DFSMS/MVS

Software Support for IBM Enterprise Storage Server

SC26-7318-00

DFSMS/MVS

Software Support for IBM Enterprise Storage Server

SC26-7318-00

Note!
Before using this information and the product it supports, be sure to read the general information under “Notices” on page 37.

First Edition (September 1999)

This edition applies to:

- Version 1 Releases 1–5 of DFSMS/MVS (5695-DF1)
- Version 1 Releases 13 and 14 of DFSORT (5740-SM1)
- Version 3 Release 5 of MVS/EREP (5658-260)
- Version 1 Release 16 of ICKDSF Standalone (5747-DS1)
- Version 1 Release 16 of ICKDSF (5655-257)
- Version 1 Releases 1–3 of OS/390 (5645-001)
- Version 2 Releases 4–7 of OS/390 (5647-A01).

It also applies to any subsequent releases of these products until otherwise indicated in new editions. Make sure you are using the correct edition for the level of the product.

Order publications through your IBM representative or the IBM branch office serving your locality. Publications are not stocked at the address given below.

A form for readers’ comments appears at the back of this publication. If the form has been removed, address your comments to:

International Business Machines Corporation
RCF Processing Department
M86/050
5600 Cottle Road
SAN JOSE, CA 95193-0001
U.S.A.

You can also send your comments electronically to:

`starpubs@us.ibm.com`

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Contents

Figures

Tables

About This Book

Welcome to *DFSMS/MVS Software Support for IBM Enterprise Storage Server*.

This book introduces the IBM® Enterprise Storage Server (ESS) and highlights its unique capabilities. It also describes Data Facility Storage Management Subsystems/Multiple Virtual Storage (DFSMS/MVS®) software support for the ESS. Therefore, it is intended for system operators, system programmers, system administrators, and application programmers who need to understand, install, and use the ESS.

We recommend that you start with the first three chapters of this book. After an overview of the ESS and DFSMS/MVS software support, these chapters define important ESS concepts. In addition, they address specific migration and coexistence considerations. Your understanding of these concepts and migration concerns is critical to your success of installing and using the ESS.

The remaining chapters of this book discuss specific ESS functions. Each chapter begins with an overview of the topics to be covered. Then, it presents information pertinent to individual topics. Whenever possible, it refers you to additional support and resources for understanding and using the ESS.

Below is a brief preview of the chapters in this book.

- "Chapter 1. Introduction" on page 1 offers an overview of the ESS, highlights its various functions, and summarizes the exploitation, toleration, and transparency support provided by DFSMS/MVS and related program products.
- "Chapter 2. ESS Concepts" on page 5 defines ESS-specific concepts that include base exposure, alias exposure, parallel access volume (PAV), PAV-base, PAV-alias, non-PAV, and multiple allegiance.
- "Chapter 3. Migration and Coexistence" on page 7 explores migration considerations and discusses specific tasks you must perform to migrate to the ESS. In doing so, it helps you plan and install DFSMS/MVS software support for the ESS.
- "Chapter 4. Parallel Access Volumes" on page 15 describes PAVs, an advanced ESS capability. After defining static and dynamic PAVs, it shows you how to configure and verify PAVs to your MVS system.
- "Chapter 5. ESS Copy Services" on page 25 introduces ESS copy services, such as the FlashCopy service, the XRC suspend/resume service for unplanned outages, and the peer-to-peer remote copy service.
- "Chapter 6. Logical Subsystem Resource Usage" on page 29 documents the updates to the IDCAMS LISTDATA and SETCACHE commands.

Related Publications

The following publications can help you understand the contents of this book.

