted.

## How CP Spooling is Extended in an SSI Cluster

Within the SSI cluster, users defined as single-configuration virtual machines have a single logical view of all their spool files. Spooling devices (such as printers) are still controlled by the spooling operator logged on to the system that physically controls those devices. Users logged on to one of the members of the SSI cluster can access all of their spool files regardless of which member they have logged on to for that session. (For a spool file to be accessible, the member on which it was created must be joined to the cluster.) Users can transfer their spool files to other users or to service virtual machines anywhere in the cluster. They can select printers and other spool output devices for processing spool files created on any member of the cluster. Thus, the end-user view of spooling is nearly transparent. Although the CP commands that manipulate spool files operate differently internally for an SSI cluster, additional user options or parameters are not required.

**Note:** User IDs defined as multiconfiguration virtual machines do not participate in cross-system spool. See “Spool Files for Multiconfiguration Virtual Machines” on page 748.

In an SSI cluster, CP spooling functions on each member of the cluster manage and share spool files cooperatively with the other members. Because of this, when all the members are operating normally, there is little awareness of the SSI cluster and no special measures are required either for users or for operators.

Cross-system spool is concerned only with closed spool files and not with the allocation of CP spool space. Each member of the cluster has its own set of spool volumes to allocate from exclusively. All other members have read and write access to these spool volumes because they are on shared DASD. However, the other members cannot allocate or release space on these volumes.

The member on which a spool file is created owns the spool space. The spool descriptor on that member is called an *original spool descriptor*. The identity of the originating member, the one that owns the spool space the file occupies, is kept in the spool descriptor. Another member can receive a copy of the original spool descriptor, which is known as a *copy spool descriptor*. Copy spool descriptors can be deleted by any of the members, but the actual returning of spool file resources is performed by the originating member. Each member has peer status. This means that each member has responsibility for its original spool descriptors and for keeping the other members' copy spool descriptors up to date.

CP tries to minimize the number of copy spool descriptors by capitalizing on the inherent differences between input and output spool files. Output spool files must be available on all members so that they can be handled by real printers or punches. Input spool files must be available only on the member where their owning user ID is active.

Because more users are involved, the number of spool file blocks in an SSI cluster might easily exceed the number normally expected on a single system. Across the SSI cluster, the total amount of real storage required for original and copy spool file blocks increases each time a member receives a copy spool file block.

### Copy Input (Reader) Spool Files

When a spool file is closed and placed on the input (reader) queue and the owner is logged on to the same member of the SSI cluster, a copy spool descriptor is not sent to another member. There is just one original spool descriptor for this spool

## Cross-System Spool in an SSI Cluster

file. If the owner is logged on to a member other than the originating member, a copy input spool descriptor is sent to the member where the user is currently logged on. In this case, the original spool descriptor and one copy spool descriptor exist. If the owner is not logged on, only the original spool descriptor on the originating member exists.

When a user logs on, all other members of the cluster send a copy of any available input (reader) spool descriptors owned by the user to the member where the user is logged on. A copy input spool descriptor exists on a member as long as the owner remains logged on to that member, assuming nothing is done to change its place in the input queue. When a user logs off, all copy input spool descriptors on that member are deleted. Only the original spool descriptors remain on the originating member.

**Note:** If a reader spool file is being dumped to tape by the SPXTAPE DUMP command on the originating member, and the owner of the file is logged on to another member, there is no indication to the owner during the dump that the file is not available.

### Copy Output (Print and Punch) Spool Files

A copy spool descriptor is sent to all members of the SSI cluster when a spool file is added to the output (printer or punch) queue. The spool descriptor remains on all members until the file is processed, purged, or transferred to the input queue. When a copy output spool descriptor is transferred to the input queue and the owner is logged on to the member that initiated the transfer, the copy output spool descriptor becomes a copy input spool descriptor and the original output spool descriptor becomes an original input spool descriptor. If the owner is not logged on to the member that originated the transfer, the copy output spool descriptor is deleted and the original output spool descriptor becomes an original input spool descriptor.

When a member receives a copy spool descriptor (output or input), it allocates the same spool ID for the file as the original, or it does not allow the copy spool descriptor to remain on this member. A file's spool ID is always the same on all members of the cluster.

### Extended CP Spooling Commands

Cross-system spool extends the scope of the following CP commands to apply to spool files anywhere in the SSI cluster:

- CHANGE
- ORDER
- PURGE
- QUERY FILES
- QUERY { READER | PRINTER | PUNCH } ALTID
- QUERY { READER | PRINTER | PUNCH } XFER
- TAG
- TRANSFER

The syntax and operands of these commands are unchanged when used in an SSI cluster.

## How the CMS Productivity Aids Process Spool Files in an SSI Cluster

In an SSI cluster, if a user issues the CMS NOTE, SENDFILE, or TELL command without specifying the node, and the recipient is a single-configuration virtual machine, the recipient can display or receive the note, file, or message when logged on to any member of the cluster. If the node is omitted and the recipient is a multiconfiguration virtual machine, the recipient can display or receive the note, file, or message only when logged on to the same member as the sender. (If the node is specified for either type of user, the communication is routed to RSCS, and RSCS must be running on both members.)

When a user in an SSI cluster issues the CMS PEEK, RDRLIST, or RECEIVE command, any spool file that resides in the shared spool of the cluster (except files transmitted through RSCS) will appear to be local. That is, the file will appear to originate from the member where the command is issued, although the file might have been created on another member of the cluster and reside on a spool volume owned by that member. (For files transmitted through RSCS, the actual origin node is displayed or recorded.)

These CMS commands do not distinguish between the instances of a multiconfiguration virtual machine. For example, if a multiconfiguration virtual machine is logged on to two members of the SSI cluster and both instances of the user ID send a file with the same file ID (but which could have different content) to the same user (logged on to any member of the cluster), in the recipient's RDRLIST display both files will appear to originate from the instance of the multiconfiguration virtual machine on the member where the recipient is logged on.

## Spool File ID Assignment and Limits

The MAXSPOOL operand of the SPOOLFILE directory statement specifies the number of spool files that the user may own in the SSI cluster (collectively, on all members). The maximum number is 9999, which is the default.

For each user, spool file IDs are assigned according to the relative position (slot number) of the member where the file is created in the list of members on the SSI system configuration statement. For each new spool file created by the user on that member, the spool ID is increased by 4, regardless of how many members are currently in the cluster. Therefore, on member 1 the user's spool files are assigned spool IDs 1, 5, 9, and so on, up to 9997. On member 2, the user's spool files are assigned spool ID numbers 2, 6, 10, and so on, up to 9998. On member 3, the user's spool files are assigned spool ID numbers 3, 7, 11, and so on, up to 9999. On member 4, the user's spool files are assigned spool ID numbers 4, 8, 12, and so on, up to 9996.

The maximum number of spool files that the user can create on any one particular member of the cluster is one quarter of the MAXSPOOL value, regardless of how many members are currently in the cluster. If the MAXSPOOL value is not evenly divisible by four, the distribution is determined by the members' slot numbers. Therefore, if the MAXSPOOL value is 9999, the user can create 2500 spool files on member 1, 2500 spool files on member 2, 2500 spool files on member 3, and 2499 spool files on member 4.

## Access to Spool Files

Privileged users have access to all output spool files from any of the members of the SSI cluster. Privileged users can access the reader files of other users only on

the member where the owner is logged on and on the member having the original spool descriptor. However, because privileged users need access only to the spool files that their member can process or to the input files that exist on their member, this is not an important limitation.

### Spool Files for Multiconfiguration Virtual Machines

User IDs defined as multiconfiguration virtual machines do not participate in cross-system spool. Each instance of a multiconfiguration virtual machine can view only the spool files owned by the instance on that member. A spool file owned by another instance of the virtual machine (that is, logged on to another member) is not visible. Spool file transfer services, such as RSCS, can be used to move spool files to the member where the intended instance of the multiconfiguration virtual machine resides.

If a SPOOLFILE statement is included in the identity entry of the multiconfiguration virtual machine definition or any included profile entry, and no SPOOLFILE statements are included in the subconfiguration entries, the MAXSPOOL value is the number of spool files that user ID can own on each member of the cluster where the user ID can log on. The maximum value on each member is 9999, which is the default. On each member the spool ID numbers begin at 1 and are incremented by 1 for each new file, up to MAXSPOOL. A SPOOLFILE statement can be included in a subconfiguration entry to set the spool file limit for the virtual machine instance on a particular member of the cluster. This overrides the default value or the value set by a SPOOLFILE statement in the identify entry or a profile entry, but only for that member.



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## Chapter 27. Preparing for Guest Relocations in a z/VM SSI Cluster

In a z/VM SSI cluster, a running guest virtual machine can be moved from one member to another. This process is called *live guest relocation*. The functions for initiating and managing guest relocations are provided by the CP VMRELOCATE command.

To prepare for live guest relocation, you need to ensure that the virtual machine has a relocatable configuration and that a matching configuration can be set up on the destination system. There are configuration attributes the guest must not have, because they cannot be relocated, and there are also characteristics the destination system must have in order to provide an identical virtual machine configuration. The relocation will fail if the guest has a configuration attribute that the relocation process does not support or if the destination system cannot satisfy the guest's configuration requirements.

To help you determine a guest's eligibility for relocation, you can use the TEST option of the VMRELOCATE command. Messages will be issued to identify conditions that need to be resolved. Eliminating or correcting conditions that will prevent a relocation will reduce the number of messages issued by the command.

**Note:** An eligibility confirmation from VMRELOCATE TEST applies only to the specific point in time when the command was executed and therefore does not guarantee eligibility when you attempt the actual relocation.

You can define relocation domains in which guests can be relocated freely between machines of different models or with different firmware or features. In special circumstances you can force a relocation to be attempted, even if certain conditions exist that would ordinarily prevent it.

---

### Supported Configuration for Relocation

A guest can be relocated if it conforms to the following configuration:

**Note:** Linux on System z is currently the only guest environment supported for relocation.

- The guest is running in an ESA or XA virtual machine in ESA/390 or z/Architecture mode.
- The guest is running with a disconnected virtual console.
- The virtual machine is defined as a single-configuration virtual machine; that is, the virtual machine definition begins with a USER statement.
- The guest's virtual processors are either all type CP or all type IFL.
- The guest was IPLed from a device, or IPLed from a named saved system (NSS) that meets the NSS criteria identified in the next item.
- The guest can use a discontinuous saved segment (DCSS) or NSS as long as the DCSS or NSS contains no SW (shared write), SC (shared with CP), or SN (shared with no data) page ranges, and the identical DCSS or NSS is available on the destination system.
- The guest can have any of the following:

## Relocating a Guest in an SSI Cluster

- Mindisks.
- Dedicated devices, including OSA and FCP devices, provided that equivalent device access is available on the destination system.
- Private virtual disks in storage (created with the DEFINE VFB-512 command).
- Virtual unit record devices with no open spool files other than open console files. If the guest has an open console file, the relocation process will close the file on the source system and open a new one on the destination system.
- Virtual network interface cards (NICs) coupled to active virtual switches.
- The guest can be using any of the following facilities:
  - Cryptographic adapter, when enabled by a CRYPTO APVIRTUAL statement in the virtual machine definition, as long as the crypto cards used for shared domains on the source and destination systems are the same AP type. The AP and domain numbers may be different, but the AP types must be the same.
  - High Performance FICON for System z (zHPF), if this I/O architecture is supported by all processors, channel paths, and CP software levels on every member of the guest's relocation domain, as well as the storage controller.
  - Virtual machine time bomb (DIAGNOSE code X'288').
  - IUCV connections to the following CP system services:
    - \*MSG
    - \*MSGALL
  - Application monitor record collection (DIAGNOSE code X'DC', authorized by the APPLMON option in the virtual machine definition), if the guest buffer is not in a shared saved segment.
  - Single Console Image Facility (SCIF).
  - Collaborative Memory Management Assist (CMMMA).

### Attention:

- A Linux guest to be relocated that uses FCP devices must have multipathing support enabled with the **queue\_if\_no\_path** option.
- To avoid possible data loss or file corruption, a relocation should not be performed when the Linux guest is actively using SCSI tapes accessed via FCP.
- Do not relocate a Linux guest that is being monitored by the Virtual Machine Resource Manager (VMRM). System and guest performance results are unpredictable and very likely to be unsatisfactory.

If the guest has any other characteristics (such as IUCV connections to other system services or other users), then it cannot be relocated. Configuration attributes not supported for relocation are identified in “Conditions That Will Prevent a Relocation” on page 754.

---

## Using Relocation Domains

A relocation domain defines a set of members of an SSI cluster among which virtual machines can relocate freely. A domain can be used to define the subset of members of an SSI cluster to which a particular guest can be relocated. Relocation domains can be defined for business or technical reasons. For example, a domain can be defined that has all of the architectural facilities necessary for a particular application, or a domain can be defined to allow access only to systems with a particular software tool. Whatever the reason for the definition of a domain, CP will allow relocation among the members of the domain without any change to architectural characteristics or CP functionality as seen by the guest.

The relocation domain for a virtual machine can be defined with the VMRELOCATE directory statement. When the user ID logs on, CP assigns a *virtual architecture level* to the virtual machine that is the maximal common subset of the architectural features (hardware architecture facilities and CP-supplied features) of all the members of the SSI cluster that belong to that relocation domain. The guest cannot use architectural features that are not included in this virtual architecture level. This ensures that the guest can be freely relocated to other members of the domain because they provide the same architectural features. Note that a feature must be supported in every relevant component (processor, channel, and device hardware, as well as the z/VM software level) on every domain member in order to be usable to the guest.

**Note:** *Freely relocated* means relocated without regard to differences in machine models, firmware, or features. The guest must still conform to the other configuration requirements identified in “Conditions That Will Prevent a Relocation” on page 754.

To determine the virtual architecture level provided in the domain, CP gathers information on the instruction set, features, and software support available on each domain member. If a member is not currently joined, then CP uses the record of that member's capabilities when it was last joined. This ensures that in the most likely case, when that member is later IPLed with the same or a higher level of capability, the guests assigned to the domain will be able relocate there. If instead the member is IPLed on less capable hardware or at a lower CP software level, then the capabilities of the domain are adjusted downward. Guests that log on or re-IPL thereafter will be limited to the new maximal common subset of architected features, so that they can relocate throughout the domain. Guests that are already running when the domain is downgraded will keep the function level they have until the next guest IPL, but in the meantime, the deficient member will be excluded from the set of eligible relocation targets for that guest.

Relocation domains can be defined with the RELOCATION\_DOMAIN system configuration statement or dynamically using the DEFINE RELODOMAIN command.

Two types of relocation domains are defined implicitly:

- A domain that includes all of the members of the SSI cluster. The name of this domain is SSI.
- A domain that includes one member of the SSI cluster. A single-member domain is defined for each member. The name of the domain is the member's system name.

When a system defined as a member of an SSI cluster is IPLed and joins the cluster, any relocation domains defined in the system configuration file for the joining member are compared with the domains defined for the existing members. If they do not match exactly, the differences are reconciled as follows:

- If the existing members and the joining member have the same domain but the lists of members in the domain do not match, the definition of the domain in use by the existing members is used for the joining member.
- If the joining member has a new domain definition that does not currently exist in the set of domains defined in the SSI cluster, the new domain is added and is propagated to the other members.

When a user ID defined by a single-configuration virtual machine definition logs on, the default associated relocation domain is the entire SSI cluster (domain SSI),

## Relocating a Guest in an SSI Cluster

unless a different relocation domain has been set by a VMRELOCATE statement in the user's virtual machine definition. If relocation of the virtual machine has been disabled on the VMRELOCATE statement and no relocation domain has been specified, the default relocation domain is the single-member domain of the system where the user logs on, and the user is assigned a virtual architecture level that is the set of all the architectural features of that system.

A virtual machine can be dynamically reassigned to a different relocation domain (or relocation can be enabled or disabled) with the SET VMRELOCATE command, but only if the new domain includes all of the architectural features in the current virtual architecture level (unless the FORCE ARCHITECTURE option is used).

**Note:** A virtual machine defined by a multiconfiguration virtual machine definition cannot be relocated. Therefore a relocation domain cannot be set for it with the VMRELOCATE statement or the SET VMRELOCATE command.

To determine the current relocation domain setting for a virtual machine logged on to the local member of the SSI cluster, use the QUERY VMRELOCATE command. (To determine the relocation domain setting for a virtual machine logged on to a remote member of the cluster, you can use the AT command to issue the QUERY VMRELOCATE command.) To find out what members of the SSI cluster are included in a particular relocation domain, use the QUERY RELODOMAIN command. The QUERY VMRELOCATE command will also identify any domain members to which the guest is temporarily excluded from relocating because they lack the capabilities the guest depends on (for example, because the hardware or software level of the member has been downgraded, or the member was added to the relocation domain since this guest last IPLed).

Figure 56 on page 753 shows an SSI cluster that includes members VMSYS01, VMSYS02, VMSYS03, and VMSYS04. The members are located on different servers, which provide different sets of architectural facilities. In addition to the implicitly defined cluster-wide relocation domain (SSI) and single-member relocation domains (VMSYS01, VMSYS02, VMSYS03, and VMSYS04), three relocation domains have been explicitly defined. Domain X includes members VMSYS02 and VMSYS03, domain Y includes members VMSYS02 and VMSYS04, and domain Z includes members VMSYS03 and VMSYS04.

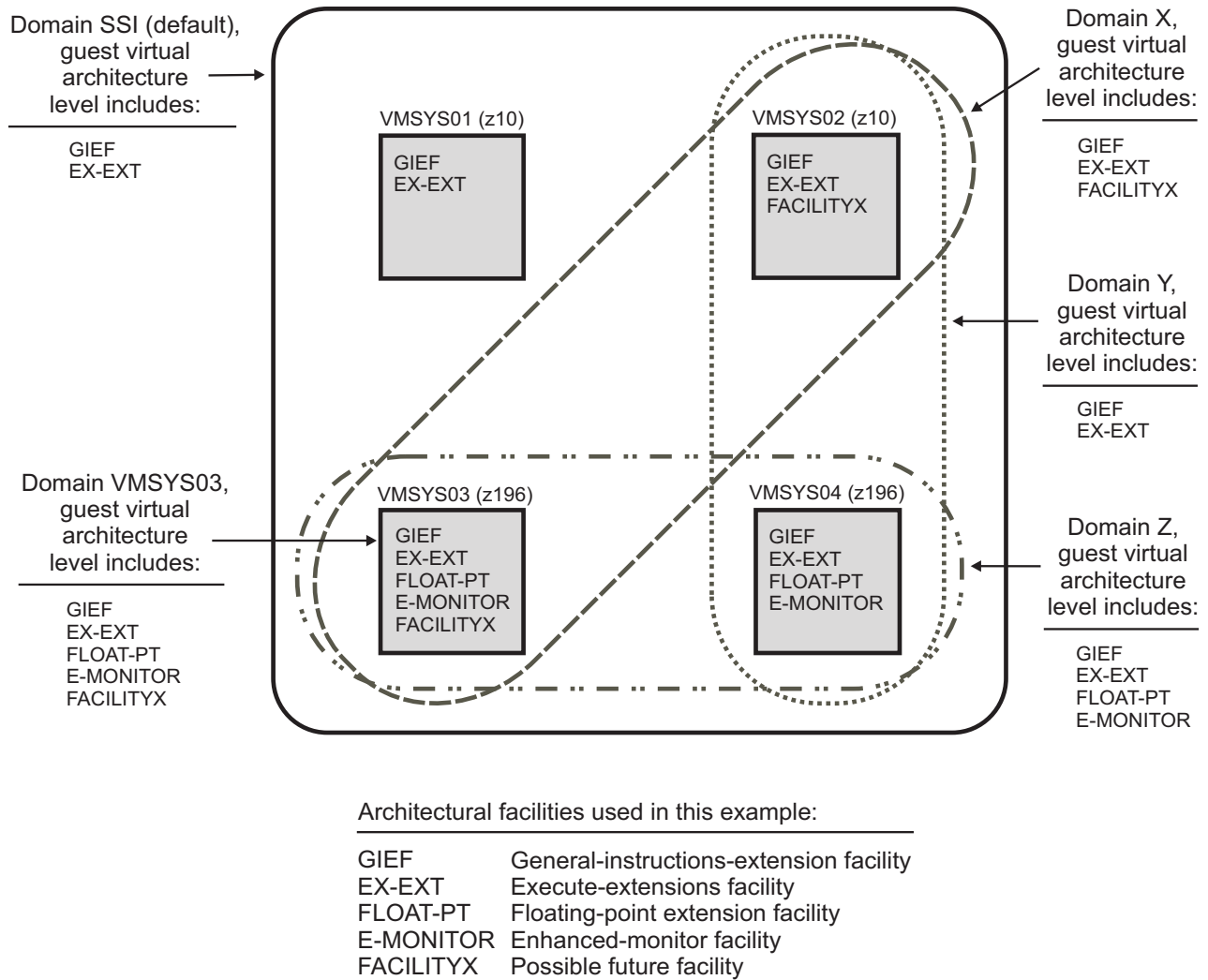


Figure 56. Example of Relocation Domains and Guest Virtual Architecture Levels in an SSI Cluster

The following scenarios apply to the environment shown in Figure 56:

- If a single-configuration virtual machine called USER1 is assigned to relocation domain X and logs on to member VMSYS03, the virtual architecture level that CP assigns to USER1 includes the general-instructions-extension facility, the execute-extensions facility, and the FACILITYX facility. USER1 can be freely relocated to member VMSYS02 because VMSYS02 is in the same relocation domain and provides the same architectural features.
- Although the floating-point extension facility is available on the server where member VMSYS03 is located, USER1 cannot use that facility because it is not included in USER1's virtual architecture level. To use the floating-point extension facility on member VMSYS03, USER1 must be reassigned to either domain Z or domain VMSYS03. However, if reassigned to domain Z, USER1 will no longer be able to use the FACILITYX facility.
- If a single-configuration virtual machine called USER2 is not assigned to any relocation domain and logs on to any member of the cluster, for example VMSYS03, the default associated relocation domain is domain SSI. The virtual architecture level that CP assigns to USER2 includes the general-instructions-

## Relocating a Guest in an SSI Cluster

extension facility and the execute-extensions facility. Because this virtual architecture level is supported on every member of the SSI cluster, USER2 can be freely relocated to any other member.

- If a single-configuration virtual machine called USER3 is assigned to relocation domain X and logs on to member VMSYS04, which is not included in domain X, CP assigns a virtual architecture level that includes the facilities that are common between domain X and member VMSYS04, which are the general-instructions-extension facility and the execute-extensions facility.
- If a multiconfiguration virtual machine called USER4 logs on to members VMSYS02 and VMSYS04, the associated relocation domain for the instance on member VMSYS02 is domain VMSYS02, and the associated relocation domain for the instance on member VMSYS04 is domain VMSYS04. The virtual architecture level for USER4 on VMSYS02 includes the general-instructions-extension facility, the execute-extensions facility, and the FACILITYX facility. The virtual architecture level for USER4 on VMSYS04 includes the general-instructions-extension facility, the execute-extensions facility, the floating-point extension facility, and the enhanced-monitor facility.

---

## Forcing a Relocation

In an emergency situation it might be necessary to ignore the results of certain parts of relocation eligibility checking and force a relocation to occur. This can be done by specifying the **FORCE** option on the **VMRELOCATE MOVE** command.

### **FORCE ARCHITECTURE**

Attempts the relocation even though the virtual machine is currently running at a virtual architecture level that includes hardware architectural facilities or CP-supplied features not available on the destination system.

### **FORCE DOMAIN**

Attempts the relocation even though the virtual machine would be moved outside of its domain.

### **FORCE STORAGE**

Overrides the following memory capacity assessment checks:

- Guest storage size exceeds auxiliary paging capacity on the destination.
- Guest maximum storage size exceeds available space on the destination.
- Guest maximum storage size exceeds auxiliary paging capacity on the destination.

The **FORCE STORAGE** option will not override the check for guest current storage size exceeding available space on the destination. For more information, see “Resource Limit Conditions” on page 758, or see the **VMRELOCATE** command in *z/VM: CP Commands and Utilities Reference*.

**Attention:** The **FORCE** option is to be used only in an emergency situation and does not guarantee that the guest can run on the new system. The relocated guest might fail on the new system because a facility in use by the guest was removed by the forced relocation.

---

## Conditions That Will Prevent a Relocation

The live guest relocation process will fail if any of these conditions are encountered.

- “Guest State Conditions” on page 755
- “Device Conditions” on page 755



- “Device State Conditions” on page 756
- “Virtual Facility Conditions” on page 757
- “Configuration Conditions” on page 757
- “Resource Limit Conditions” on page 758
- “Other Conditions” on page 758

### Guest State Conditions

The relocation will fail if any of these guest state conditions exist:

- The user ID is still logging on or is being autologged.
- The user ID is logging off or is being forced off the system.
- The guest is terminating; that is, CP is waiting for the guest to respond to a shutdown signal.
- The guest is IPLing. (You must verify that the guest has completed the IPL, as the system will not detect it.)
- A system reset of the guest is in progress.
- The guest is the primary system operator.
- The guest is defined as a multiconfiguration virtual machine; that is, the user's virtual machine definition begins with an IDENTITY statement.
- The guest has an architecture incompatibility as determined by the guest's relocation domain and the architectural capabilities of the source and destination systems.
- The SET VMRELOCATE OFF command has been issued for this guest.
- The guest is an XC mode virtual machine.
- A relocation of this guest is already in progress.

### Device Conditions

The relocation will fail if any of these device conditions exist:

- The guest has a virtual 3270 device or session (device type GRAF) as a virtual console or has a dialed or attached device.
- The ASCII console is attached to the guest.
- The guest has a temporary disk (T-disk) attached.
- The guest has a shareable virtual disk in storage attached (created by an MDISK directory statement with the V-DISK operand).
- The guest configuration includes an unsupported device.
- The guest configuration includes a logically connected virtual communication line (device type LINE).
- The guest configuration includes a virtual channel-to-channel adapter (CTCA).
- The guest configuration includes a dedicated dynamic switching device.
- The guest has a link to a local minidisk or a minidisk that cannot be linked on the destination system.

Local minidisks include minidisks owned by local instances of multiconfiguration virtual machines (such as MAINT 190, 193, 19D, and 19E).

- The guest has a link to a minidisk created with the DEFINE MDISK command.
- The guest has a link to a minidisk currently using virtual working allegiance simulation (set with the SET WRKALLEG ON command).
- The guest has a link to a non-fullpack minidisk authorized for virtual reserve/release support (defined with access mode suffix V on the MDISK directory statement).

## Relocating a Guest in an SSI Cluster

- The guest has a virtual DASD associated with a real device currently quiesced for HyperSwap®.
- The guest has a virtual FBA DASD associated with a real device for which a reserve might still be held.
- The guest configuration includes a real device for which an associated equivalency ID (EQID) does not exist. (For more information about EQIDs, see “Real Device Management” on page 722.)
- The guest configuration includes a real FCP, OSA, IQD (HyperSockets), or CTC device for which the destination system has no free device with the same EQID.
- The guest configuration includes an emulated FBA DASD for which an associated EQID has not been created.
- The guest configuration includes a device for which the associated device on the destination system is of a different device class or type.
- The guest has a simulated network device (network interface card, NIC) that does not meet the networking eligibility requirements. For example, the guest has a NIC that is coupled to a virtual switch without external connectivity or that does not exist on the destination system. For more information about the relocation requirements for networking devices, see “Live Guest Relocation Networking Considerations” in *z/VM: Connectivity*.
- The guest is not using the Single Path CHPID Virtualization facility; that is, the CHPIDVIRTUALIZATION option is not specified in the user's virtual machine definition or on the GLOBALOPTS directory statement.

## Device State Conditions

The relocation will fail if any of these device state conditions exist:

- The guest has a device for which the matching device on the destination system is offline.
- The guest has a dedicated device for which the matching device on the destination system is not free.
- The guest has a non-full-pack minidisk on a device for which the matching real device on the destination system is not attached to the system.
- The guest has a DEVNO full-pack minidisk (that is, defined by an MDISK statement with the DEVNO operand) on a device for which the matching real device on the destination system is not:
  - Already defined as a DEVNO full-pack minidisk
  - Free such that a DEVNO full-pack minidisk can be created on it
- The guest has a Parallel Access Volumes (PAV) device for which the matching real device on the destination system is not in the same PAV mode.
- The guest has active I/O to a device that will result in a delayed response (for example, certain Peer-to-Peer Remote Copy (PPRC) operations for DASD or mount requests for an Automated Tape Library (ATL)).
- The guest configuration includes a TAPE device and a real assign exists for the device or the guest owns the assign.
- The guest configuration includes a multiuser TAPE device and the equivalent device on the destination system is neither defined as multiuser nor free.
- The guest configuration includes a TAPE device defined with an encryption key and the equivalent device on the destination system is associated with a different encryption key.
- The guest has an open SPOOL file (other than a console file). This includes a VMDUMP operation in continuous output mode (CONT option).



## Virtual Facility Conditions

The relocation will fail if any of these virtual facility conditions exist:

- The guest is a Coupling Facility Service Machine; that is, the CFVM option is specified in the user's virtual machine definition.
- The guest configuration includes access to a Coupling Facility Service Machine (that is, the CFUSER option is specified in the user's virtual machine definition), or the guest has a device that is coupled to a Coupling Facility Service Machine.
- The guest has expanded storage attached.
- The guest is using VM data spaces (by using the ALSERV ADD macro and DIAGNOSE code X'248').
- The guest has an SPXTAPE operation in progress.
- This user ID has active CP traces (activated with the TRACE command).
- The guest is the subject of an enabled TRSOURCE trap of type GT.
- The guest is using DIAGNOSE code X'E0' to read from or write data to a system trace file.
- The guest has created a logical device or is using a logical device created by another virtual machine or the system.
- The guest is a worker machine; that is, the guest is using the Set Alternate User ID function (DIAGNOSE code X'D4').
- The guest is using the Virtual Machine Communication Facility (VMCF); that is, the guest has invoked the VMCF AUTHORIZE function with DIAGNOSE code X'68'.
- The guest is using CMS POSIX facilities.
- The guest has used DIAGNOSE code X'214' to establish a pending page release.
- The guest has directory authorization to use DIAGNOSE code X'98'; that is, the DIAG98 option is specified in the user's virtual machine definition.
- The guest has an IUCV connection to a system service (other than to \*MSG or \*MSGALL, which are allowed) or to another virtual machine.
- The guest has an APPC/VM connection.
- The guest has directory authorization to use DIAGNOSE code X'254' to issue tape library control commands; that is, the user's virtual machine definition includes the STDEVOPT statement with the LIBRARY CTL operands.
- The guest has directory authorization to use the virtual Multi-Path Lock Facility; that is, the LKFAC option is specified in the user's virtual machine definition.

## Configuration Conditions

The relocation will fail if any of these configuration conditions exist:

- The guest has a dedicated CPU.
- The guest has dedicated cryptographic capability; that is, APDEDICATED is specified on a CRYPTO statement in the user's virtual machine definition.
- The guest is using any of the following:
  - An NSS defined with the VMGROUP option
  - A DCSS that is a member of a segment space
  - An NSS or DCSS with a storage range of type SW, SC, or SN
- The guest is using an NSS or DCSS that does not exist on the destination system or that does not have matching attributes and content.
- The guest configuration includes more than one virtual processor type; this precludes the relocation of any guest with a virtual ZIP or ZAP.

## Relocating a Guest in an SSI Cluster

- The guest is defined with all type CP virtual processors and the destination is an all type IFL environment.
- The guest's virtual configuration mode (defined by the SET VCONFIG command) is not LINUX and the mode of the destination LPAR is LINUX only.
- The guest has a storage configuration defined with the DEFINE STORAGE CONFIGURATION command.
- The guest has 370ACCOM mode set on.