Publication Title	Order Number
IBM Enterprise Storage Server Configuration Guide	SC26–7353
IBM Enterprise Storage Server Copy Services	SC35–0355
IBM Enterprise Storage Server Host Systems Attachment Guide	SC26–7296

Publication Title	Order Number
IBM Enterprise Storage Server Introduction and Planning Guide	GC26–7294
IBM Enterprise Storage Server Quick Configuration Guide	SC26–7354
IBM Enterprise Storage Server SCSI Command Reference	SC26–7297
IBM Enterprise Storage Server System/390 Command Reference	SC26–7298
IBM Enterprise Storage Server User's Guide	SC26–7295
IBM Enterprise Storage Server Web User's Interface Guide	SC26–7346
IBM Storage Solutions Safety Notices	GC26–7229

Referenced Publications

In this book, references are made to the following publications:

Publication Title	Order Number
CICS Transaction Server for OS/390: Planning for Installation	GC33–1789
DFSMS/MVS DFSMSdfp Advanced Services	SC26–4921
DFSMS/MVS DFSMSdfp Storage Administration Reference	SC26–4920
DFSMS/MVS DFSMSdss Storage Administration Guide	SC26–4930
DFSMS/MVS DFSMSdss Storage Administration Reference	SC26–4929
DFSMS/MVS Remote Copy Administrator's Guide and Reference	SC35–0169
IBM Enterprise Storage Server Copy Services	SC35–0355
IBM Enterprise Storage Server Introduction and Planning Guide	GC26–7294
IBM Enterprise Storage Server User's Guide	SC26–7295
OS/390 HCD Planning	GC28–1750
OS/390 HCD User's Guide	GC28–1848
OS/390 Information Roadmap	GC28–1727
OS/390 MVS Diagnosis: Tools and Service Aids	SY28–1085
OS/390 MVS System Commands	GC28–1781
OS/390 Planning for Installation	GC28–1726
OS/390 Security Server (RACF) Introduction	GC28–1912

References to Product Names in DFSMS/MVS Publications

DFSMS/MVS publications support DFSMS/MVS, 5695-DF1, as well as the DFSMSdfp base element and the DFSMShsm, DFSMSdss, and DFSMSrmm features of OS/390, 5647-A01. DFSMS/MVS publications also describe how DFSMS/MVS interacts with other IBM products to perform the essential data, storage, program, and device management functions of the operating system.

DFSMS/MVS publications typically refer to another IBM product using a generic name for the product. When a particular release level of a product is relevant, the reference includes the complete name of that product. This section explains the naming conventions used in the DFSMS/MVS library for the following products:

MVS can refer to:

- MVS/ESA SP Version 5, 5695-047 or 5695-048

- The MVS base control program (BCP) of OS/390, 5647-A01

All MVS book titles used in DFSMS/MVS publications refer to the OS/390 editions. Users of MVS/ESA SP Version 5 should use the corresponding MVS/ESA book. Refer to *OS/390 Information Roadmap* for titles and order numbers for all the elements and features of OS/390.

For more information about OS/390 elements and features, including their relationship to MVS/ESA SP and related products, refer to "References to OS/390 Elements and Features" and *OS/390 Planning for Installation*.

RACF can refer to:

- Resource Access Control Facility (RACF), Version 2, 5695-039
- The RACF element of the OS/390 Security Server, an optional feature of OS/390

All RACF book titles refer to the Security Server editions. Users of RACF Version 2 should use the corresponding book for their level of the product. Refer to *OS/390 Security Server (RACF) Introduction* for more information about the Security Server.

CICS can refer to:

- CICS/MVS, 5665-403
- CICS/ESA, 5685-083
- The CICS element of the CICS Transaction Server for OS/390, 5665-147

All CICS book titles refer to the CICS Transaction Server for OS/390 editions. Users of CICS/MVS and CICS/ESA should use the corresponding books for those products. Please see *CICS Transaction Server for OS/390: Planning for Installation* for more information.

References to OS/390 Elements and Features

This book also supports OS/390, 5645-001. References to functional components of DFSMS/MVS and other MVS/ESA products are generally equivalent to the names of OS/390 base elements and optional features.

Use the table below to find the product name and level you are familiar with, its OS/390 equivalent, and whether it is a base element or an optional feature of OS/390.