## Resource Limit Conditions

The relocation will fail if any of these resource limit conditions exist:

- Guest storage size will not fit into available space on the destination.
- The guest's virtual disk in storage usage would violate the usage restrictions on the destination system.
- Relocating the guest would cause the destination system to exceed the maximum number of allowed users.

The relocation might fail if any of these resource limit conditions exist, but these checks may be overridden by using the FORCE STORAGE operand on the VMRELOCATE command:

- Guest storage size exceeds auxiliary paging capacity on the destination.
- Guest maximum storage size exceeds available space on the destination.
- Guest maximum storage size exceeds auxiliary paging capacity on the destination.

Guest storage size is defined as the sum of current guest storage (assumed to be fully populated), CP supporting structures, and private virtual disks in storage. Guest maximum storage size is defined as the sum of current guest storage, CP supporting structures, private virtual disks in storage, standby storage, and reserved storage. Available space on the destination is defined as the sum of available central, expanded, and auxiliary storage.

For additional information concerning resource limit conditions that affect relocation for a Linux guest virtual machine, see IBM z/VM Single System Image and Live Guest Relocation ([www.ibm.com/vm/ssi/](http://www.ibm.com/vm/ssi/)).

## Other Conditions

The relocation will fail if any of these conditions exist:

- A customized CP control block field appears to be in use. Fields in the VMDBK control block (VMDUSER1 - VMDUSER8 and VMDEBUG1 - VMDEBUG8) and the VDEV control block (VDEVUSR1 - VDEVUSR4) are reserved for customer and vendor use, and at least one of those fields contains something other than its initial value.
- The user ID is in system hold state on the destination system.
- The user ID was logged on to the source system by LOGON BY and the issuing user ID is in system hold state on the destination system.
- The guest is in the process of a service processor operation, such as writing the input/output configuration data set (IOCDs).

---

## Chapter 28. Converting a z/VM System to a Single-Member z/VM SSI Cluster

Use this procedure to convert a non-SSI z/VM system to the first member of a z/VM SSI cluster. This is the first step in moving to a multimember SSI cluster. To create a multimember SSI cluster, complete this procedure and then follow the procedure in Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775.

See “Before You Begin the Conversion Procedure” for requirements, suggested practices, and preparations.

In this procedure you will complete the following tasks:

- “Task 1: Prepare the Member-Specific User Volume” on page 761
- “Task 2: Update the System Configuration File” on page 762
- “Task 3: Update the User Directory” on page 765
- “Task 4: Manage the User Spool Files” on page 769
- “Task 5: Prepare the CP-Owned Volumes” on page 770
- “Task 6: Modify the Startup Parameters for the VMPSFS File Pool” on page 771
- “Task 7: Shut Down and Cold Start” on page 771
- “Task 8: Load the Spool Files” on page 771
- “Task 9: Change the User Directory to SSI-Enabled” on page 772
- “Task 10: Clean Up” on page 773

---

### Before You Begin the Conversion Procedure

#### Attention

The conversion procedure will change your system configuration. You need to plan these tasks, and you might want to use a maintenance window to execute certain steps. Before you begin the procedure, make sure that you understand the conversion process and its implications to your system.

Do not use this procedure if the system to be converted was installed with SMAPI enabled.

Make sure that you meet all of the requirements and complete the necessary preparations before you start. The examples in this procedure assume that you are following the suggested practices.

#### Requirements:

- Make sure that you understand how a z/VM SSI cluster is set up and maintained. See Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.
- Adhere to the “SSI Cluster Requirements” on page 724 and “SSI Cluster Restrictions” on page 725.
- The system to be converted must be z/VM V6.2 or later, installed by following one of the non-SSI installation procedures documented in *z/VM: Installation Guide*. The system must be installed to ECKD DASD.

## Converting a z/VM System to an SSI Cluster

- If the system to be converted was migrated from a previous z/VM release, all migration tasks must be completed before starting this procedure. For example, the customer-specific user information from the old system must be merged into the user directory on the new system.

**Attention:** The source directory created by the non-SSI installation procedure is in SSI-ready format, which means the IBM-supplied virtual machine definitions already have the correct structure for an SSI cluster. Do not attempt to use a source directory that is not in SSI-ready format, and do not modify the IBM-supplied virtual machine definitions except as instructed in this procedure.

- If you are using RACF, the RACF database must be configured to be shared by the members of the SSI cluster, and the shared database should be set up before you begin this conversion procedure. See the information on sharing RACF databases in an SSI cluster in *z/VM: RACF Security Server System Programmer's Guide*.

Suggested practices:

- See “Suggested Practices for Setting Up an SSI Cluster” on page 725.

Preparations:

- Have a copy of the memo-to-users for the IBM z/VM Single System Image Feature; it contains information you will need to complete this procedure.
- Gather the information you need to define the SSI cluster. The following example values are used in this procedure:
  - Logical partition (LPAR) name = LP01

**Note:** If z/VM is installed second level, this is the user ID of the virtual machine in which the system is running.

- Cluster name = CLUSTERA
- System name = VMSYS01

**Attention:** The system name of a member of an SSI cluster may include only alphabetic and numeric characters. If the current system name does not conform to this requirement, change the name before starting this procedure.

- Real device numbers and labels for all CP-owned and user DASD volumes.

The examples in this procedure use the default volume labels created by the installation procedure. For most volumes the naming convention is *M0mvmnn*, where *m* is the number of this member in the SSI member list (on the SSI system configuration statement) and *vnn* identifies the volume type and number (for example, P01 for the first paging volume).

- Common CP-owned volume = VMCOM1

- Created by the installation process
- Contains the parm disk, which contains the system configuration file that will be common for the SSI cluster
- Contains the source directory that will be common for the SSI cluster
- Contains the cross release utilities disk, which contains utilities such as CPFMTXA, DIRECTXA, DIRMAP, DISKMAP, and FORMSSI
- Contains the VMPSFS file pool, which will be shared by all members of the SSI cluster
- Includes the area where the SSI persistent data record (PDR) should be written

- Other CP-owned volumes:

- System residence volume = M01RES

- Paging volume = M01P01
- Spool volume = M01S01
- User volumes:
  - Additional common volume (if needed) = VMCOM2
  - Work volume = M01W01
 

This volume contains VMSYS01-specific minidisks (not shared with other members of the SSI cluster) for IBM-defined multiconfiguration virtual machines.
  - Common release-level service volumes = *vrmlRL1*, *vrmlRL2*
  - Shared user volume = USRVL1
 

This is a customer-defined volume used for minidisks for customer-defined single-configuration virtual machines.
  - Member-specific user volume = M01PV1
 

This is a customer-defined volume used for VMSYS01-specific minidisks for customer-defined multiconfiguration virtual machines.
- If necessary, notify your users to clean up their spool files. Although a user in an SSI cluster can own up to the number of spool files defined by the MAXSPOOL operand on the SPOOLFILE directory statement (9999 by default), only one quarter of the MAXSPOOL number of files may be originated on any one particular member of the cluster. You might want to set a lower limit for this system, such as 2000, and tell your users that spool files over the 2000 limit will be purged (over the weekend, for example).

---

### Task 1: Prepare the Member-Specific User Volume

Prepare the customer-defined member-specific user volume.

**Note:** For simplicity, this procedure does not show all of the system responses.

1. Log on to the MAINT*vrml* user ID for the release level of VMSYS01. Ensure that you have access to the cross release utilities disk (551).
2. Attach the volume to your virtual machine:

```
vary online rdev
attach rdev to * as vdev
```

3. Format, label, and allocate the volume:

```
cpfmtxa vdev m01pv1
```

```
CPFMTXA:
FORMAT WILL ERASE CYLINDERS 00000-nnnnn ON DISK vdev
DO YOU WANT TO CONTINUE? (YES | NO)
```

```
yes
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
ENTER ALLOCATION DATA
TYPE CYLINDERS
```

```
perm 0-end
end
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
```

### Task 2: Update the System Configuration File

Prepare a revised system configuration file that will be common for the SSI cluster.

1. Access the PMAINT CF0 minidisk:  
**access cf0 fm**
2. Make a copy of the SYSTEM CONFIG file named TEMP CONFIG on the CF0 minidisk and edit the copy.
3. Update the SYSTEM\_IDENTIFIER information.
  - a. If the file contains any SYSTEM\_IDENTIFIER\_DEFAULT statements, remove them.
  - b. Include a SYSTEM\_IDENTIFIER statement for this member of the cluster, to define the unique identifier (system name) for the z/VM system to be run in the specified LPAR.

**Note:** If z/VM is installed second level, the LPAR name field specifies the user ID of the virtual machine in which this system is running.

The system name is used as a record qualifier parameter on other configuration statements that apply only to that member of the cluster. At system initialization, CP locates the SYSTEM\_IDENTIFIER statement with that LPAR name and uses the system name to select the configuration statements to be processed for that member — all statements qualified with that identifier and all statements with no qualifier.

You should put the SYSTEM\_IDENTIFIER statement at the top of the file, following any EQUATE statements.

```
/* **** */
/* System_Identifier Information */
/* **** */

System_Identifier LPAR LP01 VMSYS01
```

4. Add an SSI statement to specify that this system configuration file defines an SSI cluster.

The SSI statement specifies the name of the cluster, the label of the DASD volume that contains the SSI persistent data record (PDR), and the system names of the members of the cluster.

```
/* **** */
/* SSI Statement */
/* **** */

SSI CLUSTERA PDR_Volume VMCOM1 ,
Slot 1 VMSYS01
```

**Note:** A member of an SSI cluster is sometimes referred to by its slot number on this statement. That is, in this example system VMSYS01 is member 1 of cluster CLUSTERA.

5. Each member of the SSI cluster must have its own SYSTEM\_RESIDENCE statement, identifying the checkpoint and warm start areas for that member. Qualify the current SYSTEM\_RESIDENCE statement for member VMSYS01.

```

/*****
/* Checkpoint and Warmstart Information */
*****/

VMSYS01: System_Residence,
Checkpoint Valid M01RES From CYL 21 For 9 ,
Warmstart Valid M01RES From CYL 30 For 9

```

6. Organize the CP\_OWNED statements. Qualify the statements for volumes that are specific to member VMSYS01. Do not qualify the statements for volumes that will be shared with the other members.

Qualify:

- System residence volume (M01RES)
- System paging volume (M01P01)

Do not qualify:

- Common volume (VMCOM1)
- Spool volume (M01S01)

**Important:** Do not change your current spool volume slot numbers.

```

/*****
/* CP_Owned Volume Statements */
*****/

VMSYS01: CP_Owned Slot 1 M01RES

/*****
/* COMMON VOLUME */
*****/

CP_Owned Slot 5 VMCOM1

/*****
/* DUMP & SPOOL VOLUMES */
*****/

CP_Owned Slot 10 M01S01

/*****
/* PAGE & TDISK VOLUMES */
*****/

VMSYS01: CP_Owned Slot 255 M01P01

```

7. Organize the USER\_VOLUME\_LIST statements. Qualify the statements for volumes that are specific to member VMSYS01. Do not qualify the statements for volumes that will be shared with the other members.

Qualify:

- Work volume (M01W01)
- Member-specific user volume (M01PV1)

Do not qualify:

- Additional common volume, if used (VMCOM2)
- Release-level service volumes (*vrml*RL1 and *vrml*RL2)



## Converting a z/VM System to an SSI Cluster

- Shared user volume (USRVL1)

Before:

```
/* **** */
/* User_Volume_List */
/* **** */

User_Volume_List M01W01
User_Volume_List VMCOM2 vrmRL1 vrmRL2 USRVL1
```

After:

```
/* **** */
/* User_Volume_List */
/* **** */
/* * Shared user volumes */
/* **** */

User_Volume_List VMCOM2 vrmRL1 vrmRL2 USRVL1

/* **** */
/* * Member-specific user volumes for Member 1 */
/* **** */

VMSYS01: User_Volume_List M01W01 M01PV1
```

8. If the file includes a VMLAN statement with the MACIDRANGE operand, that operand is ignored in an SSI cluster and the operand should be removed.

In an SSI cluster, system-defined locally administered MAC addresses are created using the prefix value specified on the MACPREFIX operand. The MACPREFIX value must be different for each member of the cluster. The default value is 02xxx, where xxx is the member's slot number on the SSI statement. If the MACPREFIX value is explicitly defined, the VMLAN statement must be qualified for the member to which it applies. Therefore if a VMLAN statement with the MACPREFIX operand is retained from the non-SSI system or created in this step, it must be qualified for member VMSYS01.

User-defined locally administered MAC addresses in an SSI cluster are created using the prefix value specified on the USERPREFIX operand. The USERPREFIX value must be identical for all members of the cluster, so the same MAC address will be created when the virtual machine is logged on to any member. The USERPREFIX value for the cluster cannot be the same as the MACPREFIX value for any member. The default USERPREFIX value in an SSI cluster is 020000.

User-defined MAC addresses from the non-SSI system will be retained in the SSI cluster if the USERPREFIX value for the cluster is the same as the USERPREFIX value in the non-SSI system. If the USERPREFIX value was not explicitly defined in the non-SSI system, the default was set to the MACPREFIX value. If the MACPREFIX value was not explicitly defined, the default value was 020000. Therefore, to retain the user-defined MAC addresses if the USERPREFIX value for the non-SSI system was set or defaulted to any value other than 020000, that value must be explicitly defined as the USERPREFIX value for the SSI cluster on a VMLAN statement for member 1.



```
VMSYS01: VMLAN MACPREFIX xxxxxx USERPREFIX yyyyyy
```

9. **Important:** Follow the instructions in the VMSSI Feature Enablement section in the *Memo to Users IBM z/VM Single System Image Feature* document that you received with your order. These instructions are required in order to enable your use of the VMSSI Feature.
10. Add a FEATURES statement (below all other FEATURES statements) to cause the system to prompt for the type of start when processing a SHUTDOWN REIPL command. (You will remove this statement at the end of this procedure.)

```
FEATURES ENABLE PROMPT AFTER_SHUTDOWN_REIPL
```

11. After you finish editing the file, use the CPSYNTAX utility (available on the MAINT 193 minidisk) to check the syntax of the configuration statements for cluster member VMSYS01:

```
cpsyntax temp config * (lpar lp01
```

**Note:** If z/VM is installed second level, the LPAR name field specifies the user ID of the virtual machine in which this system is running. The value of the LPAR operand must match the value specified on the SYSTEM\_IDENTIFIER statement that was added above.

Correct any errors before proceeding to the next task.

### Task 3: Update the User Directory

#### Explanation of the Changes

Many of the IBM-supplied user IDs are defined by multiconfiguration virtual machine definitions. A multiconfiguration virtual machine definition begins with an IDENTITY statement instead of a USER statement. When included in the common source directory for an SSI cluster, a multiconfiguration virtual machine definition can be configured to define multiple virtual machine instances, which enables the user ID to be logged on concurrently and independently to multiple members of the cluster. The virtual machine instances have common attributes but can also be configured to access different resources (for example, member-specific minidisks).

This type of virtual machine definition is used for many system support user IDs. The ability to be logged on to multiple members of the SSI cluster at the same time allows the user (such as the IBM-supplied MAINT user ID) to perform tasks on various members without having to log off one member before logging on to another. This type of virtual machine definition can also be used for service virtual machines (SVMs) and servers (such as the IBM-supplied TCPIP server) that require instances on multiple members of the cluster. Each instance supports only that member of the SSI cluster.

The source directory created by the non-SSI installation procedure is in SSI-ready format, which means the IBM-supplied multiconfiguration virtual machine definitions are configured for a single system. Each definition includes at most one active BUILD statement and its associated subconfiguration entry. The BUILD statement specifies an asterisk (\*) instead of a system name to default to the IPLed

## Converting a z/VM System to an SSI Cluster

system. The following example shows the SSI-ready format of the multiconfiguration virtual machine definition for the OPERATOR user ID.

**Note:** The statements that would be needed for additional SSI cluster members (except member-specific MDISK statements) are included as comments in the default directory.

```
IDENTITY OPERATOR password 32M 32M ABCDEFG
INCLUDE IBMDFLT
BUILD ON * USING SUBCONFIG OPERTR-1
* BUILD ON @@member2name USING SUBCONFIG OPERTR-2
* BUILD ON @@member3name USING SUBCONFIG OPERTR-3
* BUILD ON @@member4name USING SUBCONFIG OPERTR-4
AUTOLOG AUTOLOG1 OP1 MAINT
ACCOUNT 2 OPERATOR
MACH ESA
OPTION MAINTCCW

SUBCONFIG OPERTR-1
LINK OP1 191 192 RR
MDISK 191 3390 2924 005 M01RES MR READ WRITE MULTIPLE

*SUBCONFIG OPERTR-2
* LINK OP1 191 192 RR

*SUBCONFIG OPERTR-3
* LINK OP1 191 192 RR

*SUBCONFIG OPERTR-4
* LINK OP1 191 192 RR
```

If you have customer-defined virtual machines that you want to be able to run concurrently on multiple members of the SSI cluster, restructure them as multiconfiguration virtual machine definitions.

For example, suppose you have created a virtual machine called WATCHER that issues periodic queries and probes to monitor the health of other virtual machines on your system. Depending on the nature of the tests this machine performs, you might want to have a separate instance of WATCHER on each member of your SSI cluster, responsible for watching the guests running on that member. In that case, you would want to set up WATCHER as a multiconfiguration virtual machine.

Before you convert the system to an SSI cluster, the virtual machine definition for WATCHER might look like this:

```
USER WATCHER password 64M 64M G
IPL CMS
LINK MAINT 190 190
LINK MAINT 19E 19E
MDISK 191 3390 200 100 USRVL1 MR
MDISK 192 3390 300 100 USRVL1 RR
:
```

In preparation for deploying an SSI cluster, restructure WATCHER as a multiconfiguration virtual machine definition that clearly indicates which aspects of the definition are common across all instances of WATCHER and which are specific to the instance of WATCHER on a particular member of the SSI cluster.

This distinction is not particularly significant in a single-member SSI cluster, but it will facilitate the process of cloning that member to add other members to the cluster.

In this example, the WATCHER 192 minidisk contains the software run by WATCHER (execs, control files, and so on) and is read-only during normal execution. Therefore the 192 minidisk should be common across all instances of WATCHER. The WATCHER 191 minidisk is read/write, containing log files, work files, and similar items. Therefore the 191 minidisk should be specific to each instance of WATCHER.

The revised definition might look like this:

```
IDENTITY WATCHER password 64M 64M G
BUILD ON * USING SUBCONFIG WATCHR-1
IPL CMS
LINK MAINT 190 190
LINK MAINT 19E 19E
MDISK 192 3390 300 100 USRVL1 RR
:
:
SUBCONFIG WATCHR-1
MDISK 191 3390 100 100 M01PV1 MR
:
:
```

The WATCHER virtual machine is now defined in two parts. The common aspects of WATCHER are in the identity entry. The aspects that are specific to the instance of WATCHER on VMSYS01 are in subconfiguration entry WATCHR-1. The 191 minidisk has been moved to volume M01PV1. This is the volume that you prepared in “Task 1: Prepare the Member-Specific User Volume” on page 761. Note that in this example the 191 minidisk also has been moved from cylinders 200-299 on USRVL1 to cylinders 100-199 on M01PV1.

## Procedure

1. Restructure your customer-defined virtual machines, as needed, in the manner described in the WATCHER example.

**Attention:** Make sure that the virtual machine is logged off before you restructure its definition.

### DirMaint Alternative

If you have DirMaint installed and enabled, go to step 2.

If you are not using a directory manager, complete the following steps:

- a. Make a backup copy and then edit the USER DIRECT file.
  - b. Change the selected USER definitions to IDENTITY definitions.
  - c. Save your changes.
  - d. Go to step 3 on page 768.
2. **If you are using DirMaint:**
    - a. Update the DirMaint configuration to define the DIRMSAT server and DATAMOVE server for member 1 of the SSI cluster. Create a file called CONFIGSS DATADVH (on the DIRMAINT 11F disk and the 6VMDIR30 41F disk) that includes a SATELLITE\_SERVER statement and a

## Converting a z/VM System to an SSI Cluster

DATAMOVE\_MACHINE statement. For example:

```
SATELLITE_SERVER= DIRMSAT VMSYS01
DATAMOVE_MACHINE= DATAMOVE VMSYS01 *
```

**Note:** If you are using an external security manager (ESM), such as RACF, the DIRMSAT and DATAMOVE servers also must be identified to the ESM. See the external security manager considerations in *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

- b. Complete the following steps for each virtual machine definition you want to change. (These examples use WATCHER.) However, if you have more than a few definitions to change, see the information on making multiple updates to a directory in *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.
  - 1) Temporarily suspend placing the updated source directory online:  
**dirmaint offline**
  - 2) Get a copy of the user entry to be changed:  
**dirmaint foruser watcher get nolock**
  - 3) Convert the user entry to an identity entry and a subconfiguration entry.
  - 4) Put the subconfiguration entry into a separate file, using the SUBCONFIG ID as the file name. The file name of the file containing the identity entry remains unchanged, because the user ID is still the same. So for WATCHER, the files are WATCHER DIRECT and WATCHR-1 DIRECT.
  - 5) Delete the user entry from the directory, but keep any existing links:  
**dirmaint foruser watcher purge keeplinks**
  - 6) Add the identity entry to the directory:  
**dirmaint add watcher**
  - 7) Add the associated subconfiguration entry to the directory:  
**dirmaint add watchr-1 build on vmsys01 in watcher**
  - 8) Go back to 2b2 and repeat the sequence for the next definition to be changed.
3. After you finish editing the source directory, use the DISKMAP utility to check the minidisk assignments:  
**diskmap user direct fm**  
The output file is sent to your A disk. If any overlapping minidisks are flagged, make the necessary adjustments in the source directory and run DISKMAP again.
4. For the virtual machines that you restructured in step 1 on page 767 or 2 on page 767, if you changed minidisk definitions from common user volumes to the VMSYS01-specific user volume (M01PV1), copy those minidisks to the new volume.
  - a. If the M01PV1 volume is not still attached to your virtual machine (from “Task 1: Prepare the Member-Specific User Volume” on page 761), attach it now:  
**attach rdev to \* as vdev1**
  - b. Link to a minidisk that you need to copy. For example, to link to the WATCHER 191 minidisk:  
**link watcher 191 as vdev2**

- c. Copy the minidisk to M01PV1. For example, to copy the WATCHER 191 minidisk:

```
flashcopy vdev2 0 end to vdev1 100 199 synchronous
```

**Notes:**

- 1) The SYNCHRONOUS operand is required only for FlashCopy Version 1 hardware.
  - 2) Alternatively, you can use the DDR utility to copy the minidisks.
  - 3) In this example, WATCHER 191 has been moved to a different location on M01PV1 than on USRVL1.
5. Full-pack minidisks for the installation volumes are defined in the user directory, as shown in the following table. If you have added any CP-owned volumes since you installed this system, you need to define full-pack minidisks for these volumes so you can mark them with SSI ownership information in “Task 5: Prepare the CP-Owned Volumes” on page 770. For example, the M01T01 volume for temporary minidisks is not included in the initial installation. If you have added this volume, the user directory includes a USER definition for the \$TDISK\$ user ID where you can add an MDISK statement for a full-pack minidisk.

Marking ownership information on user volumes is optional. If you wish to mark the user volumes, you need to define full-pack minidisks for those volumes as well.

*Table 45. Full-Pack Minidisks Defined for the Installation Volumes*

| Volume       | Full-Pack Minidisk    |
|--------------|-----------------------|
| VMCOM1       | PMaint 141            |
| VMCOM2       | PMaint 142            |
| M01S01       | MAINT 122             |
| M01RES       | MAINT 123             |
| M01W01       | MAINT 124             |
| M01P01       | \$PAGE\$ A01          |
| M01T01       | \$TDISK\$ <i>vdev</i> |
| <i>vrml1</i> | MAINT <i>vrml</i> 131 |
| <i>vrml2</i> | MAINT <i>vrml</i> 132 |

6. Create the new object directory for VMSYS01:
  - If you are using DirMaint, issue the following commands:
 

```
dirmaint direct
dirmaint online
```
  - If you are not using DirMaint, issue the following command:
 

```
directxa user direct fm
```
7. Test your user directory changes. Verify that you can log on to the restructured virtual machines and that they run.

## Task 4: Manage the User Spool Files

In an SSI cluster, a single-configuration virtual machine cannot own more than one quarter of the MAXSPOOL number of spool files originated on any one particular member of the cluster.

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**Note:** A multiconfiguration virtual machine can have up to the MAXSPOOL number of spool files on each member of the cluster.

1. Verify that no single-configuration virtual machine has more than 2500 spool files. Read in or purge the excess.
2. Use the SPXTAPE command to dump all standard spool files and system data files to tape:

```
vary online rdev
attach rdev to * as vdev
:
:
spxtape dump vdev spool
```

**Note:** If you do not have a tape drive, either read in or delete the standard spool files (RDR, PRT, and PUN files only).

---

## Task 5: Prepare the CP-Owned Volumes

You need to mark the CP-owned volumes with SSI ownership information (cluster name and system name of the owning member) and create the SSI persistent data record. Marking SSI ownership information on the user volumes is optional.

1. Link to the full-pack minidisk for a volume to be marked (see Table 45 on page 769). For example, to link the VMCOM1 volume:

```
link pmaint 141 as vdev mr
```

2. Mark the volume with SSI ownership information:

- Mark the common volume (VMCOM1) with the cluster name but no system name:

```
cpfmtxa vdev vmcom1 owner clustera.nosys
```

- Mark each member-specific CP-owned volume (system residence, paging, and spool) with the cluster name and the system name:

```
cpfmtxa vdev m01res owner clustera.vmsys01
```

```
cpfmtxa vdev m01p01 owner clustera.vmsys01
```

```
cpfmtxa vdev m01s01 owner clustera.vmsys01
```

- Optionally, you can record ownership information on the user volumes.
  - If the volume is for member-specific minidisks, mark the volume with the SSI cluster name and the system name of the member. For example, to mark the M01W01 volume:

```
cpfmtxa vdev m01w01 owner clustera.vmsys01
```

- If the volume is to be shared among the cluster members, mark the volume with the SSI cluster name and no system name. For example, to mark the USRVL1 volume:

```
cpfmtxa vdev usrvl1 owner clustera.nosys
```

3. Create the SSI persistent data record (PDR):

```
link pmaint 141 141 w
:
:
formssi create 141 clustera
```

**Note:**

- a. The PDR should reside on the VMCOM1 volume, and cylinder 0 must be allocated as PERM.
- b. In this example, PMAINT 141 is a full-pack overlay of the VMCOM1 volume.

## Task 6: Modify the Startup Parameters for the VMPSFS File Pool

VMPSFS is the product service file pool for products loaded into SFS. VMPSFS is used by VMSES/E even if you did not load any products into SFS when you installed this z/VM system. The server for the VMPSFS file pool is VMSESRVP. In the VMSESRVP DMSPARMS file, the default startup parameter LOCAL must be changed to SSI to allow connections to VMSESRVP from all members of the SSI cluster.

1. Log on or reconnect to the VMSESRVP server.
2. Stop the file pool:  
**stop**
3. Edit the VMSESRVP DMSPARMS file and change the LOCAL startup parameter to SSI:

```
ADMIN MAINT MAINTvrm
NOBACKUP
SAVESEGID CMSFILES
SSI
FILEPOOLID VMPSFS
USERS 100
```

## Task 7: Shut Down and Cold Start

1. Prepare to use the revised system configuration file:
  - a. Rename the current SYSTEM CONFIG file to BACKUP CONFIG.
  - b. Rename the TEMP CONFIG file to SYSTEM CONFIG.
2. Shut down the system and do a cold start.  
A cold start will cause the deletion of all common spool files (RDR, PRT, and PUN) but will not delete system data files.

**shutdown reipl**

```
SYSTEM SHUTDOWN STARTED
:
:
HCPWRP962I VM SHUTDOWN COMPLETED in nn SEC
HCPWRP9277I SYSTEM TERMINATION COMPLETE,
 ATTEMPTING RESTART
:
:
hh:mm:ss Start ((Warm|Force|COLD|CLEAN) (DRain)
 (DIsable) (NODIRect) (NOAUTOlog)) or (SHUTDOWN)
```

**cold**  
:  
:

3. Log on to the MAINTvrm user ID.

## Task 8: Load the Spool Files

1. If you dumped the spool files to tape in “Task 4: Manage the User Spool Files” on page 769, load them onto the system. This resets the spool file IDs to the numbering scheme used in an SSI cluster. (For more information, see “Spool File ID Assignment and Limits” on page 747.)

```
attach rdev to * as vdev
:
:
spxtape load vdev spool nodup
```

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2. The system is now effectively running as a single-member SSI cluster. You should notice little or no difference in behavior or operation. Run the system for a while and make sure that you can log on the various user IDs. After you SSI-enable the user directory in the next task, you cannot easily back off to the old-style user directory.

When you are satisfied that the modified system is operating properly, complete the remaining tasks in this procedure.

---

### Task 9: Change the User Directory to SSI-Enabled

To complete the conversion to an SSI-enabled system and prepare for the addition of a second member system, modify the source directory to change it from an SSI-ready type to an SSI-enabled type.

1. In the source directory file, add the SSI operand to the DIRECTORY statement and change all BUILD ON \* statements to BUILD ON VMSYS01.

#### DirMaint Alternative

If you are using DirMaint, go to step 2

If you are not using a directory manager, complete the following steps:

- a. Make a backup copy and then edit the USER DIRECT file.
- b. Update the DIRECTORY statement to insert the SSI operand. For example:

```
DIRECTORY SSI 0123 3390 m01res
```

**Note:** This must be the first statement in the directory and is the only DIRECTORY statement allowed. If the file currently contains other DIRECTORY statements, remove them.

- c. Update the BUILD statements in all of the multiconfiguration virtual machine definitions (IBM-supplied and customer-defined) to replace the asterisk with system name VMSYS01. For example:

```
IDENTITY OPERATOR password 32M 32M ABCDEFG
INCLUDE IBMDFLT
BUILD ON VMSYS01 USING SUBCONFIG OPERTR-1
:
IDENTITY WATCHER password 64M
BUILD ON VMSYS01 USING SUBCONFIG WATCHR-1
:
```

Save your changes.

- d. Create the new object directory for VMSYS01:  
**directxa user direct fm**
2. **If you are using DirMaint**, complete the following steps:
  - a. Temporarily suspend placing the updated source directory online:  
**dirmaint offline**
  - b. Prepare the directory to be used for member VMSYS01 of the SSI cluster:  
**dirmaint ssi vmsys01**



This command adds the SSI operand to the DIRECTORY statement (removing any existing options) and changes all BUILD ON \* statements to BUILD ON VMSYS01.

- c. Create the new object directory for VMSYS01:

```
dirmaint direct
dirmaint online
```

3. Prior to adding additional members, the first system must be reIPLed with the SSI-enabled directory in order for the second and any subsequent systems to function properly. If you do not reIPL after switching to an SSI-enabled directory, you will have problems logging on multiconfiguration virtual machines on other members while the corresponding user IDs remain logged on to the first system.

---

### Task 10: Clean Up

You have completed the conversion of your z/VM system to a single-member SSI cluster.

1. Edit the SYSTEM CONFIG file and remove the FEATURES statement that you added in “Task 2: Update the System Configuration File” on page 762.
2. Discard the backup system configuration file and the backup user directory. They are no longer usable.
3. To add another member to the SSI cluster, see Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775.

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## Chapter 29. Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member

Use this procedure to add a member to a z/VM SSI cluster by cloning an existing member of the cluster.

See “Before You Begin the Cloning Procedure” for requirements, suggested practices, and preparations.