Product Name and Level	Name in OS/390	Base or Optional
BookManager BUILD/MVS V1R3	BookManager BUILD	optional
BookManager READ/MVS V1R3	BookManager READ	base
MVS/Bulk Data Transfer V2	Bulk Data Transfer (BDT)	base
MVS/Bulk Data Transfer File-to-File V2	Bulk Data Transfer (BDT) File-to-File	optional
MVS/Bulk Data Transfer SNA NJE V2	Bulk Data Transfer (BDT) SNA NJE	optional
IBM OS/390 C/C++ V1R2	C/C++	optional
DFSMSdfp V1R3	DFSMSdfp	base
DFSMSdss	DFSMSdss	optional

Product Name and Level	Name in OS/390	Base or Optional
DFSMShsm	DFSMShsm	optional
DFSMSrmm	DFSMSrmm	optional
DFSMS/MVS Network File System V1R3	DFSMS/MVS Network File System	base
DFSORT R13	DFSORT	optional
EREP MVS V3R5	EREP	base
FFST/MVS V1R2	FFST/MVS	base
GDDM/MVS V3R2 • GDDM-OS/2 LINK • GDDM-PCLK	GDDM	base
GDDM-PGF V2R1.3	GDDM-PGF	optional
GDDM-REXX/MVS V3R2	GDDM-REXX	optional
IBM High Level Assembler for MVS, VM, and VSE V1R2	High Level Assembler	base
IBM High Level Assembler Toolkit	High Level Assembler Toolkit	optional
ICKDSF R16	ICKDSF	base
ISPF V4R2	ISPF	base
Language Environment for MVS and VM V1R5	Language Environment	base
Language Environment V1R5 Data Decryption	Language Environment Data Decryption	optional
MVS/ESA SP V5R2.2:		
• BCP	• BCP or MVS	base
• ESCON Director Support	• ESCON Director Support	base
• Hardware configuration definition (HCD)	• Hardware configuration definition (HCD)	base
• JES2 V5R2.0	• JES2	base
• JES3 V5R2.1	• JES3	optional
• LANRES/MVS V1R3.1	• LANRES	base
• IBM LAN Server for MVS V1R1	• LAN Server	base
• MICR/OCR Support	• MICR/OCR Support	base
• OpenEdition System Services	• OpenEdition System Services	base
• OpenEdition Application Services	• OpenEdition Application Services	base
• OpenEdition DCE Base Services (OSF DCE level 1.1)	• OpenEdition DCE Base Services	base
• OpenEdition DCE Distributed File Service (DFS) (OSF DCE level 1.1)	• OpenEdition DCE Distributed File Service (DFS)	base

Product Name and Level	Name in OS/390	Base or Optional
• OpenEdition DCE User Data Privacy	• OpenEdition DCE User Data Privacy	optional
• SOMobjects Application Development Environment (ADE) V1R1	• SOMobjects Application Development Environment (ADE)	optional
• SOMobjects Runtime Library (RTL)	• SOMobjects Runtime Library (RTL)	base
• SOMobjects service classes	• SOMobjects service classes	base
Open Systems Adapter Support Facility (OSA/SF) R1	Open Systems Adapter Support Facility (OSA/SF)	base
MVS/ESA RMF V5R2	RMF	optional
RACF V2R2	Security Server: • RACF • OpenEdition DCE Security Server	optional
SDSF V1R6	SDSF	optional
SMP/E	SMP/E	base
SystemView for MVS Base	SystemView for MVS Base	base
IBM TCP/IP V3R1:	TCP/IP	base
• TCP/IP CICS Sockets	• TCP/IP CICS Sockets	optional
• TCP/IP IMS Sockets	• TCP/IP IMS Sockets	optional
• TCP/IP Kerberos	• TCP/IP Kerberos	optional
• TCP/IP Network Print Facility (NPF)	• TCP/IP Network Print Facility (NPF)	optional
• TCP/IP OpenEdition Applications	• TCP/IP OpenEdition Applications	optional
• TCP/IP OS/2 Offload	• TCP/IP OS/2 Offload	optional
TIOC R1	TIOC	base
Time Sharing Option Extensions (TSO/E) V2R5	TSO/E	base
VisualLift for MVS V1R1.1	• VisualLift Run-Time Environment (RTE)	base
	• VisualLift Application Development Environment (ADE)	optional
VTAM V4R3 with the AnyNet feature	VTAM	base
3270 PC File Transfer Program V1R1.1	3270 PC File Transfer Program	base