In this procedure you will complete the following tasks:

- “Task 1: Prepare the CP-Owned Volumes for the Target Member” on page 777
- “Task 2: Create the TCP/IP Configuration for the Target Member” on page 777
- “Task 3: Update the Configuration Files for Other Service Virtual Machines and Servers” on page 778
- “Task 4: Customize the System Startup Virtual Machine” on page 779
- “Task 5: Copy the Source Volumes to the Target Volumes” on page 779
- “Task 6: Update the User Directory” on page 782, or “Task 6A: Update the User Directory Using DirMaint” on page 787
- “Task 7: Update the System Configuration File” on page 793
- “Task 8: Enable the Existing Members to Access the Target Member” on page 798
- “Task 9: IPL the Target Member” on page 799
- “Task 10: Start the ESM Service Virtual Machine” on page 799
- “Task 11: Update the VMSES/E System-Level Product Inventory Table” on page 799
- “Task 12: Build the Saved Segments and Named Saved Systems” on page 799
- “Task 13: Start the Service Virtual Machines” on page 800
- “Task 14: Test and Verify” on page 801

---

### Before You Begin the Cloning Procedure

#### Attention

Make sure that you understand the cloning process. Failure to adhere to the documented cloning procedure can result in an unstable or unusable system.

Do not use this procedure if the current members of the cluster were installed with SMAPI enabled.

Make sure that you meet all of the requirements and complete the necessary preparations before you start. The examples in this procedure assume that you are following the suggested practices.

Requirements:

- Adhere to the “SSI Cluster Requirements” on page 724 and “SSI Cluster Restrictions” on page 725.
- Apply and place into production all needed service on the member to be cloned before you begin the cloning procedure.

## Cloning an SSI Cluster Member

- Once you begin the cloning procedure, do not apply service to any member of the cluster until the procedure is completed.
- If you are using RACF, the RACF database must be configured to be shared by the members of the SSI cluster. If the shared database is not already set up, you must set it up before you use this cloning procedure. See the information on sharing RACF databases in an SSI cluster in *z/VM: RACF Security Server System Programmer's Guide*.

Suggested practices:

- See "Suggested Practices for Setting Up an SSI Cluster" on page 725.

Preparations:

- Ensure that a logical partition for the new member has been defined and configured with access to the necessary devices.

**Note:** Although this procedure describes how to create a new member in a first-level SSI cluster, the new member could be created second-level in a virtual machine.

- Gather the information you need to define the new member. The following values are used in this procedure:
  - Logical partition (LPAR) name = LP02

**Note:** At second level, this is the user ID of the virtual machine in which the new member will be initialized.

- Cluster name = CLUSTERA
- Source member (member to be cloned) = VMSYS01

In this example, VMSYS01 is a single-member SSI cluster. However, in a multimember SSI cluster, the source member could be any existing member of the cluster.

- Target member (member to be created) = VMSYS02

In this example, VMSYS02 is the second member of the SSI cluster. However, the same procedure would be used to add other members.

- Acquire a set of DASD volumes for the new member.

**Attention:** Volume labels must be unique within the SSI cluster.

The examples in this procedure use the default volume labels that would be created by the installation procedure for a multimember SSI cluster. For most volumes the naming convention is M0*m**vnn*, where *m* is the number of this member in the SSI member list (on the SSI configuration statement) and *vnn* identifies the volume type and number (for example, P01 for the first paging volume).

- CP-owned volumes:
  - System residence volume = M02RES
  - System paging volume = M02P01
  - Spool volume = M02S01
- User volumes:
  - Work volume = M02W01
  - Member-specific user volume = M02PV1

- Obtain the TCP/IP configuration information for the new member:
  - If possible, obtain the IP addresses for the new member before cloning.

- If you are running an SSL server, you will need either a multiple-server certificate that covers the new member or a single-server certificate for the new member. For information on defining your SSL server environment, see *z/VM: TCP/IP Planning and Customization*.

---

## Task 1: Prepare the CP-Owned Volumes for the Target Member

Prepare the following CP-owned volumes for the target member:

- System paging volume (M02P01)
- Spool volume (M02S01)

**Important:** Do not format the system residence volume in this task.

**Note:** For simplicity, this procedure does not show all of the system responses.

1. On the source member, log on to the MAINT<sub>vm</sub> user ID for the release level of that system. Ensure that you have access to the cross release utilities disk (551).
2. Attach the target volumes to your virtual machine:

```
vary online rdev
attach rdev to * as vdev
```

3. Format, label, and allocate each volume.

**Attention:** Cylinder 0 is allocated as PERM by the formatting process and must not be reallocated.

For example, to prepare the system paging volume:

```
cpfmtxa vdev m02p01
```

```
CPFMTXA:
FORMAT WILL ERASE CYLINDERS 00000-nnnnn ON DISK vdev
DO YOU WANT TO CONTINUE? (YES | NO)
```

```
yes
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
ENTER ALLOCATION DATA
TYPE CYLINDERS
```

```
page 1-end
end
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
```

4. Mark the SSI ownership of the volumes. Mark each volume with the cluster name and system name. For example, to mark the paging volume, enter the following command:

```
cpfmtxa vdev m02p01 owner clustera.vmsys02
```

---

## Task 2: Create the TCP/IP Configuration for the Target Member

**Note:** For more information about the TCP/IP configuration files identified in this task, see *z/VM: TCP/IP Planning and Customization*.

1. Configure the TCP/IP stack:
  - a. Link and access the TCPMAINT 198 minidisk:

## Cloning an SSI Cluster Member

```
link to tcpmaint 198 as 198 m
access 198 fm
```

- 1) The TCPIP server configuration file for VMSYS01 must be named VMSYS01 TCPIP (*sysname* TCPIP). If it is currently named PROFILE TCPIP or some other name, rename it to VMSYS01 TCPIP.
  - 2) Make a copy of the VMSYS01 TCPIP file on the 198 minidisk and name the copy VMSYS02 TCPIP.
  - 3) If you know the IP addresses for VMSYS02, update the HOME statement in the VMSYS02 TCPIP file.
  - 4) There might be other files on this minidisk that should be made multinode capable before cloning. For example:
    - By putting member-specific logic in the global profile exit (TCPRUNXT EXEC).
    - If you need member-specific configurations for other TCP/IP servers, by creating separate *sysname* DTCPARMS files (VMSYS01 DTCPARMS and VMSYS02 DTCPARMS).
- b. Link and access the TCPMAINT 592 minidisk:

```
link to tcpmaint 592 as 592 m
access 592 fm
```

- 1) Edit the TCPIP DATA file and add a HOSTNAME statement to identify the host name for the target member. Qualify each HOSTNAME statement with the system name of the member.

```
VMSYS01: HOSTNAME VMSYS01
VMSYS02: HOSTNAME VMSYS02
```

2. Update the SSL server certificate:
  - If you obtained a new multiple-server certificate that covers system VMSYS02, replace the current certificate with the new certificate now. For information about managing the certificate database, see *z/VM: TCP/IP User's Guide*.
  - If you obtained a new single-server certificate for VMSYS02, you will replace the certificate in a later task in this procedure.

---

## Task 3: Update the Configuration Files for Other Service Virtual Machines and Servers

If service virtual machines (SVMs) or servers for other facilities, features, or products will have member-specific instances in the SSI cluster, update the corresponding configuration files to provide the member-specific information, if necessary. For example, if you will use the Performance Toolkit for centralized monitoring in your SSI cluster, see the preparation information in *z/VM: Performance Toolkit Guide*.

**Note:** DirMaint configuration updates are identified in “Task 6A: Update the User Directory Using DirMaint” on page 787.

## Task 4: Customize the System Startup Virtual Machine

The system startup virtual machine (AUTOLOG1) is defined by a multiconfiguration virtual machine definition. Therefore AUTOLOG1 will have a separate logon instance and A-disk on each member, and potentially a member-specific profile. However, when the work volume for the source member is copied to the target volume later in this procedure, AUTOLOG1 will have the identical profile on both members.

- If the profile includes an XAUTOLOG command for an SVM or server that you want logged on only to a specific member of the SSI cluster, provide some logic in the profile to process the XAUTOLOG command for that user ID only when that member is initialized.
- If the profile includes an XAUTOLOG command for an SVM or server that needs to be logged on but the specific member of the cluster is not important, you can include an XAUTOLOG command with no conditional processing. The service virtual machine will be logged on automatically to the member that is initialized first.
- If the profile includes an XAUTOLOG command for an SVM or server that you want to be able to run concurrently on multiple members of the cluster, you can include an XAUTOLOG command with no conditional processing in the profile, but you need to restructure the virtual machine definition as a multiconfiguration virtual machine definition (when you update the source directory later in this procedure).

Customize the system startup machine:

1. Link and access the AUTOLOG1 191 minidisk:

```
link to autolog1 191 as vdev m
access vdev fm
```

**Note:** If you are using RACF, make the changes to the AUTOLOG2 virtual machine instead of AUTOLOG1.

2. Edit the PROFILE EXEC file and provide the necessary logic to conditionally process the XAUTOLOG commands that are member-specific.

## Task 5: Copy the Source Volumes to the Target Volumes

Copy the source member's DASD volumes to the target member's volumes.

1. Attach the VMSYS02 system residence volume:

```
vary online rdev
attach rdev to * as vdev
```

The M01RES volume (full-pack minidisk MAINT 123) is already linked to MAINT $\overline{vrm}$  as 123.

2. Copy M01RES to the VMSYS02 system residence volume and label it M02RES:

```
flashcopy 123 0 end to vdev 0 end synchronous label m02res
```

**Notes:**

- The SYNCHRONOUS operand is required only for FlashCopy Version 1 hardware.
- Alternatively, you can use the DDR utility to copy the volume. After the copy completes, issue the CPFMTXA command to change the label of the target volume to M02RES:

```
cpfmtxa vdev m02res label
```

## Cloning an SSI Cluster Member

3. Format the checkpoint and warm start areas on M02RES to erase the VMSYS01 data.
  - a. Link (read-only) and access the PMAINT CF0 minidisk:  
**link to pmain cf0 as cf0 r**  
**access cf0 fm**
  - b. Open the SYSTEM CONFIG file and examine the SYSTEM\_RESIDENCE statement for VMSYS01 to determine the location and size of the checkpoint and warm start areas.

```
/*****
/* Checkpoint and Warmstart Information */
/*****/

VMSYS01: System_Residence,
 Checkpoint Valid M01RES From CYL 21 For 9 ,
 Warmstart Valid M01RES From CYL 30 For 9
```

- c. Format those cylinders on the M02RES volume. For example:

```
cpfmtxa vdev m02res 21.9
```

```
INVOKING ICKDSF.
FORMAT WILL ERASE CYLINDERS 21-29 ON DISK vdev
DO YOU WANT TO CONTINUE? (YES | NO)
```

```
yes
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
ENTER ALLOCATION DATA
TYPE CYLINDERS
```

```
end
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
```

```
cpfmtxa vdev m02res 30.9
```

```
INVOKING ICKDSF.
FORMAT WILL ERASE CYLINDERS 30-38 ON DISK vdev
DO YOU WANT TO CONTINUE? (YES | NO)
```

```
yes
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
ENTER ALLOCATION DATA
TYPE CYLINDERS
```

```
end
```

```
HCPCCF6209I INVOKING ICKDSF.
:
:
ICK00002I ICKDSF PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
```

4. Mark the SSI ownership of M02RES with the cluster name and system name:

```
cpfmtxa vdev m02res owner cluster.vmsys02
```



5. If you are following the suggested practice of using the same real device numbers for DASD across the LPARs, skip to step 6.  
However, if the real device number for the VMCOM1 device in LPAR LP02 is different from the real device number for that device in LPAR LP01, write a new copy of the Stand-Alone Program Loader (SAPL) on M02RES and specify the real device number for VMCOM1 in LP02.
  - a. Determine what IPL parameters (if any) were specified for SAPL on M01RES so you can specify the same parameters when you write the new copy of SAPL on M02RES. Because SAPL on M02RES is currently a duplicate of SAPL on M01RES, you can get this information by IPLing M02RES in your virtual machine and looking at the SAPL panel.
    - 1) Do a system-reset-clear on your virtual machine:  
**system clear**
    - 2) Change your virtual console mode to 3270:  
**terminal conmode 3270**
    - 3) Display the status of your virtual console to get the virtual device number (usually 0009):  
**query virtual console**  
  

```
CONS vdev ON LDEV ...
:
```
    - 4) IPL the M02RES device:  
**ipl M02RES\_vdev loadparm console\_vdev**
    - 5) When the SAPL panel is displayed, record the parameters specified in the **IPL PARAMETERS** field.
    - 6) Use the PA1 (Program Attention) key, or equivalent, to exit SAPL and get back to CP.

**Note:** In an IBM Personal Communications 3270 emulation session, right click on the session screen to display Pad 1 and click on the PA1 button.
  - 7) IPL CMS.
  - b. Write the new SAPL on M02RES, specifying the IPL parameters that you recorded plus the PDVOL parameter to specify the real device number for VMCOM1 in LPAR LP02:

```
salipl vdev (iplparms IPL_parameters pdvol=rdev
```

6. Copy the VMSYS01 work volume and member-specific user volume to the corresponding VMSYS02 volume and relabel it.

#### Attention

Complete this process for one volume before starting the next volume, and do not stop the process until the volume has been relabeled. If system VMSYS01 goes down, it might come back up with the VMSYS02 volume instead of the VMSYS01 volume (if the VMSYS02 volume has a lower real device number).

For example, to create work volume M02W01:

- a. Attach the VMSYS02 volume to your virtual machine:

```
vary online rdev
attach rdev to * as vdev
```

The M01W01 volume (full-pack minidisk MAINT 124) is already linked to MAINT<sub>vm</sub> as 124.

## Cloning an SSI Cluster Member

- b. Copy the VMSYS01 volume to the VMSYS02 volume and relabel it:  
**flashcopy 124 0 end to vdev 0 end synchronous label m02w01**

### Notes:

- - 1) The SYNCHRONOUS operand is required only for FlashCopy Version 1 hardware.
  - 2) Alternatively, you can use the DDR utility to copy the minidisks.
  - 3) In this example, WATCHER 191 has been moved to a different location on M01PV1 than on USRVL1.

### Notes:

- The SYNCHRONOUS operand is required only for FlashCopy Version 1 hardware.
- Alternatively, you can use the DDR utility to copy the volume.  
**Attention:** If you use DDR, immediately after the copy completes, issue the CPFMTXA command to change the label of the target volume to the VMSYS02 value:

```
cpfmtxa vdev m02w01 label
```

- c. Detach the VMSYS02 volume.
- d. Follow the same process for the next volume.
7. If you obtained a new single-server certificate for the SSL server on VMSYS02, replace the certificate copied from VMSYS01 now. For information about managing the certificate database, see *z/VM: TCP/IP User's Guide*.

---

## Task 6: Update the User Directory

Update the source directory to add the target member to the multiconfiguration virtual machine definitions.

### DirMaint Alternative

If you have DirMaint installed and enabled in the SSI cluster, skip this task and go to “Task 6A: Update the User Directory Using DirMaint” on page 787.

1. Make a backup copy and then edit the common source directory (USER DIRECT).
2. Update the DIRECTORY statement to add M02RES as the volume where the object directory for VMSYS02 will be created.

```
DIRECTORY SSI 123 3390 M01RES M02RES
```

3. Update each IBM-supplied multiconfiguration virtual machine definition to include a subconfiguration entry for VMSYS02:
  - a. In the identity entry, uncomment the BUILD statement for member 2 and update the statement to specify system name VMSYS02.
  - b. Uncomment the corresponding subconfiguration entry.
  - c. If the subconfiguration entry for VMSYS01 contains MDISK statements, add corresponding MDISK statements to the subconfiguration entry for

VMSYS02. The MDISK statements in the VMSYS02 subconfiguration entry must specify VMSYS02 volumes. For example, if the VMSYS01 subconfiguration entry defines a 191 minidisk on M01W01, the VMSYS02 subconfiguration entry must define the 191 minidisk on M02W01.

The following examples show the original and updated definition for the TCPIP user ID.

## Cloning an SSI Cluster Member

### Example of the original TCPIP definition:

**Note:** The real TCPIP definition could be different from this example.

```
IDENTITY TCPIP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
* BUILD ON @@member2name USING SUBCONFIG TCPIP-2
* BUILD ON @@member3name USING SUBCONFIG TCPIP-3
* BUILD ON @@member4name USING SUBCONFIG TCPIP-4
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCPIP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 2411 005 M01W01 MR RTCPIP WTCPIP MTCPIP

*SUBCONFIG TCPIP-2
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

*SUBCONFIG TCPIP-3
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

*SUBCONFIG TCPIP-4
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR
```

## Example of the updated TCPIP definition:

```

IDENTITY TCPIP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
BUILD ON VMSYS02 USING SUBCONFIG TCPIP-2
* BUILD ON @@member3name USING SUBCONFIG TCPIP-3
* BUILD ON @@member4name USING SUBCONFIG TCPIP-4
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCPIP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 2411 005 M01W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-2
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 2411 005 M02W01 MR RTCPIP WTCPIP MTCPIP

*SUBCONFIG TCPIP-3
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

*SUBCONFIG TCPIP-4
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

```

4. Update each customer-defined multiconfiguration virtual machine definition to include a subconfiguration entry for VMSYS02:
  - a. In the identity entry, add a BUILD statement for VMSYS02:
    - 1) Copy the BUILD statement for VMSYS01 and change the system name to VMSYS02.
    - 2) Change the SUBCONFIG ID to *name-2*.
  - b. Add the subconfiguration entry for VMSYS02:
    - 1) Copy the *name-1* subconfiguration entry and change the ID to *name-2*.
    - 2) Change the volume labels on the MDISK statements to the corresponding volumes for VMSYS02.
    - 3) Update other statements in the VMSYS02 configuration as required, such as DEDICATE and COMMAND statements.

## Cloning an SSI Cluster Member

**Note:** NICDEF statements do not need to be changed if the virtual switch is the same on all members of the cluster.

The following example shows the updated WATCHER definition.

```
IDENTITY WATCHER password 64M 64M G
BUILD ON VMSYS01 USING SUBCONFIG WATCHR-1
BUILD ON VMSYS02 USING SUBCONFIG WATCHR-2
IPL CMS
LINK MAINT 190 190
LINK MAINT 19E 19E
MDISK 192 3390 300 100 USRVL1 RR
:
SUBCONFIG WATCHR-1
MDISK 191 3390 100 100 M01PV1 MR
:
SUBCONFIG WATCHR-2
MDISK 191 3390 100 100 M02PV1 MR
:
```

5. After you finish editing the file, check the minidisk assignments:

**diskmap user direct fm**

The output file is written to your A disk. If any overlapping minidisks are flagged, edit the user directory file to make any needed adjustments and run DISKMAP again.

6. Create a new object directory for VMSYS01:

**directxa user direct fm**

7. If the SSI cluster includes other existing members, create a new object directory on each of those members. For example, if you are adding member 4, do the following operations on members 2 and 3.

- a. Log on to the MAINT user ID on that member.
- b. Access the PMAINT 2CC and 551 minidisks.
- c. Create the new object directory:

**directxa user direct fm**

8. If you are using RACF, edit the source directory again and modify the definition for the AUTOLOG2 user ID to change its password to NOLOG.

After you IPL the new VMSYS02 system later in this procedure, you need to start the RACFVM virtual machine. When RACFVM is initialized, it issues an XAUTOLOG command for AUTOLOG2, which issues XAUTOLOG commands for the SVMs identified in its profile. However, you need to start RACFVM without logging on those SVMs, so you can do some other operations first. After you complete those operations you will modify the AUTOLOG2 user ID again to restore its password (so keep a record of the original password), and then autolog AUTOLOG2 to start the SVMs.

**Important:** To ensure that this change affects only the object directory for the new member of the cluster, you should delay putting any directory changes online for the other members until after this change is rescinded.

9. On system VMSYS01, create the object directory for VMSYS02:

- a. Detach M01RES and attach M02RES as virtual device 123:

**detach 123**  
**attach rdev to \* as 123**

- b. Create the object directory:

```
directxa user direct fm
```

- c. Detach M02RES:

```
detach 123
```

- d. Re-link M01RES:

```
link maint 123 123 m
```

---

## Task 6A: Update the User Directory Using DirMaint

If you completed “Task 6: Update the User Directory” on page 782, skip this task and go to “Task 7: Update the System Configuration File” on page 793.

In this task you will update the DirMaint configuration to include the new member, and you will use DirMaint facilities to help you update the user directory.

**Note:** The DIRMAINT commands used in this task must be issued from a cluster member already set up, for example VMSYS01. For information about the DIRMAINT commands, see *z/VM: Directory Maintenance Facility Commands Reference*. For more information about the DirMaint configuration files updated in this task, see *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

1. Update the DIRECTORY statement to specify M02RES as the volume where the object directory for VMSYS02 will be created:

```
dirmaint directory change 1 ssi 123 3390 m01res m02res
```

2. Add the virtual machine definitions for the DIRMSAT and DATAMOVE servers for the new member, DIRMSAT2 and DATAMOV2.

- a. Get a copy of the DIRMSAT virtual machine definition:

```
dirmaint for dirmsat get noload
```

- b. Receive the DIRMSAT DIRECT file from your reader as DIRMSAT2 DIRECT.

- c. Xedit the DIRMSAT2 DIRECT file and change the volume label on each MDISK statement to the corresponding system volume for member 2.

The following examples show the DIRMSAT definition and the new DIRMSAT2 definition.

**Note:** The real DIRMSAT definition could be different from this example.

## Cloning an SSI Cluster Member

```
USER DIRMSAT AUTOONLY 128M 256M BG
IPL CMS PARM AUTOOCR
MACHINE ESA
ACCOUNT SYSTEM SYSPROG
D8ONECMD FAIL LOCK
OPTION CONCEAL D84NOPAS IGNMAXU
IUCV ANY PRIORITY MSGLIMIT 100
CONSOLE 009 3215 T
SPOOL 00C 2540 READER A
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A
LINK MAINT 190 190 RR * CMS system disk
LINK MAINT 19D 19D RR * help disk
LINK MAINT 19E 19E RR * Product code disk
LINK MAINT 123 123 MW * Object directory disk
LINK DIRMAINT 191 191 RR
LINK DIRMAINT 192 192 RR
LINK DIRMAINT 11F 11F RR
LINK DIRMAINT 21F 21F RR
LINK DIRMAINT 1DF 1DF RR
LINK DIRMAINT 15D 15D RR
LINK DIRMAINT 2DF 2DF RR
LINK PMAINT 551 551 RR
MDISK 155 3390 2206 009 M01W01 MR
MDISK 1AA 3390 2215 009 M01W01 MR
MDISK 1DE 3390 2224 020 M01W01 MR
MDISK 1FA 3390 2244 012 M01W01 MR
MDISK 2AA 3390 2256 009 M01W01 MR
```

```
USER DIRMSAT2 AUTOONLY 128M 256M BG
IPL CMS PARM AUTOOCR
MACHINE ESA
ACCOUNT SYSTEM SYSPROG
D8ONECMD FAIL LOCK
OPTION CONCEAL D84NOPAS IGNMAXU
IUCV ANY PRIORITY MSGLIMIT 100
CONSOLE 009 3215 T
SPOOL 00C 2540 READER A
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A
LINK MAINT 190 190 RR * CMS system disk
LINK MAINT 19D 19D RR * help disk
LINK MAINT 19E 19E RR * Product code disk
LINK MAINT 123 123 MW * Object directory disk
LINK DIRMAINT 191 191 RR
LINK DIRMAINT 192 192 RR
LINK DIRMAINT 11F 11F RR
LINK DIRMAINT 21F 21F RR
LINK DIRMAINT 1DF 1DF RR
LINK DIRMAINT 15D 15D RR
LINK DIRMAINT 2DF 2DF RR
LINK PMAINT 551 551 RR
MDISK 155 3390 2206 009 M02W01 MR
MDISK 1AA 3390 2215 009 M02W01 MR
MDISK 1DE 3390 2224 020 M02W01 MR
MDISK 1FA 3390 2244 012 M02W01 MR
MDISK 2AA 3390 2256 009 M02W01 MR
```

- d. Add the DIRMSAT2 virtual machine definition to the source directory:

```
dirmaint add dirmsat2
```



- e. Go back to step 2a on page 787 and repeat the sequence to create the DATAMOV2 DIRECT file from a copy of DATAMOVE DIRECT.
- f. Issue the following command to create the DVHPROFA DIRMSAT2 file:  
**dirmaint cms copyfile dvhprofa dirmsat c dvhprofa dirmsat2 c**
3. Update the CONFIGSS DATADVH file to add the DIRMSAT2 and DATAMOV2 servers.
  - a. Add a SATELLITE\_SERVER statement to define the DIRMSAT2 server.  
 Add a DATAMOVE\_MACHINE statement to define the DATAMOV2 server.

```
SATELLITE_SERVER= DIRMSAT VMSYS01
SATELLITE_SERVER= DIRMSAT2 VMSYS02
DATAMOVE_MACHINE= DATAMOVE VMSYS01 *
DATAMOVE_MACHINE= DATAMOV2 VMSYS02 *
```

**Note:** If you are using an external security manager (ESM), such as RACF, the DIRMSAT2 and DATAMOV2 servers also must be identified to the ESM. See the external security manager considerations in *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

- b. Reload the data tables from the CONFIG\* DATADVH disk files:  
**dirmaint rlddata**
4. Update the EXTENT CONTROL file to define the minidisk allocation data for the new member. When you add subconfiguration entries to the multiconfiguration virtual machine definitions (in step 5 on page 790), DirMaint will use the information from this file to identify the volumes to be used for minidisks in the new subconfiguration entries.

**Note:** The following example uses the same extents on the VMSYS02 volumes as on the VMSYS01 volumes.

- a. Send a copy of the EXTENT CONTROL file to your virtual reader:  
**dirmaint send extent control**
- b. Receive the EXTENT CONTROL file and edit it.
  - 1) The :REGIONS. section defines the areas to be used for minidisks on the DASD volumes. Entries in this section are not required in order to clone SUBCONFIG directory entries if the entire volumes specified in the :SSI\_VOLUMES. section are used for minidisk allocation and the volumes are generic 3390 volumes with 1113 cylinders. However, it is a good practice to complete this section, because entries are required to use the AUTOR method of automatic DASD space allocation provided in the DirMaint DASD allocation commands. Entries are always required for any volumes that are not generic 3390 volumes, so DirMaint knows how many cylinders are available. For each DASD device type and model specified in this section, there should be a corresponding entry in the :DEFAULTS. section.

The following example shows entries for the local work and user volumes for cluster member 1 and new entries for the corresponding volumes for cluster member 2:

## Cloning an SSI Cluster Member

```
:REGIONS.
RegionA M01W01 START END 3390-01
RegionB M01PV1 START END 3390-01
RegionC M02W01 START END 3390-01
RegionD M02PV1 START END 3390-01
:END.
```

- 2) Update the :SSI\_VOLUMES. section to specify the work and user volumes on the members of the SSI cluster to be used for allocating minidisks. A volume set name (such as SYSRES) is used to identify the volumes used for the same purpose on each member.

```
:SSI VOLUMES.
SYSRES VMSYS01 M01RES
SYSRES VMSYS02 M02RES
WORK VMSYS01 M01W01
WORK VMSYS02 M02W01
PRIVATE1 VMSYS01 M01PV1
PRIVATE1 VMSYS02 M02PV1
:END.
```

- 3) Update the :DEFAULTS. section to specify the maximum number of cylinders or blocks for any DASD device type and model identified in the :REGIONS. section. For example:

```
:DEFAULTS.
3390-01 1113
:END.
```

- a. Replace the updated EXTENT CONTROL file and reload the data:

```
dirmaint file extent control
dirmaint rldextn
```

5. Update all of the multiconfiguration virtual machine definitions (IBM-supplied and customer-defined) to add a subconfiguration entry for VMSYS02.

- a. Search the directory for all of the BUILD ON statements for member VMSYS01:

```
dirmaint scan build on vmsys01
```

The matching records are sent to you in a file. For example:

```
Userid: <=== Qualifying Record =====>
MAINT BUILD ON VMSYS01 USING SUBCONFIG MAINT-1
AVSVM BUILD ON VMSYS01 USING SUBCONFIG AVSVM-1
TSAFVM BUILD ON VMSYS01 USING SUBCONFIG TSAFVM-1
GCS BUILD ON VMSYS01 USING SUBCONFIG GCS-1
AUDITOR BUILD ON VMSYS01 USING SUBCONFIG AUDITR-1
AUTOLOG1 BUILD ON VMSYS01 USING SUBCONFIG AUTLG1-1
CMSBATCH BUILD ON VMSYS01 USING SUBCONFIG CMSBAT-1
:
:
TCPIP BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
:
:
```

- b. For each user ID listed in the search results, issue the following command to add a new BUILD statement and subconfiguration entry for VMSYS02:

```
dirmaint add name-2 like name-1 build on vmsys02 in userid
```

For example, the following command will make the changes shown in the example of the virtual machine definition for the TCPIP user ID:

```
dirmaint add tcpip-2 like tcpip-1 build on vmsys02 in tcpip
```

### Notes:

- The real TCPIP definition could be different from this example.
- The DIRMAINT ADD command adds new statements to the virtual machine definition. It does not uncomment any sample BUILD statement or subconfiguration entry that might be included in the definition.
- The :SSI\_VOLUMES. section of the EXTENT CONTROL file identifies the volumes used in the new subconfiguration entry.

## Cloning an SSI Cluster Member

```
IDENTITY TCPIP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
BUILD ON VMSYS02 USING SUBCONFIG TCPIP-2
* BUILD ON @@member2name USING SUBCONFIG TCPIP-2
* BUILD ON @@member3name USING SUBCONFIG TCPIP-3
* BUILD ON @@member4name USING SUBCONFIG TCPIP-4
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCPIP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 2411 005 M01W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-2
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 2411 005 M02W01 MR RTCPIP WTCPIP MTCPIP

*SUBCONFIG TCPIP-2
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

*SUBCONFIG TCPIP-3
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR

*SUBCONFIG TCPIP-4
* LINK TCPMAINT 491 491 RR
* LINK TCPMAINT 492 492 RR
* LINK TCPMAINT 591 591 RR
* LINK TCPMAINT 592 592 RR
* LINK TCPMAINT 198 198 RR
```

6. Send a copy of the source directory (including passwords) to your virtual reader:

**dirmaint user withpass**

7. Receive the USER WITHPASS file to the PMAINT 2CC minidisk as USER DIRECT.

8. Create a new object directory on VMSYS01:

**dirmaint direct**

If the SSI cluster includes other existing members that are already using their DirMaint satellite service machines (for example, if you are adding member 4,

and DIRMSAT2 and DIRMSAT3 are already active), this command will cause DirMaint to update the directory on those satellite systems as well as the DIRMAINT system.

9. If the SSI cluster includes other existing members and the DirMaint satellite service machines are not functional on those systems, create a new object directory on each of those members:

- a. Log on to the MAINT user ID on that member.
- b. Access the PMAINT 2CC and 551 minidisks.
- c. Create the new object directory:

```
directxa user direct fm
```

10. If you are using RACF, modify the definition for the AUTOLOG2 user ID to change its password to NOLOG.

After you IPL the new VMSYS02 system later in this procedure, you need to start the RACFVM virtual machine. When RACFVM is initialized, it issues an XAUTOLOG command for AUTOLOG2, which issues XAUTOLOG commands for the SVMs identified in its profile. However, you need to start RACFVM without logging on those SVMs, so you can do some other operations first. After you complete those operations you will modify the AUTOLOG2 user ID again to restore its password (so keep a record of the original password), and then autolog AUTOLOG2 to start the SVMs.

Issue the following DIRMAINT commands from MAINT<sub>vm</sub> on VMSYS01.

- a. Issue the following command to prevent the updated directory from being placed online. You should delay putting any directory changes online for the other cluster members until after the AUTOLOG2 change is rescinded. If you need to put changes online for a particular member, use DIRECTXA, not DIRMAINT DIRECT.

```
dirmaint offline
```

- b. Issue the following command to modify the AUTOLOG2 definition:

```
dirmaint foruser autolog2 setpw nolog
```

11. On system VMSYS01, create the object directory for VMSYS02:

- a. Detach M01RES and attach M02RES:

```
detach 123
attach rdev to * as 123
```

- b. Create the object directory:

```
directxa user direct fm
```

- c. Detach M02RES:

```
detach 123
```

- d. Re-link M01RES:

```
link maint 123 123 m
```

---

## Task 7: Update the System Configuration File

Update the common system configuration file to add the configuration information for the target member.

1. Access the PMAINT CF0 minidisk:

```
access cf0 fm
```

2. Make a copy of the SYSTEM CONFIG file named TEMP CONFIG on the CF0 minidisk and edit the copy.

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3. Uncomment the SYSTEM\_IDENTIFIER statement for member 2 and update the statement to specify LPAR name LP02 and system name VMSYS02.

```
/* **** */
/* System_Identifier Information */
/* **** */

System_Identifier LPAR LP01 VMSYS01
System_Identifier LPAR LP02 VMSYS02
/* System_Identifier LPAR @@LU-3 @@MEMSL3 */
/* System_Identifier LPAR @@LU-4 @@MEMSL4 */
```

4. In the SSI statement, uncomment the definition for member 2 and update it to specify system name VMSYS02.

**Note:** When adding a third or fourth system to an SSI cluster, it might be useful to organize the systems into relocation domains. These domains should be defined dynamically using the DEFINE RELODOMAIN command and also added to the system configuration file using RELOCATION\_DOMAIN statements. For more information, see “Using Relocation Domains” on page 750.

```
/* **** */
/* SSI Statement */
/* **** */

SSI CLUSTERA PDR_Volume VMCOM1 ,
 Slot 1 VMSYS01,
 Slot 2 VMSYS02
/* Slot 3 @@MEMSLOT3, */
/* Slot 4 @@MEMSLOT4 */
```

5. Uncomment the SYSTEM\_RESIDENCE statement for member 2 and update it to specify system name VMSYS02 as the qualifier and M02RES as the volume label. Ensure that the checkpoint and warm start values for M02RES are identical to M01RES.

```
/* **** */
/* Checkpoint and Warmstart Information */
/* **** */

VMSYS01: System_Residence,
 Checkpoint Valid M01RES From CYL 21 For 9 ,
 Warmstart Valid M01RES From CYL 30 For 9
VMSYS02: System_Residence,
 Checkpoint Valid M02RES From CYL 21 For 9 ,
 Warmstart Valid M02RES From CYL 30 For 9
/*@@MEMSLOT3: System_Residence,
/* Checkpoint Valid M03RES From CYL 21 For 9 ,
/* Warmstart Valid M03RES From CYL 30 For 9
/*@@MEMSLOT4: System_Residence,
/* Checkpoint Valid M04RES From CYL 21 For 9 ,
/* Warmstart Valid M04RES From CYL 30 For 9
```

6. Update the CP\_OWNED statements:

- a. In the system residence volume section, uncomment the statement for member 2 and update it to specify system name VMSYS02 as the qualifier and M02RES as the volume label.

```

/*****
/* CP_Owned Volume Statements */
/*****
/* RES VOLUME */
/*****

 VMSYS01: CP_Owned Slot 1 M01RES
 VMSYS02: CP_Owned Slot 1 M02RES
/*@MEMSLOT3: CP_Owned Slot 1 M03RES */
/*@MEMSLOT4: CP_Owned Slot 1 M04RES */

/*****
/* COMMON VOLUME */
/*****

 CP_Owned Slot 5 VMCOM1

```

- b. In the dump and spool volumes section, uncomment the statement for member 2 (slot 11 in this example) and specify M02S01 as the volume label.

**Important:** Spool volumes must be common, not qualified.

```

/*****
/* DUMP & SPOOL VOLUMES */
/*****

 CP_Owned Slot 10 M01S01
 CP_Owned Slot 11 M02S01
/* CP_Owned Slot 12 M03S01 */
/* CP_Owned Slot 13 M04S01 */

```

- c. In the paging volumes section, uncomment the section for member 2 and update it to specify system name VMSYS02 as the qualifier and M02P01 as the label of the paging volume.

## Cloning an SSI Cluster Member

```

/*****
/*
/* PAGE & TDISK VOLUMES
/*
/*****

/*****
/* Page and Tdisk volumes for Member 1
/*
/*****

 VMSYS01: BEGIN
 CP_Owned Slot 255 M01P01
 VMSYS01: END

/*****
/* Page and Tdisk volumes for Member 2
/*
/*****

 VMSYS02: BEGIN
 CP_Owned Slot 255 M02P01
 VMSYS02: END

/*****
/* Page and Tdisk volumes for Member 3
/*
/*****

/*@@MEMSLOT3: BEGIN
/* CP_Owned Slot 255 M03P01
/*@@MEMSLOT3: END

/*****
/* Page and Tdisk volumes for Member 4
/*
/*****

/*@@MEMSLOT4: BEGIN
/* CP_Owned Slot 255 M04P01
/*@@MEMSLOT4: END

```

7. Add one or more `USER_VOLUME_LIST` statements to identify the work volumes and member-specific volumes for member 2 and qualify the statements for system name `VMSYS02`.

```

/*****
/*
/* User_Volume_List
/*
/*****
/* COMMON user volumes
/*
/*****

 User_Volume_List VMCOM2 vrmRL1 vrmRL2 USRVL1

/*****
/* User volumes for Member 1
/*
/*****

 VMSYS01: User_Volume_List M01W01 M01PV1

/*****
/* User volumes for Member 2
/*
/*****

 VMSYS02: User_Volume_List M02W01 M02PV1

```



8. Add ACTIVATE ISLINK statements for the target member, and update the statements for the existing members, to identify the ISFC links from each member to the other members. Every member must have one direct ISFC logical link (consisting of multiple CTCA devices) defined to each of the other members. For example, if you are adding member 3, it must have links to members 1 and 2, member 1 must have links to members 2 and 3, and member 2 must have links to members 1 and 3. Use qualifiers to define the set of links for each member.

**Notes:**

- If the target member is being added to a second-level SSI cluster, the ACTIVATE ISLINK statements must specify virtual CTCAs defined by DEFINE and COUPLE statements in the profiles for the first-level user IDs.
- If the target member is being created second-level but the existing members are first-level, the ACTIVATE ISLINK statements for the target member must identify dedicated real CTCA devices, not virtual CTCAs, to enable the target member to communicate with the first-level members.

```

/*****
/* Activate ISLINK statements */
/*****
/*****
/* ISFC links for Member 1 */
/*****

VMSYS01: ACTIVATE ISLINK rdev... NODE VMSYS02

/*****
/* ISFC links for Member 2 */
/*****

VMSYS02: ACTIVATE ISLINK rdev... NODE VMSYS01

```

9. Adjust the real device numbers of the OSA devices on DEFINE VSWITCH statements, if needed.

```

/*****
/* DEFINE VSWITCH statements */
/*****
/*****

DEFINE VSWITCH switchname RDEV rdev...

```

10. If the file includes a VMLAN statement with the MACPREFIX operand for each of the existing members to specify the prefix for system-assigned locally administered MAC addresses, add a qualified statement for the target member. The MACPREFIX value must be different for each member. If the USERPREFIX option is included on the existing statements to specify the prefix for customer-assigned locally administered MAC addresses, include the USERPREFIX option on the new statement. The USERPREFIX value must be identical for all members.

```
VMSYS01: VMLAN MACPREFIX xxxxxx USERPREFIX yyyyyy
VMSYS02: VMLAN MACPREFIX zzzzzz USERPREFIX yyyyyy
```

11. After you finish editing the file, use the CPSYNTAX utility (available on the MAINT 193 minidisk) to check the syntax of the configuration statements for member VMSYS02.

```
cpsyntax temp config * (lpar lp02
```

**Note:** If z/VM is installed second level, the LPAR name field specifies the user ID of the virtual machine in which this system is running. The value of the LPAR operand must match the value specified on the SYSTEM\_IDENTIFIER statement that was added above.

If there are other existing members in the cluster, repeat the command to check the syntax of the statements for each of those members. Correct all errors before proceeding to the next step. For the example in this chapter, do the following:

```
cpsyntax temp config * (lpar lp01
```

12. Prepare to use the revised system configuration file:
  - a. Rename the current SYSTEM CONFIG file to BACKUP CONFIG.
  - b. Rename the TEMP CONFIG file to SYSTEM CONFIG.

---

## Task 8: Enable the Existing Members to Access the Target Member

All of the following commands can be issued on the current member (VMSYS01 in this example).

1. Add system VMSYS02 to the member list for the SSI cluster:

```
set ssi slot 2 vmsys02
```

**Note:** VMSYS02 will be in the Down state until the system is IPLed and joins the cluster.

2. Activate the ISFC links from the existing members to VMSYS02:

- a. Activate the links from VMSYS01 to VMSYS02:

```
activate islink rdev [rdev...] node vmsys02
```

- b. If there are other active existing members in the cluster, activate the links from each member to VMSYS02:

```
at sysname cmd activate islink rdev [rdev...] node vmsys02
```

3. Define the VMSYS02 spool volumes to CP (add the volumes to the CP-owned list) on the existing members and attach the volumes:

- a. Enable each device on member VMSYS01:

```
vary online rdev
```

- b. If there are other active existing members in the cluster, enable each device on each member:

```
at sysname cmd vary online rdev
```

- c. Define each volume to CP on member VMSYS01 and attach the volume. For example, to define volume M02S01 as slot 11 and attach it:

```
define cpowned slot 11 m02s01
attach rdev to system
```

The attach process will automatically add the volume to the CP-owned list on the other active existing members and attach the volume to those members.

4. Log off *MAINTvm*.

---

## Task 9: IPL the Target Member

When you IPL the target member, the **ACTIVATE ISLINK** statements in the configuration file will trigger the process that joins the target member to the cluster.

1. Use the HMC to IPL the M02RES device.

**Note:** To create a second level system, log on to the virtual machine in which **VMSYS02** will be initialized and IPL the M02RES minidisk.

2. Specify options **CLEAN NOAUTOLOG** to bring up **VMSYS02** without autologging any users except the system operator.

---

## Task 10: Start the ESM Service Virtual Machine

If an ESM is installed, start the ESM service virtual machine.

1. For example, if you are using RACF:

```
xautolog racfvm
```

**Note:** RACFVM issues an **XAUTOLOG** command for the **AUTOLOG2** user ID. However, you previously changed the password for **AUTOLOG2** to **NOLOG** to prevent **AUTOLOG2** from logging on and executing its profile to autolog other SVMs.

---

## Task 11: Update the VMSES/E System-Level Product Inventory Table

Update the VMSES/E System-Level Product Inventory table (**VM SYSPINV**) to add **VMSYS02** to the product records.

1. Log on to the *MAINTvm* user ID.
2. Issue the following command:

```
vmfupdat syspinv system vmsys02 vmsys01
```

---

## Task 12: Build the Saved Segments and Named Saved Systems

Build the saved segments and named saved systems.

1. If you had previously configured the **SYSTEM NETID** file on **VMSYS01**, update the file on **VMSYS02**:
  - a. Link and access the **MAINT 190** minidisk:
 

```
link to maint 190 as 190 m
access 190 fm
```
  - b. Edit the **SYSTEM NETID** file and add a record for the LPAR/processor ID and system name for this member. Make sure that file contains a record for every current member.

```
cpuid1 VMSYS01 RSCS
cpuid2 VMSYS02 RSCS
```

2. Start the **VMSESVS**, **VMSESVU**, and **VMSESVR** file pool servers on **VMSYS02**:

```
xautolog vmsevs
:
xautolog vmsevu
```

## Cloning an SSI Cluster Member

```
⋮
xautolog vmservr
```

3. Ensure that the product service file pool (VMPSFS, managed by server VMSERV) is running. Ordinarily, this server should be running on one existing member of the cluster (for example, VMSYS01). Issue the following command:

```
xautolog vmservp
```

You will receive either a message or a response:

- If you receive the following message, the server is already logged on to another member of the cluster:

```
HCP054E Already logged on SYSTEM sysname
```

- If you receive the following response, the server has been started on VMSYS02:

```
Command accepted
AUTO LOGON *** VMSERV USERS = nnnnn
```

4. Save the CMS named saved system:

```
put2prod savecms
```

5. Build the segments defined in the system segments build list:

```
put2prod segments all
```

6. Build the GCS segment and named saved system:

```
service gcs bldnuc
put2prod
```

---

## Task 13: Start the Service Virtual Machines

1. Update any remaining SVM configuration files that need to provide member-specific information for VMSYS02.
2. If you are using RACF, modify the definition for the AUTOLOG2 user ID to restore its password:
  - If you are using DirMaint:
    - a. Start the DIRMSAT2 server:

```
xautolog dirmsat2
```
    - b. Change the password on the AUTOLOG2 definition:

```
dirmaint foruser autolog2 setpw password
```
    - c. Issue the following command to cancel the previous DIRMAINT OFFLINE command and put the updated directory online immediately for all the active members:

```
dirmaint online immed
```
  - If you are not using DirMaint:
    - a. Make a backup copy and then edit the common source directory (USER DIRECT).
    - b. Change the password on the AUTOLOG2 definition.
    - c. Create the new object directory:

```
directxa user direct fm
```
    - d. If directory changes for any other members of the cluster have been put online since you changed the AUTOLOG2 password to NOLOG, you need to create new object directories for those members as well to include this change:
      - 1) Log on to the MAINT user ID on that member.
      - 2) Access the PMAINT 2CC and 551 minidisks.

- 3) Create the new object directory:

```
directxa user direct fm
```

3. Update the SSL server certificate, if necessary.

If you obtained a new single server certificate for VMSYS02, see *z/VM: TCP/IP User's Guide* for information on how to update the key database on VMSYS02 with the new certificate information.

4. Start the system startup virtual machine to autolog the SVMs:

- If you are using RACF:

```
xautolog autolog2
```

- If you are not using RACF:

```
xautolog autolog1
```

---

## Task 14: Test and Verify

1. Verify that everything is working as it should on the new member.
2. After you verify that everything is working, it is safe to make updates to the user directory.

**Reminder:** Whenever you change the common source directory, create a new object directory for each member of the cluster.

3. The cloning procedure is now completed and you can apply service to the members of the cluster, if needed.



---

## Chapter 30. Decommissioning a Member of a z/VM SSI Cluster

Use this procedure to remove a member from a z/VM SSI cluster and permanently shut down that z/VM system. This process is referred to as *decommissioning* the member.

**Note:** If a member of the cluster is simply shut down, it can be reIPLed and can rejoin the cluster. A decommissioned member cannot be reIPLed and cannot rejoin the cluster; it is permanently removed.

See “Before You Begin the Decommissioning Procedure” for assumptions, requirements, and preparations.

In this procedure you will complete the following tasks:

- “Task 1: Log on to the Member Being Decommissioned” on page 805
- “Task 2: Update the DirMaint Configuration (If Required)” on page 805
- “Task 3: Move the Workload to Other Members” on page 806
- “Task 4: Purge the Decommissioned Member's Spool Files” on page 806
- “Task 5: Update the Profile for the System Startup Virtual Machine” on page 806
- “Task 6: Shut Down the Decommissioned Member and Log on to Another Member” on page 807
- “Task 7: Remove the Member from the Member List” on page 807
- “Task 8: Update the System Configuration File” on page 807
- “Task 9: Deactivate the ISFC Links to the Decommissioned Member” on page 814
- “Task 10: Free the Decommissioned Member's DASD Volumes” on page 814
- “Task 11: Update the User Directory” on page 815
- “Task 12: Update the VMSES/E System-Level Product Inventory Table” on page 818
- “Task 13: Update the TCP/IP Configuration” on page 819
- “Task 14: Update the Configuration Files for Other Service Virtual Machines” on page 819

---

### Before You Begin the Decommissioning Procedure

Note the assumptions for this procedure. Make sure that you meet all of the requirements and complete the preparations.

|                  |
|------------------|
| <b>Attention</b> |
|------------------|

|                                                                                |
|--------------------------------------------------------------------------------|
| Do not use this procedure if the SSI cluster was installed with SMAPI enabled. |
|--------------------------------------------------------------------------------|

Assumptions:

- The member being decommissioned is **not** the last member of the SSI cluster. This procedure includes examples for decommissioning member 3 of a three-member SSI cluster, but the tasks apply to decommissioning any member except the last member of the cluster.

## Decommissioning an SSI Cluster Member

To decommission the last member of an SSI cluster, bring up a z/VM starter system on that member and format all of the member's DASD with new labels. For information about using a starter system, see *z/VM: Installation Guide*.

- A common system configuration file and a common source directory are used for the SSI cluster.
- For the member being decommissioned, object directory extents are allocated only on the system residence volume.

### Requirements:

- When decommissioned, the z/VM system must be permanently shut down.

**Note:** To reuse the LPAR for another z/VM system, reinstall z/VM and use different DASD volume labels.

- If you plan to relocate guests from the member being decommissioned to other members of the cluster, ensure that the relocation candidates and the target members meet the eligibility requirements. For more information, see Chapter 27, "Preparing for Guest Relocations in a z/VM SSI Cluster," on page 749.

### Preparations:

- Prepare a worksheet with the DASD volume labels and other information about the member being decommissioned. The following values are used in this procedure:
  - SSI cluster name = CLUSTERA
  - Logical partition name = LP03

**Note:** At second level, this is the user ID of the virtual machine in which the member system is running.

- System ID of the member being decommissioned = VMSYS03
- Labels of the DASD volumes associated with this system.

The examples in this procedure use the default volume labels created by the installation procedure for a multimember SSI cluster. The naming convention is M0*m**vnn* for most volumes, where *m* is the number of this member in the SSI member list (on the SSI configuration statement) and *vnn* identifies the volume type and number (for example, P01 for the first paging volume).

- System residence volume = M03RES
- Volume for paging = M03P01
- Volume for spool files = M03S01
- Volume for temporary disks (if used) = M03T01
- Work volume = M03W01
- Member-specific user volume = M03PV1

**Note:** In an SSI cluster in which members have different releases installed, if the member being decommissioned is the last member on which the highest release level product is installed, the cross-system highest release level programs residing on the SSI system common disk (PMAINT 551, by default) will remain at that highest release level.



## Task 1: Log on to the Member Being Decommissioned

**Note:** For simplicity, this procedure does not show all of the system responses.

1. Log on to the MAINT<sub>vm</sub> user ID for the release level on VMSYS03.

## Task 2: Update the DirMaint Configuration (If Required)

If DirMaint is not being used in the SSI cluster, skip this task and go to “Task 3: Move the Workload to Other Members” on page 806.

If DirMaint is installed and enabled in the SSI cluster, remove the member being decommissioned from the DirMaint configuration:

- If the DIRMAINT server is logged on to the member being decommissioned, log off DIRMAINT on that member and log on DIRMAINT on another member.  
**Attention:** Do not use the VMRELOCATE command to relocate the DIRMAINT virtual machine.
- Remove the DIRMSAT and DATAMOVE servers for the member being decommissioned (DIRMSAT<sub>n</sub> and DATAMOV<sub>n</sub>). Also, if you moved the DIRMAINT server, update the configuration to reflect the new location.

1. If DIRMAINT is running on VMSYS03, shut down the server:

```
dirmaint shutdown
```

```
DVHxxx2193I A shutdown command has been issued by MAINTvm from VMSYS03
DVHxxx2198A The DIRMAINT service machine is logging off
```

2. On another member of the SSI cluster, log on the DIRMAINT server and update the DirMaint configuration:

**Note:** In this example, DIRMAINT is being moved from VMSYS03 to VMSYS01.

- a. Log on to the MAINT user ID.
- b. Log on the DIRMAINT virtual machine:

```
xautolog dirmaint
```

- c. Update the CONFIGSS DATADVH file:

- 1) Remove the SATELLITE\_SERVER statement for VMSYS03 (for example, DIRMSAT3).

**Note:** If you are using an external security manager, such as RACF, the satellite for VMSYS03 also must be removed from the ESM configuration. See the external security manager considerations in *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

- 2) Remove the DATAMOVE\_MACHINE statement for VMSYS03 (for example, DATAMOV3).
- 3) Reload the data tables from the CONFIG\* DATADVH disk files:

```
dirmaint rlddata
```

3. Update the EXTENT CONTROL file to remove the minidisk allocation data for member VMSYS03.

- a. Send a copy of the EXTENT CONTROL file to your virtual reader:

```
dirmaint send extent control
```

- b. Receive the EXTENT CONTROL file and edit it.

- 1) If the :REGIONS. section includes any entries for VMSYS03 volumes, remove them.

## Decommissioning an SSI Cluster Member

- 2) Update the :SSI\_VOLUMES. section to remove the entries for VMSYS03 volumes.
- 3) If the :DEFAULTS. section includes an entry for a DASD device type and model used only on VMSYS03, remove the entry.
- c. Replace the updated EXTENT CONTROL file and reload the data:  

```
dirmaint file extent control
dirmaint rldextn
```

---

### Task 3: Move the Workload to Other Members

Move all workload from the member being decommissioned to the other members of the cluster.

1. Make sure all users are logged off VMSYS03.
2. If there are servers and service machines on VMSYS03 that you will need after VMSYS03 is decommissioned, and those virtual machines can be shut down, log them off VMSYS03 and log them on to another member of the cluster.
3. If there are guests running on VMSYS03 that you will need after VMSYS03 is decommissioned, and you do not want to shut down those guests, use the VMRELOCATE command to relocate the virtual machines to other members of the cluster. For example, to relocate the LINX7 virtual machine from member VMSYS03 to member VMSYS02:

```
vmrelocate move user linx7 to vmsys02
```

```
Relocation of LINX7 from VMSYS03 to VMSYS02 started
:
User LINX7 has been relocated from VMSYS03 to VMSYS02
```

**Note:** To relocate a virtual machine to another member of the SSI cluster, the relocation candidate and the destination system must meet the eligibility requirements. For more information, see Chapter 27, “Preparing for Guest Relocations in a z/VM SSI Cluster,” on page 749.

---

### Task 4: Purge the Decommissioned Member's Spool Files

Purge the standard spool files on the member being decommissioned. This will also remove the shadowed spool files on the other members.

1. (Optional) If you want to save the spool files, you can use the SPXTAPE command to dump them to tape and purge them after they are dumped:

```
vary online rdev
attach rdev to * as vdev
:
spxtape dump vdev std all purge
```

2. Purge the spool files:  
purge force system ur all

---

### Task 5: Update the Profile for the System Startup Virtual Machine

If the profile for the system startup virtual machine (AUTOLOG1) contains any logic to conditionally process certain XAUTOLOG commands for the member being decommissioned, remove those statements and processing logic.

1. Link (multiple-write) and access the AUTOLOG1 191 minidisk:

```
link to autolog1 191 as vdev m
access vdev fm
```

**Note:** If you are using RACF, make the changes to the AUTOLOG2 virtual machine instead of AUTOLOG1.

2. Edit the PROFILE EXEC file and remove the XAUTOLOG commands and processing logic that apply only to member VMSYS03.

---

## Task 6: Shut Down the Decommissioned Member and Log on to Another Member

1. Shut down system VMSYS03:  
**shutdown**
2. Log on to the MAINT*vm* user ID on another member of the SSI cluster, for example VMSYS02.

---

## Task 7: Remove the Member from the Member List

Remove the decommissioned member from the member list for the SSI cluster.

1. To remove system VMSYS03 from the member list, mark slot 3 as available:  
**set ssi slot 3 available**

---

## Task 8: Update the System Configuration File

Update the common system configuration file to remove configuration information for the decommissioned member.

1. Access the PMAINT CF0 minidisk:  
**access cf0 fm**
2. Make a copy of the SYSTEM CONFIG file called TEMP CONFIG on the CF0 minidisk and edit the copy.
3. Remove the SYSTEM\_IDENTIFIER statement for VMSYS03..

Before:

```

/*****
/* System_Identifier Information */
/*****

System_Identifier LPAR LP01 VMSYS01
System_Identifier LPAR LP02 VMSYS02
System_Identifier LPAR LP03 VMSYS03

```

After:

```

/*****
/* System_Identifier Information */
/*****

System_Identifier LPAR LP01 VMSYS01
System_Identifier LPAR LP02 VMSYS02

```

## Decommissioning an SSI Cluster Member

4. Update the SSI statement to remove VMSYS03 from slot 3 and mark the slot as AVAILABLE.

Before:

```
/* **** */
/* SSI Statement */
/* **** */

SSI CLUSTERA PDR_Volume VMCOM1 ,
 Slot 1 VMSYS01,
 Slot 2 VMSYS02,
 Slot 3 VMSYS03,
 Slot 4 AVAILABLE
```

After:

```
/* **** */
/* SSI Statement */
/* **** */

SSI CLUSTERA PDR_Volume VMCOM1 ,
 Slot 1 VMSYS01,
 Slot 2 VMSYS02,
 Slot 3 AVAILABLE,
 Slot 4 AVAILABLE
```

5. Remove VMSYS03 from any RELOCATION\_DOMAIN statements.

Before:

```
/* **** */
/* Relocation Domains */
/* **** */

Relocation_Domain DOMAIN1 Members VMSYS01 VMSYS02
Relocation_Domain DOMAIN2 Members VMSYS02 VMSYS03
```

After:

```
/* **** */
/* Relocation Domains */
/* **** */

Relocation_Domain DOMAIN1 Members VMSYS01 VMSYS02
Relocation_Domain DOMAIN2 Members VMSYS02
```

## 6. Remove the SYSTEM\_RESIDENCE statement for VMSYS03.

Before:

```

/*****
/* Checkpoint and Warmstart Information */
*****/

VMSYS01: System_Residence,
Checkpoint Valid M01RES From CYL 21 For 9 ,
Warmstart Valid M01RES From CYL 30 For 9
VMSYS02: System_Residence,
Checkpoint Valid M02RES From CYL 21 For 9 ,
Warmstart Valid M02RES From CYL 30 For 9
VMSYS03: System_Residence,
Checkpoint Valid M03RES From CYL 21 For 9 ,
Warmstart Valid M03RES From CYL 30 For 9

```

After:

```

/*****
/* Checkpoint and Warmstart Information */
*****/

VMSYS01: System_Residence,
Checkpoint Valid M01RES From CYL 21 For 9 ,
Warmstart Valid M01RES From CYL 30 For 9
VMSYS02: System_Residence,
Checkpoint Valid M02RES From CYL 21 For 9 ,
Warmstart Valid M02RES From CYL 30 For 9

```

## 7. Update the CP\_OWNED statements to remove VMSYS03.

## a. System residence volume.

Before:

```

/*****
/* CP_Owned Volume Statements */
*****/
/*****
/* RES VOLUME */
*****/

VMSYS01: CP_Owned Slot 001 M01RES
VMSYS02: CP_Owned Slot 001 M02RES
VMSYS03: CP_Owned Slot 001 M03RES

/*****
/* COMMON VOLUME */
*****/

CP_Owned Slot 005 VMCOM1

```

## Decommissioning an SSI Cluster Member

After:

```

/*****
/* CP_Owned Volume Statements */
/*****
/* RES VOLUME */
/*****

VMSYS01: CP_Owned Slot 001 M01RES
VMSYS02: CP_Owned Slot 001 M02RES

/*****
/* COMMON VOLUME */
/*****

CP_Owned Slot 005 VMCOM1

```

b. Dump and spool volumes.

Record the slot numbers and labels of the spool volumes. You will need this information in “Task 10: Free the Decommissioned Member's DASD Volumes” on page 814.

**Attention:** Do not delete the spool volume slots; mark them as RESERVED.

Before:

```

/*****
/* DUMP & SPOOL VOLUMES */
/*****

CP_Owned Slot 010 M01S01
CP_Owned Slot 011 M02S01
CP_Owned Slot 012 M03S01

```

After:

```

/*****
/* DUMP & SPOOL VOLUMES */
/*****

CP_Owned Slot 010 M01S01
CP_Owned Slot 011 M02S01
CP_Owned Slot 012 RESERVED

```

c. Paging and temporary disk volumes.

**Note:** Although this example shows a temporary disk volume, this volume is not included in the default z/VM installation.

Before:

```

/*****/
/* PAGE & TDISK VOLUMES */
/*****/

/*****/
/* Page and Tdisk volumes for Member 1 */
/*****/

VMSYS01: BEGIN
 CP_Owned Slot 254 M01T01
 CP_Owned Slot 255 M01P01
VMSYS01: END

/*****/
/* Page and Tdisk volumes for Member 2 */
/*****/

VMSYS02: BEGIN
 CP_Owned Slot 254 M02T01
 CP_Owned Slot 255 M02P01
VMSYS02: END

/*****/
/* Page and Tdisk volumes for Member 3 */
/*****/

VMSYS03: BEGIN
 CP_Owned Slot 254 M03T01
 CP_Owned Slot 255 M03P01
VMSYS03: END

```

After:

```

/*****/
/* PAGE & TDISK VOLUMES */
/*****/

/*****/
/* Page and Tdisk volumes for Member 1 */
/*****/

VMSYS01: BEGIN
 CP_Owned Slot 254 M01T01
 CP_Owned Slot 255 M01P01
VMSYS01: END

/*****/
/* Page and Tdisk volumes for Member 2 */
/*****/

VMSYS02: BEGIN
 CP_Owned Slot 254 M02T01
 CP_Owned Slot 255 M02P01
VMSYS02: END

```

## Decommissioning an SSI Cluster Member

8. Update the USER\_VOLUME\_LIST statements to remove the VMSYS03 work volume and member-specific user volume.

Before:

```

/*****
/* User_Volume_List */
/*****
/* COMMON user volumes */
/*****

 User_Volume_List VMC0M2 vrmRL1 vrmRL2 USRVL1

/*****
/* User volumes for Member 1 */
/*****

 VMSYS01: User_Volume_List M01W01 M01PV1

/*****
/* User volumes for Member 2 */
/*****

 VMSYS02: User_Volume_List M02W01 M02PV1

/*****
/* User volumes for Member 3 */
/*****

 VMSYS03: User_Volume_List M03W01 M03PV1

```

After:

```

/*****
/* User_Volume_List */
/*****
/* COMMON user volumes */
/*****

 User_Volume_List VMC0M2 vrmRL1 vrmRL2 USRVL1

/*****
/* User volumes for Member 1 */
/*****

 VMSYS01: User_Volume_List M01W01 M01PV1

/*****
/* User volumes for Member 2 */
/*****

 VMSYS02: User_Volume_List M02W01 M02PV1

```



9. Remove the ACTIVATE ISLINK statements for ISFC links from and to VMSYS03.

Record the device numbers of the links from each member to VMSYS03. You will deactivate these devices in “Task 9: Deactivate the ISFC Links to the Decommissioned Member” on page 814.