For more information on compatibility with OS/390 elements, see *OS/390 Planning for Installation*.

Chapter 1. Introduction

This chapter introduces the IBM® Enterprise Storage Server (ESS) and summarizes the software support provided by DFSMS/MVS® and related program products. In doing so, it first provides an overview of the ESS and highlights its technological advancements. Then, it describes the changes made to DFSMS/MVS components and related program products to support the ESS.

Enterprise Storage Server

The ESS is an IBM high-end storage subsystem. It is the newest storage subsystem succeeding the 3880 family, the 3990 family, and the 9340 family. Designed for mid-range and high-end environments, the ESS, shown in Figure 1, provides you with large capacity, high performance, continuous availability, and storage expandability.

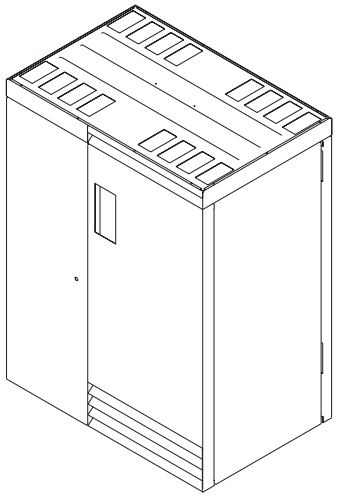


Figure 1. Overview of the Enterprise Storage Server

The ESS is also the first of the Seascape architecture storage products to provide attachment to IBM S/390® and open-system platforms. The Seascape™ architecture products come with integrated storage controllers. These integrated storage controllers allow the attachment of physical storage devices that emulate 3390 Models 2, 3, and 9 or provide 3380 track-compatability mode.

Housed in one to three storage racks, the ESS attaches to S/390 via ESCON adapters and open-system platforms via SCSI adapters. In addition, it offers concurrent, multi-host attachment support for Hewlett Packard, Sun Microsystems, and IBM RS/6000 and AS/400 host systems.

ESS Advancements

The ESS presents a wide range of technological advancements over previous storage subsystems. It also introduces some new functional features and capabilities. Specifically, the ESS:

- Emulates existing 3990 storage subsystems

- Allows 256 volumes per control unit and 16 control units per ESS
- Provides multiple allegiance capability
- Supports parallel access volumes[1] (PAVs)
- Supports the FlashCopy service
- Uses performance-oriented channel command words (CCWs) to improve data access
- Enhances suspend/resume functions of extended remote copy (XRC) service to accommodate unplanned outages
- Supports the enhanced peer-to-peer remote copy (PPRC) service.

The succeeding chapters explain, in detail, these ESS advancements and functions.

DFSMS/MVS Software Support

DFSMS/MVS software support consists of code modifications to the following DFSMS/MVS components:

- Access method services (AMS)
- Device support
- DFSMSdss
- System data mover.

In addition to DFSMS/MVS, the following program products are also changed to support the ESS:

- DFSMS Optimizer
- DFSORT
- EREP
- ICKDSF
- OS/390.

The software support provided by DFSORT, EREP, and ICKDSF are available in the authorized program analysis reports (APARs) as listed in Table 1. Check the preventive service package (PSP) bucket for the most recent information on APARs and PTFs.