Before:

```

/*****
/* Activate ISLINK statements */
/*****
/*****
/* ISFC links for Member 1 */
/*****

VMSYS01: Activate ISLINK rdev... Node VMSYS02
VMSYS01: Activate ISLINK rdev... Node VMSYS03

/*****
/* ISFC links for Member 2 */
/*****

VMSYS02: Activate ISLINK rdev... Node VMSYS01
VMSYS02: Activate ISLINK rdev... Node VMSYS03

/*****
/* ISFC links for Member 3 */
/*****

VMSYS03: Activate ISLINK rdev... Node VMSYS01
VMSYS03: Activate ISLINK rdev... Node VMSYS02

```

After:

```

/*****
/* Activate ISLINK statements */
/*****
/*****
/* ISFC links for Member 1 */
/*****

VMSYS01: Activate ISLINK rdev... Node VMSYS02

/*****
/* ISFC links for Member 2 */
/*****

VMSYS02: Activate ISLINK rdev... Node VMSYS01

```

10. Adjust the real device numbers of the OSA devices on DEFINE VSWITCH statements, if needed.

## Decommissioning an SSI Cluster Member

```
/*****
/* Define VSWITCH statements */
/*****/

Define VSWITCH switchname RDEV rdev...
```

11. Remove all other statements or entries qualified (tagged) for system VMSYS03.
12. Issue the CPSYNTAX command to check the syntax of the configuration statements for each remaining member of the cluster to make sure you have not inadvertently caused syntax errors when removing the statements for VMSYS03. Correct all errors before proceeding to the next step.

```
cpsyntax temp config * (lpar lp01
```

```
cpsyntax temp config * (lpar lp02
```

**Note:** If z/VM is installed second level, the LPAR name field specifies the user ID of the virtual machine in which this system is running. The value of the LPAR operand must match the value specified on the SYSTEM\_IDENTIFIER statement that was added above.

13. Prepare to use the revised system configuration file:
  - a. Rename the current SYSTEM CONFIG file to BACKUP CONFIG.
  - b. Rename the TEMP CONFIG file to SYSTEM CONFIG.
  - c. Make the PMAINT CF0 minidisk available to CP as file mode L:

```
cpaccess pmaint cf0 1
```

---

## Task 9: Deactivate the ISFC Links to the Decommissioned Member

Deactivate the ISFC links from the remaining members of the SSI cluster to the decommissioned member. Do this for each remaining member. You can issue all of the necessary commands from the current member.

1. For example, to deactivate the links from the current member (VMSYS02 in this example) to VMSYS03, issue a DEACTIVE ISLINK command for the devices:

```
deactive islink rdev [rdev...]
```

Link *rdev* deactivated.

2. To deactivate the links from a remote member (for example, VMSYS01) to VMSYS03, use the AT command to issue the DEACTIVE ISLINK command:

```
at vmsys01 cmd deactivate islink rdev [rdev...]
```

Link *rdev* deactivated.

---

## Task 10: Free the Decommissioned Member's DASD Volumes

Free the DASD volumes used by the decommissioned member.

1. Drain the VMSYS03 spool volumes. You need to issue the DRAIN command only once for each volume. For example, to drain volume M03S01:

```
drain volid ms3s01 all
```

2. Detach the VMSYS03 spool volumes from the remaining members. Do this for each remaining member. You can issue all of the necessary commands from the current member.

- a. For example, to detach volume M03S01 from the current member (VMSYS02 in this example):

```
detach volid ms3s01 from system
```

- b. To detach volume M03S01 from a remote member (for example, VMSYS01), use the AT command to issue the DETACH command:  
`at vmsys01 cmd detach valid ms3s01 from system`
3. Dynamically remove the VMSYS03 spool volumes from the CP-owned lists for the remaining members by defining the slots as reserved. Use the information you recorded in “Task 8: Update the System Configuration File” on page 807. For example, to remove volume M03S01, define slot 12 as reserved. Do this for each remaining member. You can issue all of the necessary commands from the current member.
  - a. For example, to update the CP-owned list for the current member (VMSYS02 in this example):  
`define cpowned slot 012 reserved`
  - b. To update the CP-owned list for a remote member (for example, VMSYS01), use the AT command to issue the DEFINE CPOWNER command:  
`at vmsys01 cmd define cpowned slot 012 reserved`
4. Delete all data from all of the VMSYS03 CP-owned and member-specific volumes.
  - a. Attach the volumes:  
`vary online rdev`  
`attach rdev to * as vdev`
  - b. Format each volume with a new label:

**Note:** Formatting the volume also removes the ownership information.

```
cpfmtxa vdev valid
```

```
CPFMTXA:
```

```
FORMAT WILL ERASE CYLINDERS 00000-nnnnn ON DISK vdev
```

```
DO YOU WANT TO CONTINUE? (YES | NO)
```

```
yes
```

```
HCPCCF6209I INVOKING ICKDSF.
```

```
:
```

## Task 11: Update the User Directory

Update the common source directory to remove the decommissioned member from the multiconfiguration virtual machine definitions.

### DirMaint Alternative

If DirMaint is installed and enabled in the SSI cluster, use DirMaint facilities to make the changes described in this task. Use the procedure for making multiple updates to a directory that is documented in *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*.

1. Make a backup copy and then edit the USER DIRECT file.
2. Update the DIRECTORY statement to remove the directory volume for VMSYS03 (M03RES).

Before:

```
DIRECTORY SSI 123 3390 M01RES M02RES M03RES
```

## Decommissioning an SSI Cluster Member

After:

|                                      |
|--------------------------------------|
| DIRECTORY SSI 123 3390 M01RES M02RES |
|--------------------------------------|

3. Update the multiconfiguration virtual machine definitions to remove the VMSYS03 configurations. In each definition, remove the BUILD statement for VMSYS03 from the identity entry and remove the associated subconfiguration entry. For example, to remove the configuration for TCPIP on VMSYS03:

Before:

```

IDENTITY TCPIP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCPIP-1
BUILD ON VMSYS02 USING SUBCONFIG TCPIP-2
BUILD ON VMSYS03 USING SUBCONFIG TCPIP-3
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCPIP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M01W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-2
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M02W01 MR RTCPIP WTCPIP MTCPIP

SUBCONFIG TCPIP-3
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M03W01 MR RTCPIP WTCPIP MTCPIP

```

## Decommissioning an SSI Cluster Member

After:

```
IDENTITY TCP/IP password 128M 256M ABG
INCLUDE TCPCMSU
BUILD ON VMSYS01 USING SUBCONFIG TCP/IP-1
BUILD ON VMSYS02 USING SUBCONFIG TCP/IP-2
OPTION QUICKDSP SVMSTAT MAXCONN 1024 DIAG98 APPLMON
SHARE RELATIVE 3000
IUCV ALLOW
IUCV ANY PRIORITY
IUCV *CCS PRIORITY MSGLIMIT 255
IUCV *VSWITCH MSGLIMIT 65535

SUBCONFIG TCP/IP-1
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M01W01 MR RTCP/IP WTCP/IP MTCP/IP

SUBCONFIG TCP/IP-2
LINK TCPMAINT 491 491 RR
LINK TCPMAINT 492 492 RR
LINK TCPMAINT 591 591 RR
LINK TCPMAINT 592 592 RR
LINK TCPMAINT 198 198 RR
MDISK 191 3390 1019 005 M02W01 MR RTCP/IP WTCP/IP MTCP/IP
```

4. Remove the virtual machine definitions for single-configuration virtual machines that run only on VMSYS03 and will not be relocated to another member of the SSI cluster. If DirMaint is installed in the cluster, remove the virtual machine definitions for the DIRMSAT server (for example, DIRMSAT3) and DATAMOVE server (for example, DATAMOV3).
5. Create a new object directory for each of the remaining members of the cluster:
  - a. If you are using DirMaint, issue the following command (which will cause the directory to be created on each member):  
**dirmaint direct**
  - b. If you are not using DirMaint:
    - 1) On the current member, issue the following command:  
**directxa user direct fm**
    - 2) If there are other existing members:
      - a) Log on to the MAINT user ID on that member.
      - b) Access the PMAINT 2CC and 551 minidisks.
      - c) Create the new object directory:  
**directxa user direct fm**

---

## Task 12: Update the VMSES/E System-Level Product Inventory Table

Update the VMSES/E System-Level Product Inventory table (VM SYSPINV) to remove the decommissioned member from the product records.

1. Issue the following command:  
**vmfupdat syspinv remove system vmsys03**

---

## Task 13: Update the TCP/IP Configuration

Reconfigure the TCP/IP stack to remove the decommissioned member.

1. Link (multiple-write) and access the TCPMAINT 198 minidisk:  
`link to tcpmaint 198 as 198 m`  
`access 198 fm`
  - a. Erase the TCPIP server configuration file for VMSYS03 (VMSYS03 TCPIP).
  - b. Remove VMSYS03 from other multinode-capable files on this minidisk. For example:
    - Remove VMSYS03-specific logic in the global profile exit (TCPRUNXT EXEC).
    - Remove VMSYS03-specific configurations for other TCP/IP servers; for example, erase the VMSYS03 DTCPARMS file.
2. Link (multiple-write) and access the TCPMAINT 592 minidisk:  
`link to tcpmaint 592 as 592 m`  
`access 592 fm`
  - a. Edit the TCPIP DATA file and add remove the HOSTNAME statement for VMSYS03.

---

## Task 14: Update the Configuration Files for Other Service Virtual Machines

1. If needed, update the configuration files for other facilities, features, and products to remove configuration information for the decommissioned member. For example, if you are using the Performance Toolkit for centralized monitoring in your SSI cluster, see the preparation information in *z/VM: Performance Toolkit Guide*.
2. Decommissioning the SSI cluster member is now complete.





---

## Chapter 31. Moving a Second-Level z/VM SSI Cluster to First-Level

Use this procedure to move a second-level z/VM SSI cluster (where the members are IPLed in virtual machines) to first-level (where the members are IPLed in logical partitions).

Before you begin the procedure, see “Assumptions for Using This Procedure.”

In this procedure you will complete the following tasks:

“Task 1: Update the System Configuration File”

“Task 2: Shut Down the Second-Level SSI Cluster and IPL the Members First-Level” on page 824

“Task 3: Update the z/VM System Where the SSI Cluster Was Installed Second-Level” on page 824

---

### Assumptions for Using This Procedure

This procedure is based upon the following assumptions:

- The SSI cluster was installed second-level by following one of the SSI installation procedures documented in *z/VM: Installation Guide*.
- The second-level cluster was installed to real DASD volumes.
- Any member-specific minidisks for customer-defined service machines and servers have been defined on additional real DASD volumes.
- DASD volume labels and addresses will not be changed.
- System names of the members and other cluster data will not be changed.
- The logical partitions in which the members will be IPLed have been defined and configured with access to the same devices that are available in the second-level environment.
- A common system configuration file is used for all members of the cluster.

The examples in this procedure show a cluster configuration consisting of four members. The following values are used:

- System names of the members: VMSYS01, VMSYS02, VMSYS03, and VMSYS04.
- Virtual machines in which the members are IPLed: USER1, USER2, USER3, and USER4.
- Corresponding logical partitions: LP1, LP2, LP3, and LP4.

---

### Task 1: Update the System Configuration File

Update the system configuration file (SYSTEM CONFIG) to specify the information for first-level execution of the SSI cluster.

**Note:** For simplicity, this procedure does not show the system responses.

1. Log on to a MAINT<sub>term</sub> user ID on any member of the cluster.
2. Access the PMAINT CF0 minidisk:

```
access cf0 fm
```

## Moving Second-Level SSI Cluster to First-Level

3. Make a copy of the system configuration file with a different name (such as 1STLVL CONFIG) on the CF0 minidisk and make the changes to the copy.
4. Define SYSTEM\_IDENTIFIER statements that map the members of the cluster to the logical partitions.

In the existing statement for each member, the LPAR name field specifies the first-level user ID of the virtual machine in which the member is IPLed.

- If you will never run the SSI cluster second-level again, update the LPAR name field to specify the name of the logical partition in which the member will be IPLed.

Before (Second-Level):

```
/* **** */
/* System_Identifier Information */
/* **** */

System_Identifier LPAR USER1 VMSYS01
System_Identifier LPAR USER2 VMSYS02
System_Identifier LPAR USER3 VMSYS03
System_Identifier LPAR USER4 VMSYS04
```

After (First-Level):

```
/* **** */
/* System_Identifier Information */
/* **** */

System_Identifier LPAR LP1 VMSYS01
System_Identifier LPAR LP2 VMSYS02
System_Identifier LPAR LP3 VMSYS03
System_Identifier LPAR LP4 VMSYS04
```

- If you intend to be able to switch between first-level and second-level execution of the SSI cluster (such as for disaster recovery), keep the second-level statements and add a new set of statements for first-level.

First-Level or Second-Level Execution:

```
/* **** */
/* System_Identifier Information */
/* **** */

System_Identifier LPAR USER1 VMSYS01
System_Identifier LPAR USER2 VMSYS02
System_Identifier LPAR USER3 VMSYS03
System_Identifier LPAR USER4 VMSYS04
System_Identifier LPAR LP1 VMSYS01
System_Identifier LPAR LP2 VMSYS02
System_Identifier LPAR LP3 VMSYS03
System_Identifier LPAR LP4 VMSYS04
```

5. Update the ACTIVATE ISLINK statements to specify the real CTCA devices for the ISFC links from each member to the other members.

The existing ACTIVATE ISLINK statements specify the virtual CTCAs defined by DEFINE and COUPLE statements in the profiles for the first-level user IDs.

## Moving Second-Level SSI Cluster to First-Level

The following example shows devices for two ISFC links between members (therefore six devices for each member) and shows the default virtual device numbers defined by the second-level installation procedure. That is, A2B1 and A2B2 are the devices for the links from VMSYS01 to VMSYS02, A2C1 and A2C2 are the devices for the links from VMSYS01 to VMSYS03, and so on.

Change the virtual device numbers to the real device numbers. That is, *rdev1* and *rdev2* are the real devices for the links from VMSYS01 to VMSYS02, *rdev3* and *rdev4* are the real devices for the links from VMSYS01 to VMSYS03, and so on.

Before:

```
/* **** */
/* * Activate ISLINK statements */
/* **** */

VMSYS01: ACTIVATE ISLINK A2B1 A2B2 NODE VMSYS02
VMSYS01: ACTIVATE ISLINK A2C1 A2C2 NODE VMSYS03
VMSYS01: ACTIVATE ISLINK A2D1 A2D2 NODE VMSYS04
VMSYS02: ACTIVATE ISLINK B2A1 B2A2 NODE VMSYS01
VMSYS02: ACTIVATE ISLINK B2C1 B2C2 NODE VMSYS03
VMSYS02: ACTIVATE ISLINK B2D1 B2D2 NODE VMSYS04
VMSYS03: ACTIVATE ISLINK C2A1 C2A2 NODE VMSYS01
VMSYS03: ACTIVATE ISLINK C2B1 C2B2 NODE VMSYS02
VMSYS03: ACTIVATE ISLINK C2D1 C2D2 NODE VMSYS04
VMSYS04: ACTIVATE ISLINK D2A1 D2A2 NODE VMSYS01
VMSYS04: ACTIVATE ISLINK D2B1 D2B2 NODE VMSYS02
VMSYS04: ACTIVATE ISLINK D2C1 D2C2 NODE VMSYS03
```

After:

```
/* **** */
/* * Activate ISLINK statements */
/* **** */

VMSYS01: ACTIVATE ISLINK rdev1 rdev2 NODE VMSYS02
VMSYS01: ACTIVATE ISLINK rdev3 rdev4 NODE VMSYS03
VMSYS01: ACTIVATE ISLINK rdev5 rdev6 NODE VMSYS04
VMSYS02: ACTIVATE ISLINK rdev7 rdev8 NODE VMSYS01
VMSYS02: ACTIVATE ISLINK rdev9 rdev10 NODE VMSYS03
VMSYS02: ACTIVATE ISLINK rdev11 rdev12 NODE VMSYS04
VMSYS03: ACTIVATE ISLINK rdev13 rdev14 NODE VMSYS01
VMSYS03: ACTIVATE ISLINK rdev15 rdev16 NODE VMSYS02
VMSYS03: ACTIVATE ISLINK rdev17 rdev18 NODE VMSYS04
VMSYS04: ACTIVATE ISLINK rdev19 rdev20 NODE VMSYS01
VMSYS04: ACTIVATE ISLINK rdev21 rdev22 NODE VMSYS02
VMSYS04: ACTIVATE ISLINK rdev23 rdev24 NODE VMSYS03
```

6. If the hardware features and architectural enhancements available to the members of the SSI cluster at first level differ from those available to the members at second level, you might want to adjust the relocation domain definitions and the assignment of guests to those domains. For example, a guest might need a particular type of cryptographic feature or High Performance FICON for System z (zHPF). A feature is available for use by a guest only if all members of its relocation domain have the feature and support it. For additional details see “Using Relocation Domains” on page 750.
7. File your changes to 1STLVL CONFIG.

## Moving Second-Level SSI Cluster to First-Level

8. Use the CPSYNTAX command to check the syntax of the configuration statements in 1STLVL CONFIG.

---

## Task 2: Shut Down the Second-Level SSI Cluster and IPL the Members First-Level

You are now ready to change the execution of the SSI cluster from second-level to first-level.

1. Shut down all the members of the cluster except the member where you are logged on as *MAINTorm*.
2. Rename the current SYSTEM CONFIG file to a different name (such as 2NDLVL CONFIG) and rename the 1STLVL CONFIG file to SYSTEM CONFIG.
3. Shut down the member where you are logged on.
4. IPL each member of the cluster in its corresponding logical partition.

If you encounter a problem bringing up the cluster first-level, you can use the old system configuration file (currently named 2NDLVL CONFIG) to bring up the cluster second-level. Once the cluster is successfully running first-level, you can discard the old file.

**Attention:** The members of the SSI cluster must be run either all first-level or all second-level. Do not attempt to run some members first-level and some second-level.

---

## Task 3: Update the z/VM System Where the SSI Cluster Was Installed Second-Level

When you are satisfied that the SSI cluster is successfully running first-level, perform one of the following tasks on the z/VM system where the SSI cluster was installed second-level.

- If you will never run the SSI cluster second-level again:
  1. If USER1, USER2, USER3, and USER4 are still logged on, log them off.
  2. Remove the virtual machine definitions for those user IDs from the source directory.
- If you intend to be able to switch between first-level and second-level execution of the SSI cluster, update the profiles for USER1, USER2, USER3, and USER4 and change the virtual device numbers of the CTCAs on the DEFINE and COUPLE statements to match the first-level real device numbers (*vdev1 = rdev1*, and so on).

The following example shows the changes in the profile for USER1.

## Moving Second-Level SSI Cluster to First-Level

Before:

```
'DEFINE CTCA A2B1'
'DEFINE CTCA A2B2'
'DEFINE CTCA A2C1'
'DEFINE CTCA A2C2'
'DEFINE CTCA A2D1'
'DEFINE CTCA A2D2'
'COUPLE A2B1 TO USER2 B2A1'
'COUPLE A2B2 TO USER2 B2A2'
'COUPLE A2C1 TO USER3 C2A1'
'COUPLE A2C2 TO USER3 C2A2'
'COUPLE A2D1 TO USER4 D2A1'
'COUPLE A2D2 TO USER4 D2A2'
```

After:

```
'DEFINE CTCA vdev1'
'DEFINE CTCA vdev2'
'DEFINE CTCA vdev3'
'DEFINE CTCA vdev4'
'DEFINE CTCA vdev5'
'DEFINE CTCA vdev6'
'COUPLE vdev1 TO USER2 vdev7'
'COUPLE vdev2 TO USER2 vdev8'
'COUPLE vdev3 TO USER3 vdev13'
'COUPLE vdev4 TO USER3 vdev14'
'COUPLE vdev5 TO USER4 vdev19'
'COUPLE vdev6 TO USER4 vdev20'
```

**Note:** Additional changes to the virtual machine configuration or profile might be necessary if any of the required virtual device numbers are already in use on this user ID.

## Moving Second-Level SSI Cluster to First-Level

---

## Chapter 32. Combining Two Non-SSI z/VM Systems to Create a z/VM SSI Cluster

This procedure outlines the process for combining two existing non-SSI z/VM systems to create a z/VM SSI cluster with two members. The process consists of converting one of the systems to cluster member 1, cloning member 1 to create member 2, and moving workload from the other non-SSI system into the cluster.

Before you begin the procedure, see “Requirements and Preparations.”

In this procedure you will complete the following tasks:

“Task 1: Convert System A to Member 1” on page 829

“Task 2: Install Program Products and Vendor Products on Member 1” on page 829

“Task 3: Clone Member 1 to Create Member 2” on page 829

“Task 4: Replicate System B Configuration Definitions in the SSI Cluster” on page 829

“Task 5: Re-IPL Member 2” on page 831

“Task 6: Move System B Workload into the SSI Cluster” on page 831

“Task 7: Test and Verify” on page 833

“Task 8: Shut Down System B” on page 833

---

### Requirements and Preparations

- Make sure that you understand how a z/VM SSI cluster is set up and maintained. For more information, see Chapter 25, “Setting Up z/VM Single System Image Clusters,” on page 709.

It is particularly important to review the following information:

- “SSI Cluster Requirements” on page 724
- “SSI Cluster Restrictions” on page 725
- “Suggested Practices for Setting Up an SSI Cluster” on page 725
- Some tasks in this procedure direct you to complete certain other procedures that might have additional requirements. Make sure that you meet the requirements and complete the preparations documented in those procedures.
- The z/VM systems to be combined must meet the following requirements:
  - The systems must be z/VM V6.2 or later, installed by following one of the non-SSI installation procedures documented in *z/VM: Installation Guide*. The systems must be installed to ECKD DASD.
  - If either system was migrated from a previous z/VM release, all migration tasks must be completed before starting this procedure. For example, the customer-specific user information from the old system must be merged into the user directory on the new system.

**Attention:** In z/VM V6.2 and later, the IBM-supplied source directory is arranged to facilitate SSI deployment (referred to as *SSI-ready*). The structure and layout of the directory differ significantly from pre-V6.2 releases, **even in a non-SSI installation**. The directories for the two non-SSI systems to be combined must conform to the SSI-ready format so they can be merged into a single source directory for the SSI cluster.

## Combining Two z/VM Systems to Create an SSI Cluster

- The systems must not be part of a CSE complex. For information about converting a CSE complex to an SSI cluster, see Chapter 33, “Converting a CSE Complex to a z/VM SSI Cluster,” on page 835.
- This procedure does not cover the situation where the systems are members of an existing ISFC collection.
- If an external security manager (ESM) is being used, it must be used on both members of the SSI cluster and the ESM database must be shared. For further information on how to configure the RACF database DASD for use in an SSI cluster, see *z/VM: RACF Security Server System Programmer's Guide*.
- Choose one system as the “master” system (called system A in this procedure). This is the system that you will convert to member 1 of the SSI cluster, which will set the attributes that will be common for all the members of the cluster. This system will also, by default, supply the virtual machine definitions for user IDs that exist on both systems.

Some key considerations in deciding which of the two systems to designate as system A include:

- If one system has significantly more resources (DASD, virtual machines, and so on) than the other, it might be advantageous to pick that one as system A. The non-master system (system B) will need to be replicated to some extent in the cluster. By using the smaller system for system B, you reduce the amount of replication and the extra resources needed.
- Although member 1 of the SSI cluster will retain the system name of system A, member 2 must have a different system name than system B (because system B will still be running when member 2 is created). If there is a larger impact to one system for changing the system name, then that might be the reason to use it as system A.
- Virtual machines with customer-assigned MAC addresses on system A can retain those MAC addresses in the SSI cluster. However, virtual machines with customer-assigned MAC addresses on system B might have different MAC addresses in the cluster. (For more information, see “Task 6: Move System B Workload into the SSI Cluster” on page 831.) If that is a problem for one of the systems, then make that one system A.
- If an ESM is used, the SSI cluster will inherit the ESM characteristics of system A.
- Service considerations:
  - System A must be at the same service level or a higher service level than system B.
  - Because cluster member 1 will be created from system A, and member 2 will be cloned from member 1, only local modifications on system A will be retained in the SSI cluster. Local modifications on system B will be lost.
- An assumption for using this procedure is that system A and system B are first-level systems. Therefore cluster member 1 will be first-level. If member 2 will be created first-level, a new logical partition is required. Ensure that the logical partition is defined and configured with access to the devices that will be shared with member 1. To enable you to move system B workload into the cluster, member 2 (and also member 1) will require access to the same devices as system B. To facilitate this, consider defining the new logical partition on the same central processor complex as system B.



---

### Task 1: Convert System A to Member 1

Follow the procedure in Chapter 28, “Converting a z/VM System to a Single-Member z/VM SSI Cluster,” on page 759. Make sure that you meet all of the requirements and complete the necessary preparations before you begin.

---

### Task 2: Install Program Products and Vendor Products on Member 1

If there are products currently installed only on system B that you intend to run in the SSI cluster, install them on member 1 before it is cloned.

**Note:** Ensure that each product is licensed for member 1 and member 2.

---

### Task 3: Clone Member 1 to Create Member 2

Follow the procedure in Chapter 29, “Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member,” on page 775. Make sure that you meet all of the requirements and complete the necessary preparations before you begin.

Additional requirements:

- Provide sufficient paging, spooling, and temporary disk volumes on member 2, and common user volumes in the cluster, for the workload that you intend to move from system B. You can simplify the updates in the SSI cluster directory by allocating the additional common user volumes one-for-one for the user volumes on system B, so that each minidisk on system B can be copied to the same cylinder (or block) range on the corresponding new volume.

**Note:** For a system B user ID that will be defined as a multiconfiguration virtual machine in the SSI cluster, minidisks that might be located on the same user volume on system B will be located on separate user volumes in the cluster. Some minidisks might be located on a common user volume, but other minidisks will be located on member-specific user volumes.

- Give member 2 a new system name (different from system B).
- Customize the IP addresses of the TCP/IP service machines on member 2 (that is, use different IP addresses than on system B) to enable member 2 to coexist with production on system B.

Complete the entire cloning procedure, which will make member 2 a replica of member 1, capable of running the workload that member 1 runs (the workload from system A). Then return to this procedure and complete the remaining tasks to move system B configuration definitions and workload into the SSI cluster.

---

### Task 4: Replicate System B Configuration Definitions in the SSI Cluster

Most member-specific updates to the SSI cluster system configuration file should have been handled in the cloning procedure. However, additional updates might be required to include system and network configuration definitions from system B. The following list identifies examples of some configuration definitions that should be examined and adjusted if necessary.

- Virtual switches

## Combining Two z/VM Systems to Create an SSI Cluster

- If a virtual switch with the same name exists on both system A and system B, but they are not intended to interconnect the same virtual machines, define a different name for one of the virtual switches on a new DEFINE VSWITCH statement.
- Generally, a virtual switch is defined to be included in all members of the SSI cluster, so users can access that network when logged on to any member. However, if any virtual switch is intended to be member-specific, qualify the DEFINE VSWITCH statement for that member.

**Note:** If you change the virtual switch configuration for a cluster member, you can issue the DEFINE VSWITCH and SET VSWITCH commands on that member to dynamically make the same changes for the current system IPL.

- MAC addresses
  - If the system B configuration includes a VMLAN statement with the MACIDRANGE operand, that operand is ignored in the SSI cluster and should not be copied.
  - Customer-assigned locally administered MAC addresses are created using the VMLAN USERPREFIX value. This value, which must be identical for all members of the SSI cluster, was established in the conversion of system A to member 1. Therefore virtual machines with customer-assigned MAC addresses on system B might have different MAC addresses in the SSI cluster. For more information, see “Task 6: Move System B Workload into the SSI Cluster” on page 831.
  - System-assigned locally administered MAC addresses are created using the VMLAN MACPREFIX value. This value must be different for each member of the cluster and also different from the USERPREFIX value. The MACPREFIX value for member 2 was established when member 2 was cloned from member 1.
- Operating parameters
  - In general, most operating parameters (defined on statements such as FEATURES and PRIV\_CLASSES) should be set consistently for all members of the SSI cluster. Therefore the unqualified statements included from the conversion of system A to member 1 should suffice for the cluster.
  - If any operating parameters were unique to system A, those statements should be qualified for member 1. If any operating parameters are unique to system B, copy those statements and qualify them for member 2.
- System user IDs
  - Virtual machines identified on SYSTEM\_USERIDS statements provide services that should be available on all members of the SSI cluster. Therefore they should be defined as multiconfiguration virtual machines. The user IDs for these virtual machines were inherited from system A in the conversion to member 1.
  - If any system user IDs defined only on system B will be added to the SSI cluster source directory, add the appropriate SYSTEM\_USERIDS statements. If any of the user IDs apply only to member 2, qualify the statements for member 2. If any system user IDs from system A apply only to member 1, qualify those SYSTEM\_USERIDS statements for member 1.
- Device definitions
  - Device definitions (statements such as RDEVICE, DEVICES, OPERATOR\_CONSOLES, and EMERGENCY\_MESSAGE\_CONSOLES) that were common between system A and system B should also be common in the SSI cluster and should be handled by the unqualified statements included from the conversion of system A to member 1.

- If any device definitions were unique to system A, qualify those statements for member 1. If any device definitions are unique to system B, copy those statements and qualify them for member 2.
- Product and feature licensing and enablement
  - Product and feature enablement for member 1 has been inherited from system A. If a product or feature on system A was not licensed for system B, obtain a license for member 2.
  - A product or feature that was licensed only for system B should be licensed for member 1 and member 2.
  - PRODUCT statements generally should not be qualified by member name, so that a properly licensed product is enabled for the entire SSI cluster.

---

### Task 5: Re-IPL Member 2

If you changed the configuration for member 2 in the previous task, re-IPL member 2 to include those changes.

**Note:**

1. Re-IPL member 1 also if you changed its configuration. Qualifying statements for member 1 that were previously unqualified does not change its configuration.
2. You do not need to re-IPL a cluster member to include changes to the virtual switch configuration if those changes were also made dynamically.

---

### Task 6: Move System B Workload into the SSI Cluster

Move customer-defined virtual machines and associated user data from system B into the SSI cluster.

The IBM-defined virtual machines are already included in the directory from the conversion of system A to member 1. The IBM-supplied multiconfiguration virtual machine definitions were updated to include member 2 in the cloning procedure. However, the current specifications for member 2 are essentially a replica of the specifications for member 1 and might need to be customized with the specifications from system B.

If an ESM is being used, it might be necessary to merge the system B ESM database into the shared ESM database for the SSI cluster.

**Note:** Although this task describes operating on one virtual machine at a time, it might be more convenient and efficient to process a set of virtual machines in parallel, such as those comprising a particular workload, or even all of the virtual machines being moved from system B. Before you can log on the user IDs in the cluster and test them, you will need to bring the updated directory online on both member 2 and member 1.

1. For each system B user ID to be included in the cluster, define the virtual machine in the cluster source directory:
  - If the user ID is to be defined as a single-configuration virtual machine:
    - If the user ID did not exist on system A, you can copy the virtual machine definition from the system B directory. Update each MDISK statement to define the minidisk on the common user volume added in the cloning procedure that corresponds to the system B volume that holds the minidisk.

## Combining Two z/VM Systems to Create an SSI Cluster

- If the user ID existed on system A, a virtual machine definition for that user ID is already included in the cluster source directory from the conversion of system A to member 1. Either select a version to keep (the one from system A or the one from system B), merge the two versions, or copy the virtual machine definition from system B and give one of the versions a new user ID in the cluster. If you keep the version from system B, merge the versions, or copy the virtual machine definition, update each MDISK statement copied from system B to define the minidisk on the common user volume added in the cloning procedure that corresponds to the system B volume that holds the minidisk. If you select one of the versions or merge them, you can place the other version's minidisks at different virtual device numbers, to allow continued access.
- If the user ID is to be defined as a multiconfiguration virtual machine:
  - If the user ID did not exist on system A, create the multiconfiguration virtual machine definition.
  - If the user ID existed on system A, a virtual machine definition for that user ID is already included in the cluster source directory from the conversion of system A to member 1 and should be in the correct format. However, if you did not restructure the virtual machine definition as a multiconfiguration virtual machine definition in either the conversion procedure or the cloning procedure, do it now.
  - In either case, if an aspect of the virtual machine definition applies when the user ID logs on to any member of the cluster, such as an MDISK statement for a global minidisk, include the statement in the identity entry. Define a global minidisk on a common user volume.

If an aspect of the virtual machine definition applies only when the user ID logs on to a specific member of the cluster, such as an MDISK statement for a local minidisk, include the statement in the subconfiguration entry for that member. Define a local minidisk on the corresponding member-specific user volume.

MDISK statements and other specifications from system A that apply only to member 1 should be included in the subconfiguration entry for member 1.

For each MDISK statement copied from system B that applies only to member 2, include the statement in the subconfiguration entry for member 2 and define the minidisk on the member 2 user volume added in the cloning procedure that corresponds to the system B volume that holds the minidisk.

For an example of restructuring a virtual machine definition as a multiconfiguration virtual machine definition, see “Task 3: Update the User Directory” on page 765 in the conversion procedure. For an example of updating a multiconfiguration virtual machine definition for a new cluster member, see “Task 6: Update the User Directory” on page 782 in the cloning procedure.

- If the virtual machine definition on system B includes a NICDEF statement with the MACID operand, the MAC address for that virtual network adapter will be retained in the SSI cluster **only** if the USERPREFIX value on system B (set or defaulted) is the same as the USERPREFIX value established for the SSI cluster in the conversion of system A to member 1. However, if that is the case, the system B user must not have the same MACID as a user on system A. In an SSI cluster, two devices cannot have the same MAC address. Therefore if two users in the cluster have the same MACID, the device will be defined for the first user to log on to any member.

- If you change the name of a virtual switch or define a new one, ensure that a corresponding NICDEF statement is included in the definition of each virtual machine intended to use that virtual switch.
- 2. To make the directory changes effective, create a new object directory on both member 1 and member 2, either manually (using the DIRECTXA utility) or using DirMaint or another directory manager.
- 3. For each system B user ID that was moved to the cluster and is now included in the online directory on member 1 and member 2, transfer the user data:
  - a. Log off the user ID on system B.
  - b. Change the password to NOLOG in the system B directory.  
**Attention:** Before you log on this user ID in the SSI cluster, ensure that the NOLOG on system B has been made effective by creating a new object directory for system B.
  - c. On member 2 (or member 1), use the FLASHCOPY command (or use the DDR utility) to copy the system B volumes or minidisks containing the user data to the volumes specified in the virtual machine definition in the SSI source directory.

**Note:** If the user volume in the cluster has been allocated one-for-one for the user volume on system B, and you have moved all the users represented on that volume, you can copy the entire volume.

- d. On system B, use the SPXTAPE DUMP command to dump the spool files onto tape. This includes customer-defined saved segments containing user data (for example, Linux file systems) and customer-defined named saved systems (for example, an IPLable Linux).

**Note:** In an SSI cluster, the number of spool files that a single-configuration virtual machine can own that were originated on any one particular member of the cluster is limited to one quarter of the MAXSPOOL value. Therefore you might need to purge some files for this user before dumping them.

- e. Log on the user ID on member 2 and member 1 and verify that the virtual machine operates correctly.
- f. On member 2, use the SPXTAPE LOAD command to load the spool files onto a spool volume owned by member 2.

---

### Task 7: Test and Verify

Verify that everything that previously worked on system B now works correctly on members 1 and 2.

---

### Task 8: Shut Down System B

Shut down system B and decommission its system and user volumes.



---

## Chapter 33. Converting a CSE Complex to a z/VM SSI Cluster

z/VM V6.2 was the last release to support the cross system extensions (CSE) environment. If you want to upgrade the z/VM systems in a CSE complex, you must convert the CSE complex to a z/VM SSI cluster. A z/VM SSI cluster offers a more comprehensive clustering solution than a CSE complex and adds functionality not available in CSE, such as multisystem installation, single point of maintenance, autonomic minidisk cache management, and virtual server mobility.

**Note:** The cross-system link (XLINK) function that was included in CSE is still supported for non-SSI systems. See Appendix D, “Using Cross-System Link (XLINK),” on page 859.

The conversion of a CSE environment to an SSI environment is complex. Therefore this topic does not provide a step by step procedure, but offers an overview of a possible approach.

---

### A Possible Conversion Approach

Use one of the SSI installation procedures documented in *z/VM: Installation Guide* to install a separate SSI cluster, either second level or in LPARs, using full-pack minidisks or dedicated DASD volumes. At some point the systems in the new SSI cluster will need to reside in real LPARs, so understanding how they will be defined is required regardless of whether you use the second level approach.

After the new SSI cluster is created, gradually and with caution move your workload to the SSI cluster. It is likely that you will want to copy your infrastructure virtual machines (such as servers and SVMs) before you copy your guest virtual machines and general users.

SYSAFFIN directory statements are not supported in an SSI-enabled directory. If you have virtual machines defined with SYSAFFIN statements to provide different logon configurations for the systems in the CSE complex, you need to convert them to multiconfiguration virtual machine definitions (IDENTITY definitions) to provide different logon configurations for the members of the SSI cluster.

The following example shows the definition of a virtual machine called WATCHER that has a different 191 disk for each CSE system.

```
USER WATCHER password 64M
 IPL CMS
 LINK MAINT 190 190
 LINK MAINT 19E 19E
 MDISK 192 3390 300 100 CSECM1 RR
 SYSAFFIN VMA
 MDISK 191 3390 100 100 VMAPV1 MR
 SYSAFFIN VMB
 MDISK 191 3390 100 100 VMBPV1 MR
 SYSAFFIN VMC
 MDISK 191 3390 100 100 VMCPV1 MR
 SYSAFFIN VMD
 MDISK 191 3390 100 100 VMDPV1 MR
```



## Converting CSE to SSI

The following example shows the converted definition for WATCHER. The following changes were made:

- Changed “USER” to “IDENTITY”.
- Added a BUILD ON statement to the identity entry for each cluster member, specifying the ID of the SUBCONFIG statement that begins the subconfiguration entry for that member.
- Changed each SYSAFFIN statement to a SUBCONFIG statement with an ID that matches the corresponding BUILD statement. Note that in this example the volumes for the minidisks have also been changed.

```
IDENTITY WATCHER password 64M
 BUILD ON VMSYS01 USING SUBCONFIG WATCHR-1
 BUILD ON VMSYS02 USING SUBCONFIG WATCHR-2
 BUILD ON VMSYS03 USING SUBCONFIG WATCHR-3
 BUILD ON VMSYS04 USING SUBCONFIG WATCHR-4
IPL CMS
LINK MAINT 190 190
LINK MAINT 19E 19E
MDISK 192 3390 300 100 USRVL1 RR

SUBCONFIG WATCHR-1
 MDISK 191 3390 100 100 M01PV1 MR

SUBCONFIG WATCHR-2
 MDISK 191 3390 100 100 M02PV1 MR

SUBCONFIG WATCHR-3
 MDISK 191 3390 100 100 M03PV1 MR

SUBCONFIG WATCHR-4
 MDISK 191 3390 100 100 M04PV1 MR
```

It is also important to reflect any user modifications to the directory from your current CSE environment into the directory for the SSI cluster.

In addition, you need to address the handling of minidisks:

- Copy the minidisk to a new volume in the SSI cluster.
- Define the SSI minidisk on the same physical volume as the CSE minidisk. You need to ensure that the volume is defined as SHARED YES, so CP knows the device is shared outside the SSI cluster. However, there is no LINK protection, as CP cannot analyze link conflicts between an SSI cluster and a CSE complex. You should consider deleting or commenting-out the MDISK definition on the CSE system, if appropriate.

Move over to the SSI cluster any spool files needed by the workload, such as NSSs and DCSSs.

Prior to allowing the virtual machines to be used in the new SSI environment, it would be wise to ensure they can no longer run on the CSE systems (for example, by making them NOLOG), to avoid the virtual machines running in both environments at the same time.



---

## Part 6. Appendixes



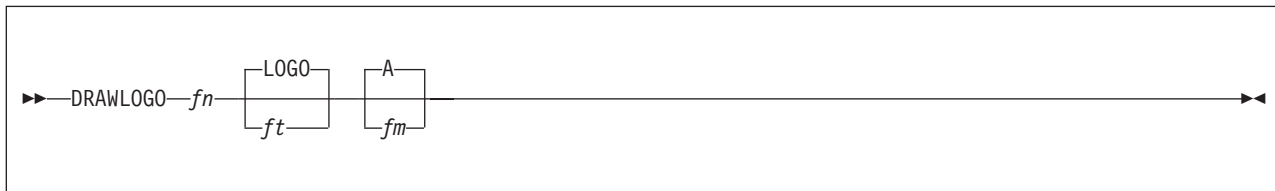
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## Appendix A. Sample Utility Programs

This appendix describes a sample (unsupported) utility program, DRAWLOGO, which is supplied with z/VM. A sample XEDIT macro, X\$DRWL\$X, which is used by DRAWLOGO, is also supplied. The DRAWLOGO sample program is shipped with a file type of SAMPEXEC. The X\$DRWL\$X sample XEDIT macro has a file type of SAMPXEDI. By default these files are loaded onto the CP samples disk, 2C2, owned by user MAINT<sup>vm</sup>.

To use the DRAWLOGO utility, you must change its file type from SAMPEXEC to EXEC and change the file type of X\$DRWL\$X from SAMPXEDI to XEDIT.

## DRAWLOGO



### Purpose

Use DRAWLOGO to create logo screens for your z/VM system. DRAWLOGO lets you edit the text of a logo file and modify the 3270 screen attributes in a logo file.

For information on how to use this utility, see the “Creating Logo Screens” on page 322.

### Operands

*fn* is the file name of the logo file.

*ft* is the file type of the logo file. The default file type is LOGO.

*fm* is the file mode of the logo file. The default file mode is A.

### Usage Notes

1. When you enter DRAWLOGO, you are placed in an XEDIT session. If the DRAWLOGO utility does not recognize the type of logo (online message, body of logo, input area, or printer separator page), DRAWLOGO prompts you for the type of logo.
2. To put the new logo configuration file into production, use the CP REFRESH command. See the *z/VM: CP Commands and Utilities Reference*.
3. DRAWLOGO invokes the X\$DRWL\$X XEDIT macro, which must be available.

### Return Codes

In addition to the return code listed, DRAWLOGO may return a return code from the CMS LISTFILE and CMS XEDIT commands. See the *z/VM: CMS Commands and Utilities Reference* for a list of return codes that the CMS LISTFILE and CMS XEDIT commands generate.

#### Code    Meaning

- |   |                                  |
|---|----------------------------------|
| 4 | No minidisk accessed in R/W mode |
|---|----------------------------------|

---

## Appendix B. Device Class and Type Codes

This appendix is the HCPDVTYP copy file and can be found in macro library HCPOM1.

---

### Device Class Definitions

| DEVCLAS BIT DEFINITIONS |     |       | DEVICE CLASSES                         |
|-------------------------|-----|-------|----------------------------------------|
| CLASAIFF                | EQU | X'FF' | Adapter-Interrupt-Facility (AIF) Class |
| CLASTERM                | EQU | X'80' | TERMINAL DEVICE CLASS                  |
| CLASGRAF                | EQU | X'40' | GRAPHIC DISPLAY DEVICE CLASS           |
| CLASGRFR                | EQU | X'41' | GRAPHIC DISPLAY DEVICE CLASS (REMOTE)  |
| CLASPOOL                | EQU | X'20' | UNIT RECORD SPOOLING DEVICE CLASS      |
| CLASTAPE                | EQU | X'08' | MAGNETIC TAPE DEVICE CLASS             |
| CLASDASD                | EQU | X'04' | DIRECT ACCESS STORAGE DEVICE CLASS     |
| CLASSPEC                | EQU | X'02' | SPECIAL DEVICE CLASS                   |
| CLASSVCM                | EQU | X'10' | SIMULATED DEVICE CLASS                 |
| CLASSWCH                | EQU | X'01' | SWITCH DEVICE CLASS                    |

---

### Device Type Definitions within Device Classes

| DEVTYPE BIT DEFINITIONS |     |       | DEVICE TYPES BY DEVICE CLASSES                |
|-------------------------|-----|-------|-----------------------------------------------|
| TYP2700                 | EQU | X'80' | TERM - 2700 BISYNC LINE                       |
| TYPBSC                  | EQU | X'88' | TERM - BISYNC LINE FOR 3270<br>REMOTE STATION |
| TYPCONS                 | EQU | X'40' | TERM - CONSOLE DEVICE                         |
| TYP3215                 | EQU | X'40' | TERM - 3215 CONSOLE                           |
| TYP1052                 | EQU | X'40' | TERM - 1052 CONSOLE                           |
| TYPTTY                  | EQU | X'20' | TERM - USASCII-8 TELEGRAPH TERMINAL           |
| TYPIBM1                 | EQU | X'10' | TERM - IBM TERMINAL CONTROL TYPE 1            |
| TYPUNDEF                | EQU | X'1C' | TERM - TERMINAL TYPE UNDEFINED                |
| TYP2741                 | EQU | X'18' | TERM - 2741 COMMUNICATIONS TERMINAL           |
| TYP3767                 | EQU | X'18' | TERM - 3767 IN 2741 COMPATIBILITY MODE        |
| TYP1050                 | EQU | X'14' | TERM - 1050 COMMUNICATIONS TERMINAL           |
| TYPSDLC                 | EQU | X'08' | TERM - SDLC INTEGRATED ADAPTER                |
| TYPTELE2                | EQU | X'20' | TERM - TELE2 INTEGRATED ADAPTER               |
| TYPHDL                  | EQU | X'24' | TERM - HDLC INTEGRATED ADAPTER                |
| TYPILAN                 | EQU | X'28' | TERM - ILAN INTEGRATED ADAPTER                |
| TYPELAN                 | EQU | X'28' | TERM - ELAN INTEGRATED ADAPTER                |
| TYPIC                   | EQU | X'04' | TERM - Integrated console                     |
| TYP3270                 | EQU | X'40' | GRAF - 3270 GENERIC DISPLAY STATION           |
| TYP3277                 | EQU | X'80' | GRAF - 3277 DISPLAY STATION                   |
| TYP3278                 | EQU | X'40' | GRAF - 3278 DISPLAY STATION                   |
| TYP3178                 | EQU | X'40' | GRAF - 3178 DISPLAY STATION                   |
| TYP3279                 | EQU | X'40' | GRAF - 3279 DISPLAY STATION                   |
| TYP3179                 | EQU | X'40' | GRAF - 3179 DISPLAY STATION                   |
| TYP3180                 | EQU | X'40' | GRAF - 3180 DISPLAY STATION                   |
| TYP3290                 | EQU | X'40' | GRAF - 3290 DISPLAY STATION                   |
| TYP3190                 | EQU | X'40' | GRAF - 3190 DISPLAY STATION                   |
| TYP3271                 | EQU | X'20' | GRAF - 3271 CONTROLLER (REMOTE)               |
| *YP3274                 | EQU | X'21' | GRAF - 3274 CONTROLLER (REMOTE)               |
| TYP3275                 | EQU | X'10' | GRAF - 3275 DISPLAY STATION                   |
| *YP3276                 | EQU | X'11' | GRAF - 3276 DISPLAY STATION                   |
| TYP3284                 | EQU | X'08' | GRAF - 3284 PRINTER                           |
| TYP3286                 | EQU | X'08' | GRAF - 3286 PRINTER                           |
| TYP3287                 | EQU | X'09' | GRAF - 3287 PRINTER                           |
| TYP3288                 | EQU | X'08' | GRAF - 3288 PRINTER                           |
| TYP3289                 | EQU | X'09' | GRAF - 3289 PRINTER                           |
| TYP3287L                | EQU | X'08' | GRAF - 3287 LOGICAL PRINTER                   |

## Device Class and Type Codes

|           |     |       |                                                       |
|-----------|-----|-------|-------------------------------------------------------|
| TYP3289L  | EQU | X'08' | GRAF - 3289 LOGICAL PRINTER                           |
| TYP2250   | EQU | X'04' | GRAF - 2250 DISPLAY UNIT                              |
| TYP3250   | EQU | X'04' | GRAF - 3250 DISPLAY UNIT                              |
| TYP5080   | EQU | X'06' | GRAF - 5080 DISPLAY UNIT                              |
| TYPCLUST  | EQU | X'30' | GRAF - CLUSTER CTLR (3271 OR 3275)                    |
| TYPPRDR   | EQU | X'80' | SPOL - CARD READER DEVICE                             |
| TYP2501   | EQU | X'81' | SPOL - 2501 CARD READER                               |
| TYP2540R  | EQU | X'82' | SPOL - 2540 CARD READER                               |
| TYP3505   | EQU | X'84' | SPOL - 3505 CARD READER                               |
| TYP PUN   | EQU | X'40' | SPOL - CARD PUNCH DEVICE                              |
| TYP2540P  | EQU | X'42' | SPOL - 2540 CARD PUNCH                                |
| TYP3525   | EQU | X'44' | SPOL - 3525 CARD PUNCH                                |
| TYP PRT   | EQU | X'20' | SPOL - PRINTER TYPE DEVICE                            |
| TYP1403   | EQU | X'21' | SPOL - 1403 PRINTER                                   |
| TYP32XX   | EQU | X'22' | SPOL - 3203 OR 3211 PRINTER                           |
| TYP3203   | EQU | X'26' | SPOL - 3203 PRINTER                                   |
| TYP3211   | EQU | X'22' | SPOL - 3211 PRINTER                                   |
| TYP3800   | EQU | X'28' | SPOL - 3800 PRINTER                                   |
| TYP3262   | EQU | X'23' | SPOL - 3262 PRINTER                                   |
| TYP4245   | EQU | X'24' | SPOL - 4245 PRINTER                                   |
| TYP4248   | EQU | X'29' | SPOL - 4248 PRINTER                                   |
| TYP3820   | EQU | X'25' | SPOL - 3820 PRINTER - DEDICATED ONLY                  |
| TYP AFP1  | EQU | X'27' | SPOL - AFP1 PRINTER - DEDICATED ONLY                  |
| TYP VAFP  | EQU | X'2A' | SPOL - VAFP PRINTER - SIMULATED ONLY                  |
| TYP SYS   | EQU | X'10' | SPOL - SYSTEM VIRT DEVICE FOR DUMPS                   |
| TYP3420   | EQU | X'10' | TAPE - 3420 TAPE DRIVE                                |
| TYP3422   | EQU | X'80' | TAPE - 3422 TAPE DRIVE                                |
| TYP3424   | EQU | X'42' | TAPE - 3424 TAPE DRIVE                                |
| TYP3430   | EQU | X'20' | TAPE - 3430 TAPE DRIVE                                |
| TYP3480   | EQU | X'40' | TAPE - 3480 TAPE DRIVE                                |
| TYP3490   | EQU | X'81' | TAPE - 3490 TAPE DRIVE                                |
| TYP3590   | EQU | X'83' | TAPE - 3590 TAPE DRIVE                                |
| TYP9348   | EQU | X'44' | TAPE - 9348 TAPE DRIVE                                |
| TYP3330   | EQU | X'40' | DASD - 3330 DISK STORAGE FACILITY                     |
| TYP3340   | EQU | X'20' | DASD - 3340 DISK STORAGE FACILITY                     |
| TYP3350   | EQU | X'10' | DASD - 3350 DISK STORAGE FACILITY                     |
| TYP3350C  | EQU | X'11' | DASD - 3350 4 X 8 PAGING STORAGE                      |
| TYP3350D  | EQU | X'12' | DASD - 3350 4 X 4 PAGING STORAGE                      |
| TYP2305   | EQU | X'08' | DASD - 2305 FIXED HEAD STORAGE FACILITY               |
| TYP3380   | EQU | X'04' | DASD - 3380 DISK STORAGE FACILITY                     |
| TYP3390   | EQU | X'82' | DASD - 3390 DISK STORAGE FACILITY                     |
| TYP3375   | EQU | X'80' | DASD - 3375 DISK STORAGE FACILITY                     |
| TYP3370   | EQU | X'02' | DASD - 3370 DISK STORAGE FACILITY                     |
| TYP9345   | EQU | X'81' | DASD - 9345 DISK STORAGE FACILITY                     |
| TYP9332   | EQU | X'21' | DASD - 9332 FBA DASD                                  |
| TYP9335   | EQU | X'22' | DASD - 9335 FBA DASD                                  |
| TYP9336   | EQU | X'24' | DASD - 9336 FBA DASD                                  |
| TYP FBA   | EQU | X'28' | DASD - GENERIC FBA DASD                               |
| TYP9033   | EQU | X'40' | SWCH - 9033 SWITCH DEVICE                             |
| TYP9032   | EQU | X'80' | SWCH - 9032 SWITCH DEVICE                             |
| TYP2032   | EQU | X'20' | SWCH - 2032 FICON Switch device                       |
| TYPCTCA   | EQU | X'80' | SPEC - CHANNEL TO CHANNEL ADAPTER                     |
| TYP3088   | EQU | X'80' | SPEC - 3088 MULTISYSTEM CHANNEL COMMUNICATION UNIT    |
| TYP3704   | EQU | X'40' | SPEC - 3704 PROGRAMMABLE COMMUNICATION CONTROL UNIT   |
| TYP3705   | EQU | X'40' | SPEC - 3705 PROGRAMMABLE COMMUNICATION CONTROL UNIT   |
| TYPOSA    | EQU | X'20' | SPEC - OPEN SYSTEMS ADAPTER DEVICE                    |
| TYP3851   | EQU | X'02' | SPEC - MSS MASS STORAGE COMMUNICATOR                  |
| TYP3890   | EQU | X'08' | SPEC - 3890 DOCUMENT PROCESSOR                        |
| TYP UNSUP | EQU | X'01' | SPEC - DEVICE UNSUPPORTED BY THE VM/370 MIGRATION AID |
| TYP FCP   | EQU | X'10' | SPEC - Open FCP Adapter (FCP)                         |

|          |     |       |                          |
|----------|-----|-------|--------------------------|
| TYPDYNIO | EQU | X'02' | VCM - Dynamic I/O        |
| TYPMSGF  | EQU | X'01' | VCM - Message Facility   |
| TYPAIF0  | EQU | X'00' | AIF - AIF Adapter Type 0 |

## Device Features by Class and Type

| DEVFEAT BIT DEFINITIONS |     |       | FEATURES OF DEVICES BY CLASS/TYPE                                   |
|-------------------------|-----|-------|---------------------------------------------------------------------|
| FTR0PRDR                | EQU | X'80' | GRAF - OPERATOR ID CARD READER                                      |
| FTRDIAL                 | EQU | X'01' | GRAF - 3275 WITH SWITCHED LINE SUPPORT                              |
| FTRUCS                  | EQU | X'01' | SPOL - UCS FEATURE                                                  |
| FTR4WCGM                | EQU | X'80' | SPOL - 3800 WITH FOUR WRITEABLE CHARACTER GENERATION MODULES        |
| FTR7TRK                 | EQU | X'80' | TAPE - 7-TRACK FEATURE                                              |
| FTRDUAL                 | EQU | X'40' | TAPE - DUAL DENSITY FEATURE                                         |
| FTRTRAN                 | EQU | X'20' | TAPE - TRANSLATE FEATURE                                            |
| FTRCONV                 | EQU | X'10' | TAPE - DATA CONVERSION FEATURE                                      |
| FTRCMPCT                | EQU | X'08' | TAPE - DATA COMPACTION FEATURE                                      |
| FTRRPS                  | EQU | X'80' | DASD - ROTATIONAL POSITIONAL SENSING                                |
| FTRDYNP                 | EQU | X'40' | DASD/TAPE - DYNAMIC PATHING FEATURE                                 |
| FTRVUA                  | EQU | X'20' | DASD - 3330V THAT MAY BE DEDICATED TO A VIRTUAL MACHINE             |
| *TRSYSV                 | EQU | X'10' | DASD - 3330V THAT MAY BE USED BY VM FOR MOUNTING MSS SYSTEM VOLUMES |
| FTR35MB                 | EQU | X'08' | DASD - 35 MB DATA MODULE (3340)                                     |
| FTR70MB                 | EQU | X'04' | DASD - 70 MB DATA MODULE (3340)                                     |
| FTRRSRL                 | EQU | X'02' | DASD/TAPE/SPEC - RESERVE/RELEASE CCW FEATURE                        |
| FTRCOMP                 | EQU | X'01' | DASD - 3350 IN 3330 COMPAT. MODE                                    |
| FTRTERM                 | EQU | X'80' | SPEC - UNSUPPORTED TERMINAL DEVICE                                  |
| FTRGRAF                 | EQU | X'40' | SPEC - UNSUPPORTED GRAPHIC DISPLAY DEVICE                           |
| FTRSPOOL                | EQU | X'20' | SPEC - UNSUPPORTED UNIT RECORD SPOOLING DEVICE                      |
| FTRTAPE                 | EQU | X'08' | SPEC - UNSUPPORTED MAGNETIC TAPE DEVICE                             |
| FTRDASD                 | EQU | X'04' | SPEC - UNSUPPORTED DIRECT ACCESS DEVICE                             |
| FTRSWCH                 | EQU | X'01' | SPEC - UNSUPPORTED DYNAMIC SWITCH                                   |
| FTRTYP1                 | EQU | X'10' | SPEC - TYPE ONE CHANNEL ADAPTER                                     |
| FTRTYP4                 | EQU | X'40' | SPEC - TYPE FOUR CHANNEL ADAPTER                                    |

## Device Model Definitions

**Note:** This list contains only commonly compared model numbers. It is NOT a complete list of supported devices or models.

| DEVMODEL CODE DEFINITIONS |     |       | RDEVDVMN DEVICE MODEL NUMBERS       |
|---------------------------|-----|-------|-------------------------------------|
| M230502                   | EQU | X'02' | DASD - 2305 MODEL 2                 |
| M333001                   | EQU | X'01' | DASD - 3330 MODEL 1 (404 CYLINDERS) |
| M333002                   | EQU | X'01' | DASD - 3330 MODEL 2 (404 CYLINDERS) |
| M333011                   | EQU | X'11' | DASD - 3330 MODEL 11(808 CYLINDERS) |
| M3380E                    | EQU | X'0A' | DASD - 3380 MODEL E                 |
| M3380K                    | EQU | X'1E' | DASD - 3380 MODEL K                 |
| M3390N                    | EQU | X'02' | DASD - 3390 MODEL 1 NATIVE MODE     |
| M3390E                    | EQU | X'96' | DASD - 3390 MODEL 1 EMULATION MODE  |
| M3391N                    | EQU | X'06' | DASD - 3390 MODEL 2 NATIVE MODE     |
| M3391E                    | EQU | X'8A' | DASD - 3390 MODEL 2 EMULATION MODE  |
| M3393N                    | EQU | X'0A' | DASD - 3390 MODEL 3 NATIVE MODE     |
| M3393E                    | EQU | X'9E' | DASD - 3390 MODEL 3 EMULATION MODE  |
| M3399N                    | EQU | X'0C' | DASD - 3390 MODEL 9 NATIVE MODE     |

## Device Class and Type Codes

|         |     |         |                                                         |
|---------|-----|---------|---------------------------------------------------------|
| M934500 | EQU | X'00'   | DASD - 9345 MODEL 1                                     |
| M934504 | EQU | X'04'   | DASD - 9345 MODEL 2                                     |
| M380001 | EQU | X'01'   | SPOL - 3800 PRINTER MODEL 1                             |
| M380003 | EQU | X'03'   | SPOL - 3800 PRINTER MODEL 3                             |
| M380008 | EQU | X'08'   | SPOL - 3800 PRINTER MODEL 8                             |
| M327702 | EQU | X'02'   | GRAF - 3277 DISPLAY STATION MODEL 2                     |
| M308861 | EQU | X'61'   | SPEC - 3088 CTCA PCA adaptor card<br>with CLAW support. |
| M308862 | EQU | X'62'   | SPEC - 3088 OSA card                                    |
| CUT1731 | EQU | X'1731' | SPEC - OSA-Express Control Unit Type                    |
| DVT1731 | EQU | X'1731' | SPEC - OSA Direct Express Agent DEV                     |
| DVT1732 | EQU | X'1732' | SPEC - OSA Direct Express Device Type                   |



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## Appendix C. Stand-Alone Dump Program (Uses Tapes)

To create the stand-alone dump utility tape, see “Creating the Stand-Alone Dump Utility” on page 846. For details on how to take a stand-alone dump, see “Setting Up to Run the Stand-Alone Dump Utility” on page 851.

CP can produce several types of dumps: a CP dump, a snapdump, a stand-alone dump and a virtual machine dump. Dumps are especially helpful in analyzing problems such as wait states, infinite loops, and abends. This chapter describes how to create the stand-alone dump utility and use it. For more information on the stand-alone dump utility, debugging various types of problems, the other dump types, and other problem diagnosis tools, see *z/VM: Diagnosis Guide*.

z/VM includes a stand-alone dump utility that you tailor according to your installation's configuration, using CMS. After you install z/VM, you should create the stand-alone dump utility and place it on tape or a DASD for emergency use. If, after a system failure, CP cannot create an abend dump, you can use the stand-alone dump utility to dump all of storage.

This chapter describes how to create the stand-alone dump utility and provides reference information about the:

- HCPSADMP EXEC
- HCPSDC ASSEMBLE file

---

### Overview of the Stand-Alone Dump Utility

With the stand-alone dump utility, you can dump all of real storage when z/VM cannot create a CP abend dump. This utility dumps all resident, nonzero pages, CP and non-CP. It cannot dump virtual machine storage and nonresident pages from the paging device.

To use the stand-alone dump utility to dump real storage, you must have access to IPL the real machine. (This is usually done by the System Administrator, not a user.) You can IPL the stand-alone dump utility from tape or a DASD and direct the output to a tape. You may need to reserve several tapes to hold all the information. Basic error recovery is available for DASD and tape devices used as IPL or output devices.

Typically, an installation can have several stand-alone dump utilities generated and ready to run. It would be useful to have the following configurations available for the stand-alone dump utility:

- IPL from tape with output directed to tapes
- IPL from DASD with output directed to tapes

These configurations let you take a stand-alone dump with any of the supported possible environments.

### Creating the Stand-Alone Dump Utility

Your installation can generate the stand-alone dump utility to customize the facility to your system configuration. This gives you control over the device used to IPL the stand-alone dump utility and the output device for the dump. Invoke the HCPSADMP EXEC in a CMS virtual machine to do the generation.

Do not call the HCPSADMP EXEC from within another exec. Also, do not queue up the answers ahead of time when running the HCPSADMP EXEC.

To use the HCPSADMP EXEC:

- You must have read/write access to file mode A.
- The following files must exist on an accessed disk:
  - HCPSADMP EXEC
  - HCPGPI MACLIB
  - HCPPSI MACLIB
  - HCPOM1 MACLIB
  - HCPOM2 MACLIB
  - HCPVM CNTRL (the control file)
  - HCPLDR MODULE
  - HCPSADLD EXEC (the load list)
  - LDT HCPSADWT
  - HCPSAD TEXT
  - HCPSAH TEXT

You are asked to answer a series of questions that describe the environment where the stand-alone dump utility will run. The HCPSADMP EXEC checks all input for validity and returns messages if you enter invalid data.

1. If the system has generated more than one stand-alone configuration, use unique names for each configuration. The active configuration must always be named HCPSDC. If you answer Y to create a new HCPSDC module, (refer to “Example for Generating the Stand-Alone Dump Utility” on page 849), the original is erased.

**Note:** Do not use a stand-alone dump tape or DASD created from a previous release of z/VM to attempt to dump your current z/VM system. When the HCPSADMP utility asks if you want to create a new HCPSDC module, be sure to answer YES to create a new one for your current z/VM system.

2. If you respond with N to any of the questions (refer to “Example for Generating the Stand-Alone Dump Utility” on page 849), the exec goes directly to the next question without doing the indicated work.
3. When the exec asks you to enter the real output device number, you are limited to four digits for z/VM.