Table 1. APAR Numbers for DFSORT, EREP, and ICKDSF Support

Program Product	APAR Number	Description
DFSORT	PQ13030	
EREP	IR39721	MVS
	VM62129	VM
	DY45132	VSE
ICKDSF	PQ26800	

DFSMS/MVS, DFSMS Optimizer, and OS/390 provide software support for the ESS in program temporary fixes (PTFs). This support is available in the following three types:

- Exploitation support
- Toleration support
- Transparency support.

1. Unless otherwise indicated, the term *volume* refers to a logical volume in this book.

The exploitation, toleration, and transparency support is available for specific releases of DFSMS/MVS and related program products. See Table 3 on page 8 for detailed information.

Exploitation Support

Exploitation support enables your system to define and recognize both the new ESS control unit type (2105) and the associated device types (3380A, 3380B, 3390A, and 3390B). This support allows you to fully exploit ESS capabilities, such as PAVs and copy services.

Toleration Support

Toleration support is designed for use on systems that cannot exploit ESS capabilities. This support allows your system to define and recognize both the new ESS control unit type (2105) and the associated device types (3380A, 3380B, 3390A, and 3390B). As a result, your system can share an input/output definition file (IODF) created by other systems, including exploiting systems. However, your system will see an ESS as a 3990 control unit and the attached devices as regular 3380s and 3390s.

Transparency Support

Transparency support allows your system to use an ESS only as a regular 3990 control unit. In this case, you must define the ESS as a 3990 control unit in the hardware configuration definition (HCD). As a result, your system cannot recognize the new ESS control unit type (2105) or the associated device types (3380A, 3380B, 3390A, or 3390B). In addition, your system will not be able to share an IODF that contains the new ESS control unit type and the associated device types.

Chapter 2. ESS Concepts

As a new Seascape architecture product, the ESS introduces a variety of new concepts to storage subsystems. In order to successfully install and use the ESS, you need to understand these concepts.

This chapter briefly defines the following ESS-specific concepts:

- Base exposure
- Alias exposure
- Multiple allegiance
- Parallel access volume (PAV)
- Non-PAV
- PAV-base
- PAV-alias
- Storage subsystem emulation.

Base and Alias Exposures

An *exposure* is a device extension that enables MVS to perform multiple concurrent I/O operations to the device. The ESS introduces two types of exposures:

- *Base exposure* is a device number associated with a PAV. It is used for query, data control, and data access operations.
- *Alias exposure* is a device number associated with a base exposure and representing the same logical volume as the base device number. It is used for data access I/O operations, query, and control operations.

Multiple Allegiance

Traditionally, IBM storage subsystems allow only one channel program to be active to a disk volume at a time. This means that, once the subsystem accepts an I/O request for a particular unit address, this unit address appears ″busy″ to subsequent I/O requests. This *single allegiance* capability ensures that additional requesting channel programs cannot alter data that is already being accessed.

By contrast, the ESS is capable of *multiple allegiance*, or concurrent execution of multiple requests from multiple hosts. That is, the ESS can queue and concurrently execute multiple requests for the same unit address, provided that no extent conflict occurs. A *conflict* refers to either the inclusion of a Reserve request by a channel program or a Write request to an extent that is in use.

Parallel Access Volume

In addition to multiple allegiance, the ESS enables multiple concurrent accesses to a single volume from a single host. To MVS, this volume is a *parallel access volume* (PAV).

The PAV capability represents a significant advancement by the ESS in I/O processing. Traditionally, MVS queues I/O requests on a control block when a volume is busy executing another one. Each volume has a unique control block with a unit address or a volume ID. MVS cannot start more than one I/O request to the same unit address at one time. This kind of volume is a *non-PAV* volume.

To enable multiple, concurrent accesses to a single volume from a single host, MVS must be able to associate multiple device numbers with a single volume. The ESS provides that capability by allowing you to define a PAV-base address and one or more PAV-alias addresses.