An example of the prompts and replies that appear on the virtual machine console during HCPSADMP EXEC execution is shown in “Example for Generating the Stand-Alone Dump Utility” on page 849.

Following the data that you provide, the HCPSADMP EXEC:

- Creates a file called HCPSDC ASSEMBLE and writes the file on your A disk

- Assembles the HCPSDC ASSEMBLE file to create the HCPSDC TEXT file and link-edits it with the stand-alone dump utility module
- Writes the stand-alone dump utility load module on a real device.

At the end of this procedure, the stand-alone dump utility resides on auxiliary storage (tape or disk) ready for loading at any time.

### Before You Begin to Create the Stand-Alone Dump

Before you create the stand-alone dump utility, note the following:

- If you use a DASD as the IPL device, the stand-alone dump utility takes up cylinder 0. The volume you use as the IPL device may be any CP-formatted DASD volume *except* the system residence (SYSRES) volume. The cylinder must be formatted as PERM space; use ICKDSF. The remaining cylinders may be formatted and used for any CP function *other* than system residence functions.
- If the volume you are going to use as your IPL device is shared through cross-system link, the data created for cross-system link by the XLINK FORMAT command must be placed in a cylinder other than cylinder 0 (its default location). The CSELVOL macroinstruction may be used to define an alternative location for cross-system link data for specified volumes.
- Any IPL device (tape or DASD) must be write-enabled.
- When you create the stand-alone dump utility, you can specify up to eight dump devices. With one exception, the stand-alone dump utility chooses the first ready device as a dump device. The exception is the IPL device. If a dump device is also the IPL device, the stand-alone dump utility chooses any other ready dump device first. Device 0000 can be used to indicate that the IPL device should be used if another ready device is not found.
- Choosing a dump device:
  - You may wish to include tape drives on different tape control units. Otherwise, if the tape control unit for the stand-alone dump devices is inoperative at the time of failure, you will not be able to run the utility.
  - To increase the amount of dump data the stand-alone dump utility can write on one tape, choose tape drives that can write the most data per tape reel or cartridge.

**Note:** It is suggested that the 3590 be used for central storage sizes of 2 GB or more due to the 3590's speed and high data capacity.

**Attention:** The stand-alone dump utility does *not* support device sharing with other processor complexes. Therefore, when you are ready to use the stand-alone dump utility, you should make sure no other system on any other processor complex is using any of the possible dump devices.

### Devices You Can Use to IPL a Stand-Alone Dump

The following are the devices you can use to IPL the stand-alone dump utility:

#### DASD

3380 and 3390

**Tape** 3480, 3490 and 3590

#### Notes:

1. If you select a DASD as the IPL device:

## HCPSADMP Stand-Alone Dump Program (Uses Tapes)

- a. It cannot be a device that has the Stand-Alone Program Loader (SAPL) on it.
  - b. It cannot be the resident system device.
  - c. It must be CP-formatted by using either a CPFMTXA command or ICKDSF (recommended).
  - d. Cylinder 0 must be allocated as permanent space.
  - e. The stand-alone dump uses cylinder 0.
  - f. The remaining cylinders may be formatted and used for any CP function other than system residence functions.
2. The stand-alone dump IPL tape can be the same as the tape to which you direct the dump output. If you choose to use the same tape, the dump will NOT be written over the stand-alone dump utility. That is, the same tape can be IPLed to take a dump at a later time.
  3. Do not try to IPL from a device that is not in the previous list. The stand-alone dump utility does not support FBA DASD.

### Devices to Which You Can Send Dump Output

The following are the devices to which the dump output can be directed:

**Tape** 3480, 3490 and 3590

#### Notes:

1. You can specify a maximum of eight real device numbers for the dump output device. To increase the amount of dump data the stand-alone dump utility can write on a tape, choose tape drives that can write the most data per tape reel or cartridge. You can enter up to four digits for each real output device number. It is suggested that the 3590 be used for central storage sizes of 2 GB or more due to the 3590's speed and high data capacity.
2. When you configure the stand-alone dump utility, you can use any tape device type from the list of supported devices. You may wish to include tape drives on different control units. Otherwise, if the tape control unit is inoperative at the time of the failure, you will not be able to run the program.
3. All 3480 tape devices save tape data in non-compact format. All 3490 and 3590 tape devices save tape data in compact format.
4. Do not send the stand-alone dump output to a device that is not included in the previous list.
5. If device number 0000 is found in the output address list, it will be checked for a valid subchannel number and readiness. If no usable device is found in the output address list and device 0000 is in the list, then if the IPL device was a tape, it will be used as the output device. Hence, device 0000 can be used to indicate that the dump can be sent to the IPL device.

The stand-alone dump utility selects, as the dump output device, the first available device in the list, excluding the IPL device (if it is in the list). If you want the stand-alone dump output to go to the IPL tape, make all other devices that are in the list not ready. If no other device within the output address list is available and the IPL tape address is in the list, or 0000 is in the list, then the IPL device receives the dump.

If you select a tape for the dump output device, other than the IPL tape, the stand-alone dump utility:

1. Rewinds the tape to ensure that the dump is at the beginning of the tape

2. Sets the density to the highest value for the tape device.

If the tape device selected is the one on which the stand-alone dump utility resides, the utility writes the dump at the same density as the stand-alone dump utility was written.

When using tape, reserve the complete tape for the stand-alone dump utility; do not put the stand-alone dump utility on a tape with the other stand-alone utilities.

Use a single-volume, nonlabeled tape for the stand-alone dump utility. Be sure that the tape is nonlabeled, because the utility does not check to ensure that it is a nonlabeled tape.

### Example for Generating the Stand-Alone Dump Utility

The following is an example of generating the stand-alone dump utility. In this example:

- You are placing the stand-alone dump utility on a 3390 DASD device with an address of 150.
- The control file in this example is HCPVM.
- The system sends the dump output to the first available 3590 tape drive whose address is 570, 571, 572, 573, 574, 575, 576, or 577.
- The HCPSDC ASSEMBLE file is created and contains the HCPSDCMP macroinstruction.
- It is assumed that the stand-alone dump utility residence volume is attached to your virtual machine and that you have the appropriate minidisk accesses.

**Note:** To ensure the proper access order, use the UTILITY EXEC (see the *z/VM: Installation Guide*).

1. Use the CP ATTACH command to attach logically the stand-alone dump utility residence device to your virtual machine. For example, if you enter:  

```
attach rdev * vdev
```

the command attaches the device specified by *rdev* to the virtual machine.
2. Establish the appropriate minidisk accesses by entering:  

```
vmfsetup servp2p cp
```
3. Ensure that the HCPSADMP EXEC and HCPVM CNTRL files to be used are on a minidisk accessed earliest in the user's search order. HCPSADMP EXEC uses the HCPVM CNTRL file.

Under CMS, enter:

```
hcpsadmp
```

The exec replies:

```
THE HCPSADMP EXEC:
-OPTIONALLY CREATES A NEW HCPSDC ASSEMBLE FILE
CONTAINING AN HCPSDCMP MACRO WITH SELECTED PARAMETERS
ON YOUR A DISK. THE NEWLY CREATED MODULE WILL BE
REASSEMBLED.
-OPTIONALLY PLACES A LINK-EDITED HCPSAD MODULE (HCPSAD,
HCPSAH AND HCPSDC) ONTO WHATEVER DEVICE IS DEFINED AS THE
RESIDENCE DEVICE, WHERE THE RESIDENCE DEVICE IS THE
TARGET DEVICE ON WHICH THE STAND-ALONE DUMP UTILITY
WILL RESIDE.
```

```
PLEASE RESPOND YES, NO (OR END TO EXIT EXEC) WHEN IT
PROMPTS YOU. IF YOU RESPOND NO, YOU MUST HAVE A HCPSDC
```

## HCPSADMP Stand-Alone Dump Program (Uses Tapes)

TEXT FILE FROM A PRIOR GENERATION OF THE STAND-ALONE  
DUMP UTILITY.

DO YOU WANT TO CREATE A NEW HCPSDC MODULE?

Enter:

**yes**

PLEASE SELECT RESIDENCE DEVICE TYPE  
(3380, 3390, 3480, 3490, 3590 or END):

**3390**

PLEASE ENTER RESIDENCE DEVICE NUMBER

**150**

PLEASE SELECT OUTPUT DEVICE TYPE  
(3480, 3490, 3590 or END):

**3590**

PLEASE SELECT OUTPUT DEVICE NUMBER OR LIST:  
A LIST MUST BE PLACED WITHIN  
PARENTHESES AND THE ADDRESSES  
SEPARATED BY COMMAS

**(570,571,572,573,574,575,576,577)**

ASSEMBLING HCPSDC

HCPSDC TEXT CREATED  
PRT FILE 4584 SENT FROM MAINT PRT AS 1234 RECS 0056 COPY 001 HOLD NOKEEP

DO YOU WANT TO PLACE THE STAND  
ALONE DUMP ONTO 150?

**yes**

LOAD LIST: HCPSADLD EXEC A2 mm/dd/yy hh:mm (MNT190)

These messages inform you about the load list that the exec is using.

CPU STOPPED; DISABLED WAIT PSW 000A0000 00008200

When the HCPSADMP EXEC completes successfully, your virtual machine enters a disabled wait state, code 8200.

For details on how to take a stand-alone dump, see “Setting Up to Run the Stand-Alone Dump Utility” on page 851.

---

## The HCPSADMP EXEC

The HCPSADMP EXEC creates a load module of the stand-alone dump utility and writes the module on a real device. To invoke this exec, enter:

**hcpsadmp**

The exec command line has no operands. It prompts you for the information it needs. See “Creating the Stand-Alone Dump Utility” on page 846.

## Usage Notes

1. The IPL device, the device from which the stand-alone dump utility is loaded, cannot be the CP system residence device.
2. If the IPL device is a tape, the stand-alone dump utility supports that same tape as a dump device, the device to which dumps are sent.

3. This utility does not support FBA DASD devices. For device support information, refer to “Devices You Can Use to IPL a Stand-Alone Dump” on page 847 and “Devices to Which You Can Send Dump Output” on page 848.
4. When the HCPSADMP EXEC completes successfully, your virtual machine enters a disabled wait state, code 8200.
5. If device number 0000 is found in the output address list, it will be checked for a valid subchannel number and readiness. If no usable device is found in the output address list and device 0000 is in the list, then if the IPL device was a tape, it will be used as the output device. Hence, device 0000 can be used to indicate that the dump can be sent to the IPL device.

---

### Before You Begin

Before you run the stand-alone dump utility, you must know:

- The location of the stand-alone dump utility
- The real device number of the *IPL device*
- The real device numbers of the *dump devices*.

### Program Location

The program resides on either a DASD volume or on a tape.

### IPL Device

The IPL device may be either a DASD or a tape drive. If the utility resides on a DASD volume, the IPL device is the device on which the volume is mounted. If the program resides on tape, you must use a device with the same tape density as the device on which the tape was created. You can use the same tape drive as both the IPL device and the dump device.

### Dump Device

The dump device must be a tape drive.

---

### Setting Up to Run the Stand-Alone Dump Utility

When an irrecoverable error occurs, CP tries to store status about the system in storage areas designated for this purpose. At this point, do the following:

1. If the stand-alone dump utility resides on tape, select a tape drive from which to load (IPL) the utility. The tape drive you choose as the IPL device must support the same tape density as the device on which the tape was created.
2. Contact the operator of any other system that shares the IPL device or any of the required dump devices, and make sure the system is not using it. Follow your installation's normal procedures.

**Attention:** The 3480, 3490, and 3590 tape drives are the only devices that the stand-alone dump utility supports sharing with other processor complexes. If you try to share a tape drive, which is neither a 3480, 3490, or 3590 while running this utility, you may lose data that the device is processing for another system.

Therefore, make sure the dump devices (except for 3480, 3490, and 3590s) are not in use by any other processor complex. Also, make sure that no other system is using the device from which you plan to load (IPL) the utility.

3. If the IPL device is a tape drive, remove any tape that is currently mounted.
4. If any dump device is a 3422 tape drive, remove any tape that is currently mounted.



## HCPSADMP Stand-Alone Dump Program (Uses Tapes)

5. From the dump devices generated for the stand-alone dump utility, choose one to be the dump device for this run. Then, if the dump devices are 3480s, 3490s, or 3590s, go to step 6. Otherwise, make all the other dump devices not ready.

The utility searches the list of dump devices in the order that your installation specified when it generated the utility. With one exception, the program chooses the first ready device. The exception is the IPL device. If a dump device is also the IPL device, the utility chooses any other ready dump device first. Therefore, to make sure the utility chooses the dump device you want, make all the other dump devices not ready. Device 0000 may be used to indicate that the IPL device should be used if another ready device is not found.

You do not need to make not ready a 3480, 3490, or 3590 dump device that is in use by another system. The stand-alone dump utility recognizes that the device is in use by another system and tries to find another dump device.

6. Make the stand-alone dump utility ready to load (IPL) on the IPL device.

The utility resides on either a tape or a DASD volume. Depending on its location, do one of the following:

- If the utility resides on a tape, mount the tape enabled for writing on the tape drive you chose for the IPL device. For a 3422, make sure the tape has a write-enable ring. For a 3480, 3490 or 3590, turn the thumb wheel on the tape cartridge so that the white dot does not show.

Because the utility writes out some data to the IPL device, you *must* mount the tape enabled for writing. If you mount the tape for reading only, you cannot run the utility successfully.

- If the utility resides on a DASD volume, make sure the volume is mounted and the device write-enabled.

Because the utility writes out some data to the IPL device, you *must* make sure the DASD is write-enabled. If you IPL the utility without write-enabling the DASD, you cannot run the utility successfully.

7. Make the dump device ready to receive the dump.

If the dump device is the same as the IPL device, the IPL tape is already mounted. Go to step 8.

**Note:** If you use a tape drive as both the IPL device and the dump device, the utility starts writing the dump on the tape that contains the utility. You cannot change tapes between the time you IPL the utility and the time it starts to create the dump. However, the dump does not overwrite the utility on tape.

If the dump device is *not* the same as the IPL device, mount a scratch tape enabled for writing on the dump device. For a 3422, make sure the tape has a write-enable ring. For a 3480, 3490, or 3590 turn the thumb wheel on the tape cartridge so that the white dot does not show.

8. At your processor complex's system console, perform a store-status operation. This stores various processor information (clock, PSW's, registers, and architecture mode) in assigned storage locations. It is VERY IMPORTANT that the store-status operation is done so that the dump will contain useful information.

You are now ready to load the stand-alone dump utility into storage.

---

## Running the Stand-Alone Dump Utility

To run the stand-alone dump utility:



1. Display locations X'0' to X'18' at the console. The stand-alone dump IPL sequence overlays these bytes, so they cannot be recovered.  
If you are dumping VM CP, locations X'0' to X'18' are not important because CP does not use absolute page 0.
2. Stop all operations on the LPAR. Before you take a stand alone dump, stop all processors. Do not clear storage.
3. Make sure the IPL device and dump device for this run are ready.  
If the IPL device and dump device are not ready, the utility cannot run successfully. If the utility does not run successfully the first time you load it, you will lose important data. If you try to run the stand-alone dump utility again, you will create a dump of the stand-alone dump utility and that is probably not what you intended to do.
4. If the stand-alone dump utility resides on a tape, then mount and ready the volume, making sure that the tape is write-enabled.
5. Ready the output device. If you want the system to place the stand-alone dump on the IPL tape, make all other tapes listed as output devices (at generation time) *not* ready.  
If you do not want the stand-alone dump on a device that is listed as a possible output device, the device must not be ready at the time you IPL the stand-alone dump utility.
6. IPL the stand-alone dump utility. As soon as the stand-alone dump utility is loaded, it starts to create the dump.

**Note:** Do not use the LOAD CLEAR command to load the stand-alone dump utility. This command destroys the storage contents you are trying to dump.

Initially, the stand-alone dump utility writes the first seventeen pages of storage to the IPL device. This provides an area to load the stand-alone dump utility and work space. (For information about the tape and DASD format, see "Tape Format" on page 855 and "DASD Format" on page 856.) This step causes the system to place the dump on the output tape.

7. After the CPU has gone into a wait state, display the PSW to determine the status. A wait state of 8200 indicates that the stand-alone dump has successfully completed. If the stand-alone dump utility is unsuccessful because of some error that you can fix (for example, an I/O error on the output tape):
  - a. Correct the error.
  - b. Invoke a hardware RESTART to restart the stand-alone dump.  
If you re-IPL the stand-alone dump utility again, part or all of the first seventeen pages of storage will be invalid. After the initial IPL, you cannot change the IPL address or IPL volume. For a complete description on the different wait state codes, see "Monitoring Stand-Alone Dump Utility Execution."

You are done when you get a PSW with a wait state 8200, indicating the stand-alone dump has completed successfully.

---

## Monitoring Stand-Alone Dump Utility Execution

The utility communicates various normal and error conditions to you by loading a wait-state PSW. To find out whether the utility has loaded a wait state, display the current PSW on your processor complex's system console. The wait-state number appears as a 3-digit or 4-digit number in the right half of the PSW.

### Normal Wait States

In normal operation, the stand-alone dump utility may enter three wait states:

| Wait State | Meaning |
|------------|---------|
|------------|---------|

- |      |                                                                                                                                                                                                                                                                                                                                                |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8200 | This is a disabled wait state indicating the stand-alone dump utility is complete. The system has successfully placed the stand-alone dump utility on its residence device, or it has successfully completed taking a stand-alone dump.                                                                                                        |
| 8202 | The utility has filled the tape on the dump device. To continue, remove the tape from the dump device. Then mount a new tape on the dump device with a write-enable ring or with the thumb wheel turned so that the white dot does not show, as appropriate. This wait is enabled to detect when the new tape is mounted.                      |
| 909  | The dump device is not ready and your intervention is required. For example, if you forget to enable a tape for writing when you mount a new dump tape, the program loads a PSW with this wait state. To continue, correct the condition on the dump device and make it ready. This wait is enabled to detect when the device is ready to use. |

### Error Wait States

The stand-alone dump utility may also load a PSW with wait states for various error conditions. The following list briefly describes the error wait states and the corresponding messages you receive. For more details, see *z/VM: CP Messages and Codes*.

| Disabled Wait State | Meaning |
|---------------------|---------|
|---------------------|---------|

- |      |                                                                           |
|------|---------------------------------------------------------------------------|
| 8201 | Stand-alone dump failure; no dump device available                        |
| 8203 | IPL device specified has no real corresponding device                     |
| 8204 | Resident device is not a CP-formatted volume                              |
| 8205 | Error writing stand-alone dump utility to resident device                 |
| 8206 | Verify path to dump device; a potential configuration change was detected |
| 8207 | Non-zero condition code from SIGP SARCH instruction.                      |
| 9013 | Stand-alone dump failure; dump device is not a tape                       |
| 9017 | Stand-alone dump failure; program check                                   |
| 9018 | Stand-alone dump failure; machine check                                   |
| 9019 | Stand-alone dump failure; fatal I/O error                                 |
| 9044 | Unexpected channel error                                                  |

---

### Rerunning the Stand-Alone Dump Utility

If the stand-alone dump utility fails for some reason, you can run the utility again. However, you should note that:

- Depending on the point of failure of the dump utility, you may lose at least the first six pages of storage, and possibly other pages.

- You lose any status you saved when you performed the store-status operation at the processor complex's console. This is important data for the VM CP operating system and it is unlikely that the original problem can be diagnosed without it.

---

### Restarting z/VM

After the dump is created, remove any scratch tapes you used and the stand-alone dump utility, if it resides on tape. Then remount any tapes z/VM requires.

To restart the system, use your processor complex's system console to load the z/VM Control Program into storage. Then bring up the z/VM system as you normally do.

---

### Viewing the Stand-Alone Dump

Your installation's support personnel can use the VM Dump Tool to look at and format the stand-alone dump. For more information, see *z/VM: VM Dump Tool*.

The format of a stand-alone dump is dependent on the architecture mode of the processor that was dumped. It is VERY IMPORTANT that the store-status operation is done before creating the dump so that the architecture mode is correct and a dump of the correct format is produced. A stand-alone dump contains the following information:

1. The symptom record which contains various information including the CPU model and serial number, TOD clock and what program produced the dump.
2. A dump file map record which contains record numbers of important records in the dump.
3. Dump information records which contains a copy of the store-status information for each processor and various other information. The format of this data is dependent on the architecture mode of the processor at the time of the dump.
4. An address space information record which contains the size of the address space and other various storage-related information. The format of this data is dependent on the architecture mode of the processor at the time of the dump.
5. Nonzero pages of storage and the storage key of each page. The format of this data is dependent on the architecture mode of the processor at the time of the dump. For ESA/390 architecture mode dumps, storage addresses up to 2 Gigabytes are dumped. For z/Architecture mode dumps, storage addresses up to 512 Gigabytes are dumped.

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### Tape Format

A tape used with the stand-alone dump facility has the format shown in Figure 57 on page 856.

- If the IPL tape and the dump device are not the same, the IPL tape includes sections A, B, and C.
- If the dump device is a tape, but not the same tape as the IPL tape, the dump output tape includes sections C and D.
- If the IPL device and the dump device are the same, the tape includes sections A, B, C, and D.
- The format of the dump in section D is dependent on architecture mode of the machine.

## HCPSADMP Stand-Alone Dump Program (Uses Tapes)

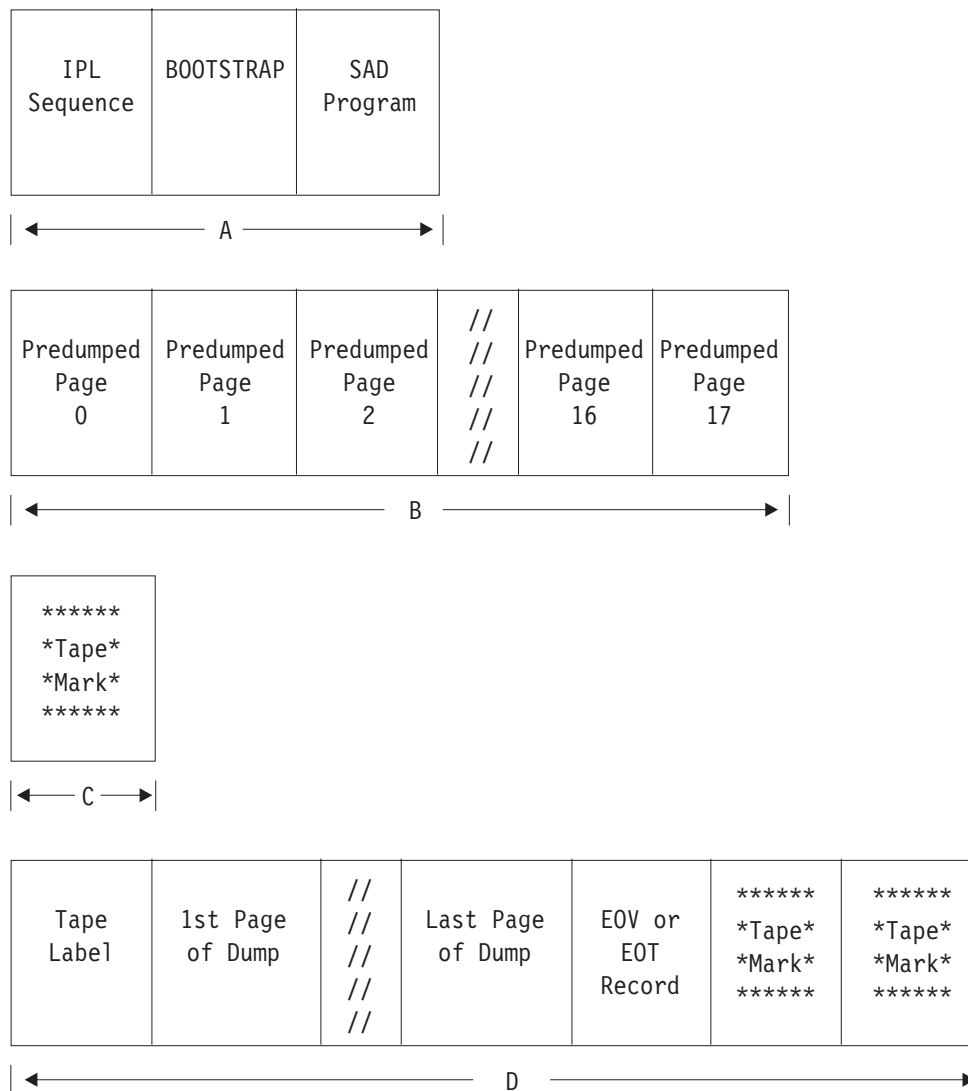


Figure 57. Stand-Alone Dump Facility Tape Format

- A** Written by the stand-alone dump utility on the IPL tape at generation time.
- B** Written by BOOTSTRAP on the IPL tape.
- C** Written by BOOTSTRAP if the IPL tape is the same as the dump tape.  
Written by the stand-alone dump program if the IPL tape is not the same as the dump tape.
- D** Written by the stand-alone dump program on the dump tape.

## DASD Format

When you use a DASD device to IPL the stand-alone dump program, the system uses cylinder 0 to hold the program. Cylinder 0 must be CP-formatted and allocated as permanent space. The stand-alone dump facility has the format shown in Figure 58 on page 857.

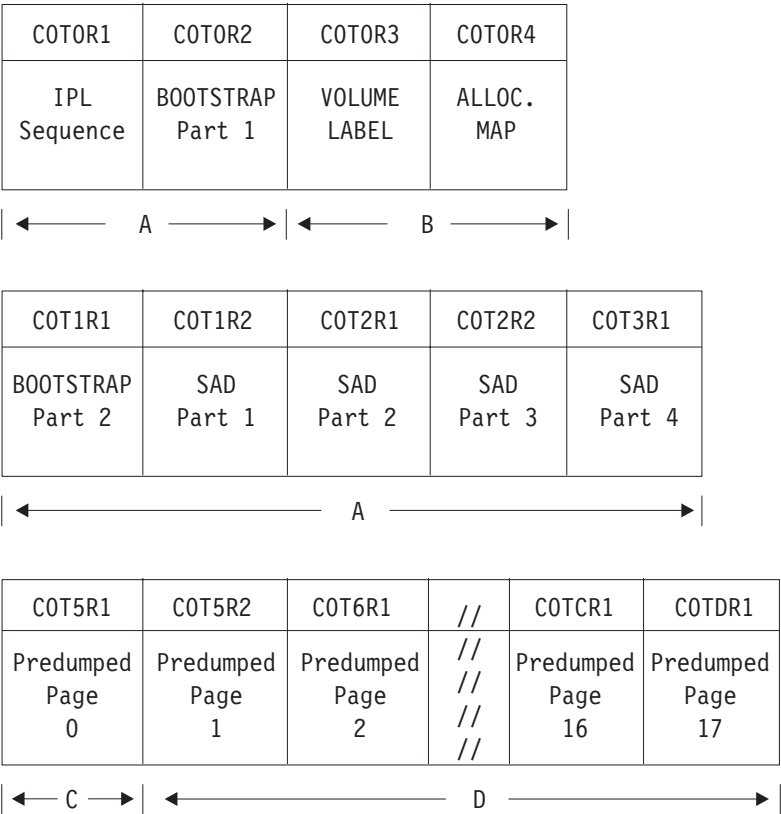


Figure 58. Stand-Alone Dump Facility DASD Format

- A      Written by the stand-alone dump utility on the IPL DASD at generation time.
- B      Written by the FORMAT/ALLOCATE program.
- C      Written by the BOOTSTRAP Part 1 on the IPL DASD.
- D      Written by the BOOTSTRAP Part 2 on the IPL DASD.
- CnTnRn identifies cylinder, track, and record numbers.



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## Appendix D. Using Cross-System Link (XLINK)

Cross-system link (XLINK) extends CP link protocols to control normal, stable, and exclusive read or read/write access across multiple VM systems for minidisks on shared DASD.

**Note:** Support for the cross system extensions (CSE) environment has been removed. z/VM single system image (SSI) clusters provide the new technology for clustering z/VM systems. The XLINK function that was included in CSE is still supported for non-SSI systems, and “CSE” is still used in some function and object names, command responses, and messages related to XLINK.

---

### Planning for Cross-System Link

Before using the cross-system link function, make sure that you understand the capabilities, requirements, and restrictions.

#### Shared DASD

Only count-key-data (CKD) and extended-count-key-data (ECKD) DASD are supported for cross-system link. Cross-system link does not work with fixed-block architecture (FBA) DASD.

For cross-system link to control links between multiple VM systems, the real volumes on which the minidisks reside must be physically and logically shared by all systems. Physical sharing is provided by having the disk drives accessible to all systems. Logical sharing is assured by corresponding I/O device specifications (in the system configuration files and IOCPs if needed) and identical volume lists (in XLINK\_VOLUME\_INCLUDE and XLINK\_VOLUME\_EXCLUDE configuration statements) on all of the systems. Cross-system link does not use real reserve/release.

#### Maximum Number of Systems

Only VM systems that are not members of an SSI cluster can participate in cross-system link. The list of participating systems is defined by XLINK\_SYSTEM\_INCLUDE and XLINK\_SYSTEM\_EXCLUDE configuration statements on all of the systems.

The maximum number of systems supported for cross-system link is 56 if only ECKD devices are used. If any shared CKD devices are used, then the maximum number of systems supported depends on the device type. See Table 46 on page 869 for the maximum number of systems (XLINK map records) supported for various DASD types.

#### Performance Considerations

When DASD are shared, the chance of having high contention volumes is increased because potentially more users have access to one or more minidisks on the same volume. To achieve better I/O performance:

- Use 4 KB block formatting on all CMS minidisks.
- Ensure that DASD cache is enabled for a volume that contains heavily used *read-only* minidisks. This can dramatically reduce the volume's busy time.

- If possible, put heavily used minidisks on separate volumes and assign users to these minidisks so that the load is primarily from a single system.

### Minidisk Cache (MDC) Feature

Because the VM minidisk cache (MDC) feature does not address cross-cache invalidation, the scope of MDC is limited to one system only.

**Attention:** Using MDC with cross-system link might cause data integrity problems.

Because CACHING=ON is the default for the real device, you can identify a device on which shared minidisks reside by specifying SHARED YES on the RDEVICE statement in the system configuration file. This specification prevents MDC for the device. Alternatively, you can suppress MDC at a more granular level by specifying NOMDC on the MINIOPT directory statement for shared minidisks, or by using the SET MDCACHE command.

### Placing of the CSE Area

CP keeps control information about the state of cross-system links to minidisks on a special area (called the *CSE area*) of the real volume where the minidisks reside. The CSE area must be initialized with the XLINK FORMAT utility. CP updates the information in the CSE area only when the first link to that minidisk occurs, when a link higher than any other links to that minidisk occurs, or when the last link of that type disappears. It is important that this area not be inadvertently updated by any program other than CP.

If you do not specify a particular location for the CSE area, CP initializes the CSE area starting on cylinder 0, track 1, when you issue the XLINK FORMAT command. Because CP keeps the volume label and allocation maps on cylinder 0, track 0, the default location for the CSE area should be available. Allocate the location you choose for the CSE area as PERM space with the CPFMTXA utility.

#### Notes:

1. For some device types, the CSE area resides on multiple cylinders. See Table 46 on page 869. When reserving space for the CSE area, these cylinders must also be considered.
2. Do not define user minidisks in the space reserved for the CSE area, except for the purpose described under “Protecting the CSE Area” on page 865.

### Synchronization of Directories

To protect your system's minidisks when they are shared with other systems, the directory statements for shared DASD volumes must be kept exactly synchronized.

To enable multiple systems to link to the same minidisks, the MDISK directory statements for all shared volumes must be identical on all of the systems. Directory entries for user IDs that exist on multiple systems (and therefore might be logged on simultaneously) should not contain MDISK or LINK statements with an access mode of multiwrite (M/W) if these minidisks are used by CMS. When a hardware path from each system to the proper device is defined, and identical minidisk extents in the directory are also defined, minidisks become available to every system.