A *PAV-base* is the device number associated with the attributes and status of a PAV. It is the only device number used for accessing a PAV if aliases are not enabled.

A *PAV-alias* is an additional device number through which a PAV is accessed, allowing concurrent I/O operations.

See *IBM Enterprise Storage Server User's Guide* for more information about PAVs.

Storage Subsystem Emulation

In non-exploitation mode, the ESS appears as a 3990 storage subsystem to MVS. In fact, the ESS can *emulate* multiple 3990 storage subsystems via a logical subsystem (LSS). Each LSS appears to MVS as a 3990 Model 3 or Model 6 storage subsystem with up to 256 logical volumes and provides the following functions:

- Track and record caching
- DASD fast write
- Cache fast write
- PPRC
- XRC
- Concurrent copy.

Chapter 3. Migration and Coexistence

This chapter helps you plan for and migrate to the ESS. It explores migration and coexistence considerations for installing the software support provided by DFSMS/MVS® and related program products. In addition, it describes specific tasks you must perform to migrate to the ESS.

Planning for Migration and Coexistence

As pointed out in “DFSMS/MVS Software Support” on page 2, DFSMS/MVS and related program products provide toleration, exploitation, and transparency support for the ESS. Table 2 shows that the type of support you install determines the ESS functions you will be able to use. Therefore, you must decide the ESS functions you want to use before you install any of the software support.

Table 2. ESS Functions Based on DFSMS/MVS Software Support Type

ESS Functions	Exploitation Support	Toleration Support	Transparency Support
Emulate existing 3990 storage subsystems.		✔	✔
Allow 256 volumes per control unit and 16 control units per ESS	✔	✔	✔
Provide the multiple allegiance capability	✔	✔	✔
Support PAVs (See ″Note″ below for details)	✔	✔	
Support the FlashCopy service	✔		
Use performance-oriented CCWs to improve data access	✔		
Enhance XRC suspend/resume functions to accommodate unplanned outages	✔		
Support the enhanced PPRC service	✔		
Note: This toleration support for PAVs allows your system to define and recognize both the new ESS control unit type (2105) and the associated device types (3380A, 3380B, 3390A, and 3390B). However, your system will see an ESS as a 3990 control unit and the attached devices as regular 3380s and 3390s.			

In order to install and use the ESS in either exploitation or toleration mode, you must perform the following migration tasks:

- Evaluate your current system environment.
- Define or alter SMS constructs.
- Install DFSMS/MVS software support.
- Install and configure the ESS.
- Remove unsupported unit information modules (UIMs) from the HCD.
- Define the ESS to MVS.
- Activate the new IODF.
- Initialize ESS Volumes.
- Migrate your data.

The following sections briefly describe each of these tasks.

Evaluating Your Current System Environment

To prepare for installing DFSMS/MVS software support, we recommend that you evaluate your current system environment. Your evaluation helps you:

- Identify all systems within a sysplex that share a common IODF.

  Note: DFSMS/MVS software support is designed for you to use the ESS on systems sharing a common IODF. The discussion, hereafter, assumes that you do use a common IODF for systems in a multi-system environment.
- Determine the systems on which you will install the ESS.
- Identify the levels of these systems. This is to ensure that your system release levels allow you to:
  - Install the appropriate type of DFSMS/MVS software support as described in Table 3.
  - Use the desired ESS functions as described in Table 2 on page 7.

Defining or Altering SMS Constructs

After you identify the systems to which you will attach the ESS, make sure you perform the following steps:

- Define or alter existing storage group constructs to include ESS volumes.
- Define or alter existing storage class constructs to ensure proper storage class allocation.
- Create or alter automatic class selection (ACS) routines to select the appropriate SMS constructs.
- Validate and activate the modified source control data sets (SCDSs) that use the new SMS constructs.

Installing DFSMS/MVS Software Support

The three types of software support are designed to run on specific releases of DFSMS/MVS and related program products as shown in Table 3. Make sure that you install the software support appropriate to the release level of your system. Check the PSP bucket for the most recent information on APARs and PTFs.