You can use the OPTION, MDISK, or LINK directory statements to give a specified user sole write access to a minidisk for a limited period of time, thus offering



increased data integrity in cases where the stability of a given minidisk is required. The LNKSTABL and LNKEXCLU operands of the OPTION directory statement authorize a user to use the stable and exclusive link modes of the LINK command and DIAGNOSE code X'E4'. This global authority allows a virtual machine to perform a stable link to any minidisk to which it has password-level authorization. You can also specify stable and exclusive authority to a specific minidisk using the mode suffix letter (S or E) on the MDISK or LINK directory statements. While stable or exclusive links to a minidisk are in effect, access to that minidisk by any other user will be restricted or denied. For more information about the LNKSTABL and LNKEXCLU options, see the "OPTION Directory Statement" on page 561. For more information about link accesses, see "LINK Directory Statement" on page 524 or "MDISK Directory Statement" on page 539.

---

## Setting Up Cross-System Link

To set up and enable the cross-system link function, you need to do the following on each system:

1. Define the systems and volumes on XLINK statements in the system configuration file (see "Defining the Systems and Volumes for Cross-System Link").
2. Initialize the volumes for sharing (see "Initializing the Volumes for Cross-System Link" on page 862).
3. IPL the systems to establish the cross-system link function.
4. Verify the cross-system links (see "Verifying Cross-System Link" on page 863).

## Defining the Systems and Volumes for Cross-System Link

Define the participating systems and shared DASD volumes with XLINK statements in the system configuration file. The lists of systems and volumes must be identical on each participating system.

### **XLINK\_SYSTEM\_INCLUDE**

This statement defines a system to be included in the cross-system link function. The statement includes a SLOT *n* operand that defines the position of the system in the list of participating systems. Create a statement for each system. For more information, see "XLINK\_SYSTEM\_INCLUDE Statement" on page 312.

### **XLINK\_SYSTEM\_EXCLUDE**

This statement defines a system to be excluded from the cross-system link function. For more information, see "XLINK\_SYSTEM\_EXCLUDE Statement" on page 311.

### **XLINK\_VOLUME\_INCLUDE**

This statement defines a DASD volume to be included in the cross-system link function. Create a statement for each shared volume. For more information, see "XLINK\_VOLUME\_INCLUDE Statement" on page 316.

### **XLINK\_VOLUME\_EXCLUDE**

This statement defines a DASD volume to be excluded from the cross-system link function. For more information, see "XLINK\_VOLUME\_EXCLUDE Statement" on page 314.

### **XLINK\_DEVICE\_DEFAULTS**

This statement can be used to change the defaults for the CSE area location and format for specific DASD types. For more information, see "XLINK\_DEVICE\_DEFAULTS Statement" on page 307.

**Note:** Changing the defaults is not recommended. This statement allows you to provide link support for new devices with new geometries, should that become necessary in the future.

### Initializing the Volumes for Cross-System Link

The CSE area on each DASD volume contains link information about the minidisks on that volume. To prepare the volume for sharing, you need to format the CSE area with the XLINK FORMAT utility.

#### Generating the XLINK Utility Program

The XLINK utility program (XLINK MODULE) contains the XLINK FORMAT and XLINK DISPLAY utilities. The DASD parameters used by these XLINK utilities must be the same as those used by CP. Therefore, if you changed any of the CSE area defaults on XLINK\_DEVICE\_DEFAULTS or XLINK\_VOLUME\_INCLUDE statements, you need to generate an updated version of the XLINK utility program before you use XLINK FORMAT to initialize the CSE area. Use the VMFBLD EXEC to generate the XLINK MODULE on each system:

```
VMFBLD PPF ppfname compname HCPXLOAD XLINK (ALL
```

where:

*ppfname*

is the name of the product parameter file

*compname*

is the name of the component

For information about the VMFBLD EXEC, see *z/VM: VMSES/E Introduction and Reference*.

#### Initializing the CSE Area on the Shared Minidisk Volumes

Use the XLINK FORMAT utility to format the CSE area on each DASD volume that cross-system link will control. You must format the CSE areas before the cross-system link function can be activated.

**Note:** If you changed the defaults for the CSE area, you must IPL the system prior to running XLINK FORMAT.

To initialize the CSE area on a shared minidisk volume:

1. Connect the volume to be formatted to the virtual machine by one of the following methods:
  - a. Use the LINK command, in R/W mode, to link to a minidisk that defines a portion of the volume from cylinder 0 to where the CSE area is assigned. The default assignment for the CSE area is on cylinder 0. This method is preferred because it does not expose any data beyond the CSE area.

**Note:** The CSE area on some devices will reside on multiple cylinders. If you are using one of those devices, your minidisk must include all of those cylinders. See Table 46 on page 869 for devices that use multiple cylinders for the CSE area.
  - b. Use the LINK command, in R/W mode, to link to a minidisk that defines the entire real volume (a full-pack minidisk).
  - c. Use the ATTACH command to attach the real volume to the virtual machine.

For information about the LINK and ATTACH commands, see *z/VM: CP Commands and Utilities Reference*.

2. Enter an XLINK FORMAT command that specifies the virtual address and the real volume identification of the volume to be formatted:

```
XLINK FORMAT vaddr valid
```

The volume label on the disk must match the volume name given on the command. This command is run under CMS. Therefore, it does not require that you have any special CP privilege class. However, the command does require write access to the specified device.

You should run the XLINK FORMAT utility before you load the new CP module. However, if you wish to initialize the CSE area to something other than the defaults, you must IPL the system prior to running XLINK FORMAT.

For more information about the XLINK FORMAT utility, see *z/VM: CP Commands and Utilities Reference*.

## Verifying Cross-System Link

You can use the XLINK CHECK command to determine whether one or more volumes are under cross-system link control:

```
XLINK CHECK valid1...validn
```

For more information about the XLINK CHECK command, see *z/VM: CP Commands and Utilities Reference*.

## Controlling Cross-System Link

The lists of systems participating in cross-system link and the shared DASD volumes under cross-system link protection are controlled by the XLINK statements in the system configuration file (see “Defining the Systems and Volumes for Cross-System Link” on page 861). The lists of systems and volumes must be identical on all of the participating systems. CP cannot coordinate these definitions across the systems. Therefore, if you modify or add a statement on one system, you need to make the same change on the other systems.

The XLINK RESET command is provided to recover links and prevent lockouts if one of the systems participating in cross-system link fails.

**Attention:** Incorrect use of this command might cause a loss of minidisk data. For more information, see *z/VM: CP Commands and Utilities Reference*.

---

## CSE Area

Information about the state of current cross-system links is kept on the CSE area on each DASD volume being shared. To see these link indicators, use the XLINK DISPLAY utility. For information about the XLINK DISPLAY response, see *z/VM: CP Commands and Utilities Reference*.

The CKD cross-system link support uses a single track on each real DASD volume to hold information about the status of links to each of the minidisks contained on that volume. This information is contained in map records. There is one map record for each system in the complex and one byte in each map record for each cylinder on the volume. Because CKD minidisks always begin on a cylinder boundary, a particular byte in a particular map record can represent the status of a particular system's links to a particular minidisk on that real DASD volume. A single channel program is used to interrogate and update the map records for each

link mode. See Figure 59 on page 865 for an example of the format of a CKD-formatted CSE area, and see Figure 60 on page 866 for an example of map records for a CKD-formatted CSE area.

The ECKD cross-system link support uses multiple tracks on each real DASD volume to hold information about the status of links to each of the minidisks contained on that volume. This information is contained in link records. There is one link record for each system in the complex on each track and one half byte in each link record for each cylinder on the volume. Each link record is 256 bytes long and contains link information for 512 cylinders. Multiple cylinders will be used if the number of tracks needed for the CSE area is greater than the number of tracks per cylinder. A series of channel programs are used to interrogate and update the link flag. See Figure 61 on page 867 for an example of an ECKD-formatted CSE area, and Figure 62 on page 868 for an example of link records for an ECKD-formatted CSE area.

Link states are signified by the following flags:

**NOLINK**

No links exist for the minidisk.

**READ** Read links exist for the minidisk, but write links do not.

**WRITE**

At least one write link, and possibly one or more read links, exist for the minidisk.

**STABLE READ**

At least one stable read link, and possibly one or more read links exist for the minidisk. No write links will be granted while the STABLE READ flag exists for the minidisk.

**STABLE WRITE**

One stable write link, and possibly one or more read links exist for the minidisk. No write links will be granted while the STABLE WRITE flag exists for the minidisk.

**EXCLUSIVE READ**

One exclusive read link exists for the minidisk. No links will be granted while the EXCLUSIVE READ flag exists for the minidisk.

**EXCLUSIVE WRITE**

One exclusive write link exists for the minidisk. No links will be granted while the EXCLUSIVE WRITE flag exists for the minidisk.

For cross-system link to operate, the CSE area must be formatted properly. You can use cross-system link only with volumes that are currently attached to the system by CP and that have been formatted by the XLINK FORMAT utility. Cross-system link cannot support DASD that have not been formatted by this utility or that are attached to virtual machines.

The XLINK FORMAT utility writes the map records and other control information on the CSE area of each volume. The cylinder containing the CSE area must have been allocated as PERM space. Make sure that no user minidisks are allocated on that cylinder. To prevent inadvertent changes, no program other than CP should have write access to the CSE area of any volume attached to the system.

Because the CSE area for each shared volume is on that volume, any damage to the volume results in a loss of access to that volume only.

## Location of the CSE Area

The CSE area may be placed at any unused location on a volume. If no other area was specified, CP uses the default location of cylinder 0, track 1. CP keeps the volume label and allocation maps on cylinder 0, track 0. Therefore, the remaining tracks on cylinder 0 should be available. Regardless of the location of the CSE area, it must be allocated as PERM space. For some device types, the CSE area resides on multiple cylinders. Table 46 on page 869 indicates the number of cylinders used for each device.

CP needs to update the link information only when the first link to that minidisk occurs, when a link higher than any other links to that minidisk occurs, or the last link of that type is detached. Thus, the first link to a minidisk causes the disk arm to move to the CSE area, but subsequent links might not.

To reduce the need for, and frequency of, I/O activity to CSE areas, the primary read-only (RR) link mode should be used in LINK commands and directory statements whenever possible. Because RR links are always granted when any nonexclusive link exists on a given system, CSE is not concerned with the information on the CSE area.

If the disk arm does move, it moves to the CSE area, which defaults to track 1 of cylinder 0. If a minidisk is frequently linked (more than once a second) in a mode other than RR, or if the type of access changes frequently from R/O to R/W, it might be useful to move that minidisk as close to the CSE area as possible. This avoids long seeks on every LINK command. Alternatively, the CSE area could be moved to a different position on the volume, closer to the high-usage minidisk.

## Protecting the CSE Area

To protect the CSE areas from inadvertent assignment as a user's minidisk space, it might be helpful to assign a NOLOG user ID to the cylinder on which the area resides. Access to the cylinder containing the CSE area must be strictly controlled.

## Format of the CSE Area on a CKD Volume

Figure 59 illustrates the general format of a CKD-formatted CSE area.

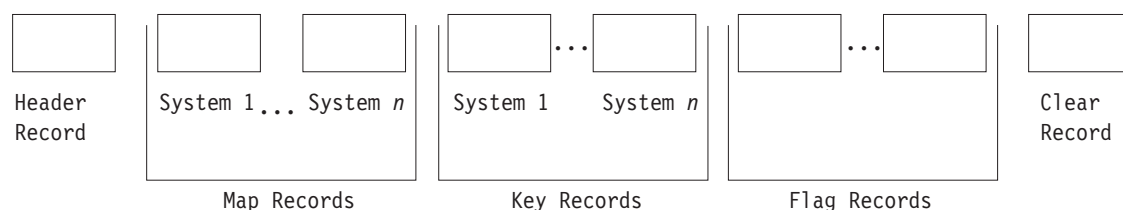


Figure 59. Format of a CKD-Formatted CSE Area

A CKD-formatted CSE area contains the following records:

### 1 Header Record

Contains 240 bytes of general cross-system link information.

### *n* Map Records

One record per system, each containing link information for a cylinder on the volume. The length of the data area is greater than or equal to the number of cylinders on the volume.

## *n* Key Records

One record per system, each containing 1 byte of irrelevant information. The key area is used as a comparison argument.

## 7 Flag Records

Each record contains a byte representing NOLINK, READ, WRITE, STABLE READ, STABLE WRITE, EXCLUSIVE READ, or EXCLUSIVE WRITE link flags.

## 1 Clear Record

Contains NOLINK link flags in all bytes. The length is the same as a map record.

*n* is the number of map records on this track. The number of sharing systems cannot exceed this value. The recommended value for *n* is equal to the maximum track capacity. If it is necessary to change this value, use the MAP\_RECORDS operand on the XLINK\_DEVICE\_DEFAULTS statement (see "XLINK\_DEVICE\_DEFAULTS Statement" on page 307) or the XLINK\_VOLUME\_INCLUDE statement (see "XLINK\_VOLUME\_INCLUDE Statement" on page 316).

The number of map records used should equal the number of systems that are participating in cross-system link.

The map records show the state of the existing links on a CKD DASD for the systems participating in cross-system link. Figure 60 is an example.

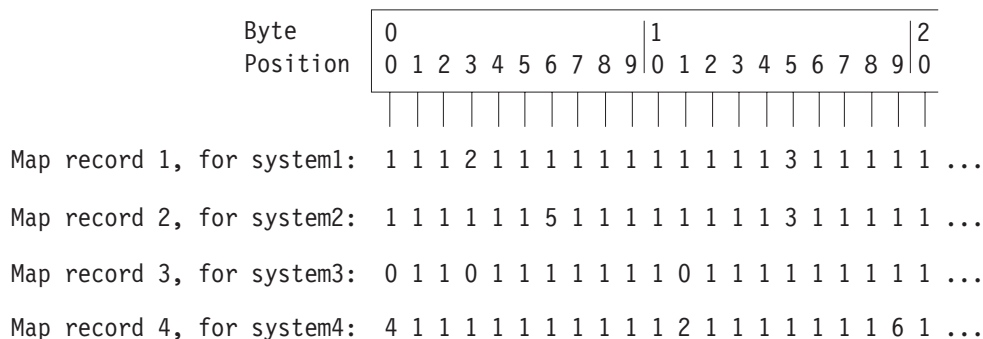


Figure 60. Sample Map Records for Four Systems in a CKD-Formatted CSE Area

The following values are used in the map records to indicate the link state flags:

| Value | Link State Flag |
|-------|-----------------|
| 1     | NOLINK          |
| 0     | READ            |
| 2     | WRITE           |
| 3     | STABLE READ     |
| 4     | STABLE WRITE    |
| 5     | EXCLUSIVE READ  |
| 6     | EXCLUSIVE WRITE |

The map records shown in Figure 60 indicate the following links:

- System1 has write links to a minidisk beginning at cylinder 3 and stable read links to a minidisk beginning at cylinder 15.
- System2 has an exclusive read link to a minidisk beginning at cylinder 6 and stable read links to a minidisk beginning at cylinder 15.
- System3 has read links to minidisks beginning at cylinders 0, 3, and 11.

- System4 has a stable write link to a minidisk beginning at cylinder 0, write links to minidisks beginning at cylinder 11, and an exclusive write link to a minidisk beginning at cylinder 19.

## Format of the CSE Area on an ECKD Volume

Figure 61 illustrates the general format of an ECKD-formatted CSE area.

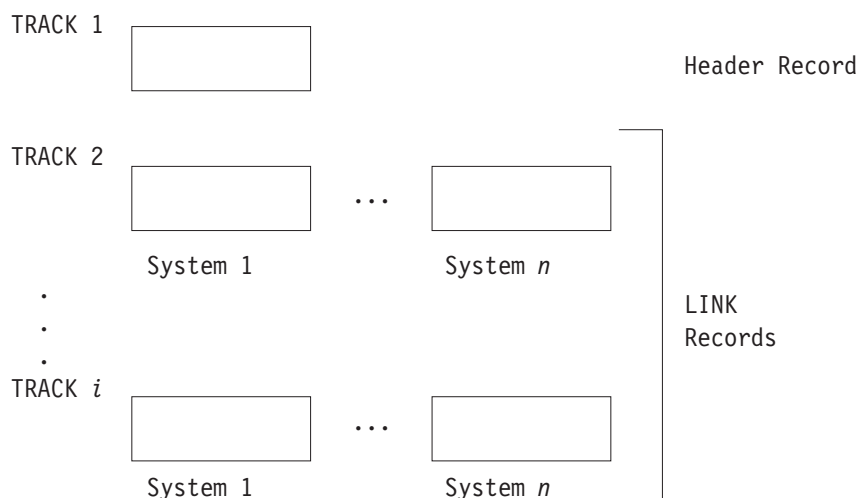


Figure 61. Format of an ECKD-Formatted CSE Area

An ECKD-formatted CSE area contains the following records:

### 1 Header Record

Contains 56 bytes of general cross-system link information.

### $n \times i$ Link Records

Each record is 256 bytes long and contains link information for 512 cylinders on the volume. Record X on track 2 represents cylinders 0–511 for system X, record X on track 3 represents cylinders 512–1023 for system X, and so on.

- $n$  is the number of link records on each track, which is the number of systems defined as sharing minidisks with cross-system link. If it is necessary to change this value, use the MAP\_RECORDS operand on the XLINK\_DEVICE\_DEFAULTS statement (see “XLINK\_DEVICE\_DEFAULTS Statement” on page 307) or the XLINK\_VOLUME\_INCLUDE statement (see “XLINK\_VOLUME\_INCLUDE Statement” on page 316).

**Note:** For some devices, the CSE area does not fit on one cylinder, so multiple cylinders are used. Table 46 on page 869 indicates the number of cylinders used for each device.

- $i$  is the number of tracks needed to hold link records with link information for at least the number of cylinders on this volume. If it is necessary to change this value, use the MAP\_RECORD\_LENGTH operand on the XLINK\_DEVICE\_DEFAULTS statement (see “XLINK\_DEVICE\_DEFAULTS Statement” on page 307) or the XLINK\_VOLUME\_INCLUDE statement (see “XLINK\_VOLUME\_INCLUDE Statement” on page 316).



## Using XLINK

The link records show the state of the existing links on an ECKD DASD for the systems participating in cross-system link. Figure 62 is an example.

|                             | Byte<br>Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |   |   |   |   |   |   |   |     |     |   |     |
|-----------------------------|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|-----|---|-----|
|                             |                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |     |   |     |
| Link record 1, for system1: |                  | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | ... |     |   |     |
| Link record 2, for system2: |                  | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0   | ... |   |     |
| Link record 3, for system3: |                  | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0   | 0   | 0 | ... |
| Link record 4, for system4: |                  | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 0 | 0   | 0   | 6 | ... |

*Figure 62. Sample Link Records for Four Systems in Track 2 of an ECKD-Formatted CSE Area*

The following values are used in the link records to indicate the link state flags:

| Value | Link State Flag |
|-------|-----------------|
| 0     | NOLINK          |
| 1     | READ            |
| 4     | WRITE           |
| 2     | STABLE READ     |
| 3     | STABLE WRITE    |
| 5     | EXCLUSIVE READ  |
| 6     | EXCLUSIVE WRITE |

The link records shown in Figure 62 indicate the following links:

- System1 has write links to a minidisk beginning at cylinder 3 and stable read links to a minidisk beginning at cylinder 15.
- System2 has an exclusive read link to a minidisk beginning at cylinder 6 and stable read links to a minidisk beginning at cylinder 15.
- System3 has read links to minidisks beginning at cylinders 0, 3, and 11, and stable read links to a minidisk beginning at cylinder 15.
- System4 has a stable write link to a minidisk beginning at cylinder 0, write links to a minidisk beginning at cylinder 11, stable read links to a minidisk beginning at cylinder 15, and an exclusive write link to a minidisk beginning at cylinder 19.

## Default Values for the CSE Area

By default, the XLINK FORMAT utility formats each CKD DASD volume with the maximum number of map records that can be recorded on one track. The same defaults are used for ECKD DASD, although the maximum number allowed is higher. Table 46 on page 869 shows, by device type, the default number of map records (which is also the number of systems that can be supported for cross-system link), and the default map record lengths.



Table 46. Defaults for the CSE Area

| Device Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Number of Map Records | Map Record Length | Number of cylinders needed for CSE area |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------|-----------------------------------------|
| 3330 (3350 in 3330 compatibility mode)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8                     | 808               | 1                                       |
| 3340                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4                     | 696               | 1                                       |
| 3350                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 15                    | 555               | 1                                       |
| 3375                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12                    | 959               | 1                                       |
| 3380 type K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8                     | 2655              | 1                                       |
| 3380 non-type K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 11                    | 1770              | 1                                       |
| 3390-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12                    | 1113              | 1                                       |
| 3390-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8                     | 2226              | 1                                       |
| 3390-3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8                     | 3339              | 1                                       |
| 3390-9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 56                    | 65520             | 9                                       |
| 9345-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12                    | 1440              | 1                                       |
| 9345-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8                     | 2156              | 1                                       |
| Other                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 8                     | 1024              | 1                                       |
| <b>Note:</b> <ol style="list-style-type: none"> <li>1. These defaults support CKD and ECKD DASD. FBA DASD are not supported.</li> <li>2. The length of each map record is the maximum number of cylinders on any currently existing model of that device type.</li> <li>3. The “Number of cylinders needed for CSE area” value is for ECKD DASD only. If the last cylinder on the volume is specified for the CSE area and multiple cylinders are needed, the CSE area will not wrap to the beginning of the volume for the other CSE area cylinders.</li> <li>4. Eight records are defined for other devices, but the actual number of records used is limited to the number that fit on one track on such a device.</li> </ol> |                       |                   |                                         |



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## Programming Interface Information

This publication primarily documents information that is NOT intended to be used as Programming Interfaces of z/VM.

This publication also documents intended Programming Interfaces that allow the customer to write programs to obtain the services of z/VM. This information is identified where it occurs, either by an introductory statement to a chapter or section or by the following marking:

**PI**

<...Programming Interface information...>

**PI end**

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## Glossary

For a list of z/VM terms and their definitions, see *z/VM: Glossary*.

The z/VM glossary is also available through the online z/VM HELP Facility, if HELP files are installed on your z/VM system. For example, to display the definition of the term “dedicated device”, issue the following HELP command:

```
help glossary dedicated device
```

While you are in the glossary help file, you can do additional searches:

- To display the definition of a new term, type a new HELP command on the command line:

```
help glossary newterm
```

This command opens a new help file inside the previous help file. You can repeat this process many times. The status area in the lower right corner of the screen shows how many help files you have open. To close the current file, press the Quit key (PF3/F3). To exit from the HELP Facility, press the Return key (PF4/F4).

- To search for a word, phrase, or character string, type it on the command line and press the Clocate key (PF5/F5). To find other occurrences, press the key multiple times.

The Clocate function searches from the current location to the end of the file. It does not wrap. To search the whole file, press the Top key (PF2/F2) to go to the top of the file before using Clocate.





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## Bibliography

See the following publications for additional information about z/VM. For abstracts of the z/VM publications, see *z/VM: General Information*, GC24-6193

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### Where to Get z/VM Information

z/VM product information is available from the following sources:

- z/VM V6.3 Information Center (publib.boulder.ibm.com/infocenter/zvm/v6r3/)
- IBM: z/VM Internet Library (www.ibm.com/vm/library/)
- IBM Publications Center (www.ibm.com/e-business/linkweb/publications/servlet/pbi.wss)
- IBM Online Library: z/VM Collection, SK5T-7054

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### z/VM Base Library

#### Overview

- z/VM: *General Information*, GC24-6193
- z/VM: *Glossary*, GC24-6195
- z/VM: *License Information*, GC24-6200

#### Installation, Migration, and Service

- z/VM: *Installation Guide*, GC24-6246
- z/VM: *Migration Guide*, GC24-6201
- z/VM: *Service Guide*, GC24-6247
- z/VM: *VMSES/E Introduction and Reference*, GC24-6243

#### Planning and Administration

- z/VM: *CMS File Pool Planning, Administration, and Operation*, SC24-6167
- z/VM: *CMS Planning and Administration*, SC24-6171
- z/VM: *Connectivity*, SC24-6174
- z/VM: *CP Planning and Administration*, SC24-6178
- z/VM: *Getting Started with Linux on System z*, SC24-6194
- z/VM: *Group Control System*, SC24-6196
- z/VM: *I/O Configuration*, SC24-6198

- z/VM: *Running Guest Operating Systems*, SC24-6228
- z/VM: *Saved Segments Planning and Administration*, SC24-6229
- z/VM: *Secure Configuration Guide*, SC24-6230
- z/VM: *TCP/IP LDAP Administration Guide*, SC24-6236
- z/VM: *TCP/IP Planning and Customization*, SC24-6238
- z/OS and z/VM: *Hardware Configuration Manager User's Guide*, SC33-7989

### Customization and Tuning

- z/VM: *CP Exit Customization*, SC24-6176
- z/VM: *Performance*, SC24-6208

### Operation and Use

- z/VM: *CMS Commands and Utilities Reference*, SC24-6166
- z/VM: *CMS Pipelines Reference*, SC24-6169
- z/VM: *CMS Pipelines User's Guide*, SC24-6170
- z/VM: *CMS Primer*, SC24-6172
- z/VM: *CMS User's Guide*, SC24-6173
- z/VM: *CP Commands and Utilities Reference*, SC24-6175
- z/VM: *System Operation*, SC24-6233
- z/VM: *TCP/IP User's Guide*, SC24-6240
- z/VM: *Virtual Machine Operation*, SC24-6241
- z/VM: *XEDIT Commands and Macros Reference*, SC24-6244
- z/VM: *XEDIT User's Guide*, SC24-6245
- *CMS/TSO Pipelines: Author's Edition*, SL26-0018

### Application Programming

- z/VM: *CMS Application Development Guide*, SC24-6162
- z/VM: *CMS Application Development Guide for Assembler*, SC24-6163
- z/VM: *CMS Application Multitasking*, SC24-6164
- z/VM: *CMS Callable Services Reference*, SC24-6165
- z/VM: *CMS Macros and Functions Reference*, SC24-6168
- z/VM: *CP Programming Services*, SC24-6179
- z/VM: *CPI Communications User's Guide*, SC24-6180

- *z/VM: Enterprise Systems Architecture/Extended Configuration Principles of Operation*, SC24-6192
- *z/VM: Language Environment User's Guide*, SC24-6199
- *z/VM: OpenExtensions Advanced Application Programming Tools*, SC24-6202
- *z/VM: OpenExtensions Callable Services Reference*, SC24-6203
- *z/VM: OpenExtensions Commands Reference*, SC24-6204
- *z/VM: OpenExtensions POSIX Conformance Document*, GC24-6205
- *z/VM: OpenExtensions User's Guide*, SC24-6206
- *z/VM: Program Management Binder for CMS*, SC24-6211
- *z/VM: Reusable Server Kernel Programmer's Guide and Reference*, SC24-6220
- *z/VM: REXX/VM Reference*, SC24-6221
- *z/VM: REXX/VM User's Guide*, SC24-6222
- *z/VM: Systems Management Application Programming*, SC24-6234
- *z/VM: TCP/IP Programmer's Reference*, SC24-6239
- *Common Programming Interface Communications Reference*, SC26-4399
- *Common Programming Interface Resource Recovery Reference*, SC31-6821
- *z/OS: IBM Tivoli Directory Server Plug-in Reference for z/OS*, SA76-0148
- *z/OS: Language Environment Concepts Guide*, SA22-7567
- *z/OS: Language Environment Debugging Guide*, GA22-7560
- *z/OS: Language Environment Programming Guide*, SA22-7561
- *z/OS: Language Environment Programming Reference*, SA22-7562
- *z/OS: Language Environment Run-Time Messages*, SA22-7566
- *z/OS: Language Environment Writing Interlanguage Communication Applications*, SA22-7563
- *z/OS MVS Program Management: Advanced Facilities*, SA22-7644
- *z/OS MVS Program Management: User's Guide and Reference*, SA22-7643

## Diagnosis

- *z/VM: CMS and REXX/VM Messages and Codes*, GC24-6161
- *z/VM: CP Messages and Codes*, GC24-6177

- *z/VM: Diagnosis Guide*, GC24-6187
- *z/VM: Dump Viewing Facility*, GC24-6191
- *z/VM: Other Components Messages and Codes*, GC24-6207
- *z/VM: TCP/IP Diagnosis Guide*, GC24-6235
- *z/VM: TCP/IP Messages and Codes*, GC24-6237
- *z/VM: VM Dump Tool*, GC24-6242
- *z/OS and z/VM: Hardware Configuration Definition Messages*, SC33-7986

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## z/VM Facilities and Features

### Data Facility Storage Management Subsystem for VM

- *z/VM: DFSMS/VM Customization*, SC24-6181
- *z/VM: DFSMS/VM Diagnosis Guide*, GC24-6182
- *z/VM: DFSMS/VM Messages and Codes*, GC24-6183
- *z/VM: DFSMS/VM Planning Guide*, SC24-6184
- *z/VM: DFSMS/VM Removable Media Services*, SC24-6185
- *z/VM: DFSMS/VM Storage Administration*, SC24-6186

### Directory Maintenance Facility for z/VM

- *z/VM: Directory Maintenance Facility Commands Reference*, SC24-6188
- *z/VM: Directory Maintenance Facility Messages*, GC24-6189
- *z/VM: Directory Maintenance Facility Tailoring and Administration Guide*, SC24-6190

### Open Systems Adapter/Support Facility

- *zEnterprise System, System z10, System z9 and eServer zSeries: Open Systems Adapter-Express Customer's Guide and Reference*, SA22-7935
- *System z9 and eServer zSeries 890 and 990: Open Systems Adapter-Express Integrated Console Controller User's Guide*, SA22-7990
- *System z: Open Systems Adapter-Express Integrated Console Controller 3215 Support*, SA23-2247
- *System z10: Open Systems Adapter-Express3 Integrated Console Controller Dual-Port User's Guide*, SA23-2266

### Performance Toolkit for VM

- *z/VM: Performance Toolkit Guide*, SC24-6209
- *z/VM: Performance Toolkit Reference*, SC24-6210

## **RACF Security Server for z/VM**

- *z/VM: RACF Security Server Auditor's Guide, SC24-6212*
- *z/VM: RACF Security Server Command Language Reference, SC24-6213*
- *z/VM: RACF Security Server Diagnosis Guide, GC24-6214*
- *z/VM: RACF Security Server General User's Guide, SC24-6215*
- *z/VM: RACF Security Server Macros and Interfaces, SC24-6216*
- *z/VM: RACF Security Server Messages and Codes, GC24-6217*
- *z/VM: RACF Security Server Security Administrator's Guide, SC24-6218*
- *z/VM: RACF Security Server System Programmer's Guide, SC24-6219*
- *z/VM: Security Server RACROUTE Macro Reference, SC24-6231*

## **Remote Spooling Communications Subsystem Networking for z/VM**

- *z/VM: RSCS Networking Diagnosis, GC24-6223*
- *z/VM: RSCS Networking Exit Customization, SC24-6224*
- *z/VM: RSCS Networking Messages and Codes, GC24-6225*
- *z/VM: RSCS Networking Operation and Use, SC24-6226*
- *z/VM: RSCS Networking Planning and Configuration, SC24-6227*

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## **Prerequisite Products**

### **Device Support Facilities**

- *Device Support Facilities: User's Guide and Reference, GC35-0033*

### **Environmental Record Editing and Printing Program**

- *Environmental Record Editing and Printing Program (EREP): Reference, GC35-0152*
- *Environmental Record Editing and Printing Program (EREP): User's Guide, GC35-0151*



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