Table 3. DFSMS/MVS Software Support for Applicable Releases

Applicable Release	Exploitation Support	Toleration Support	Transparency Support
DFSMS/MVS 1.1		✔	✔
DFSMS/MVS 1.2		✔	✔
DFSMS/MVS 1.3	✔		✔
DFSMS/MVS 1.4	✔		✔
DFSMS/MVS 1.5	✔		
DFSMS Optimizer	✔		
OS/390 1.3	✔		
OS/390 2.4	✔		
OS/390 2.5	✔		

Table 3. DFSMS/MVS Software Support for Applicable Releases (continued)

Applicable Release	Exploitation Support	Toleration Support	Transparency Support
OS/390 2.6	✓		
OS/390 2.7	✓		

Note: All ESS functions, except the PAV capability, will be available to your system if it runs an exploitation DFSMS/MVS release and a non-exploitation OS/390 release.

Sample System Environments for ESS

Let's consider the system configuration in Figure 2 for an example. This configuration contains a sysplex with three systems. All three systems share a single IODF but run different release levels of DFSMS/MVS. System A runs DFSMS/MVS 1.1, System B runs DFSMS/MVS 1.4, and System C runs DFSMS/MVS 1.5.

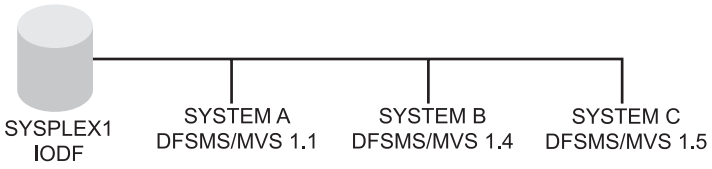


Figure 2. Sysplex with Three Systems Sharing a Single IODF

Let's assume that you will attach a single ESS to Systems A, B, and C. The sections below present sample environments in which you can use ESS on all three systems.

Sysplex with the Exploitation and Toleration Support

Figure 3 on page 10 shows that you want to use the ESS exploitation functions on Systems B and C, with all three systems sharing a single IODF. For that purpose, you need to install toleration support on System A and exploitation support on Systems B and C.

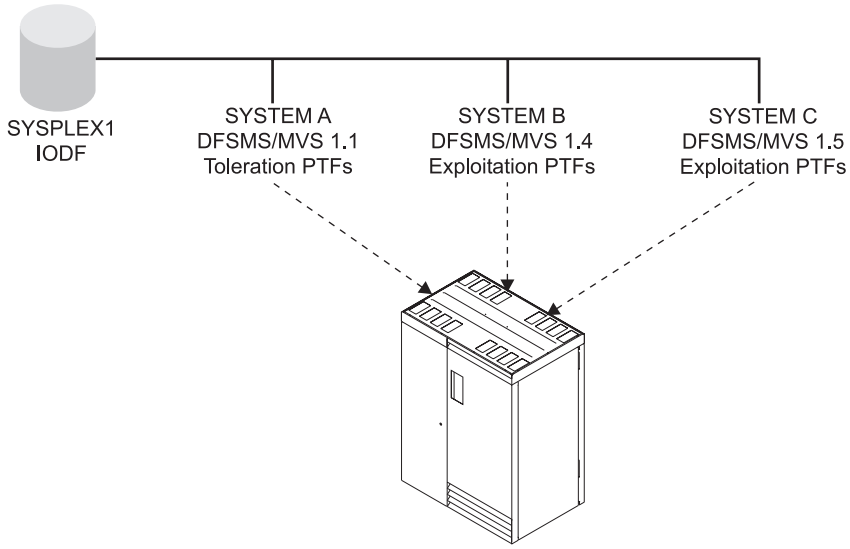


Figure 3. Sysplex with Toleration and Exploitation Support

Sysplex with the Exploitation Support

Let's say that you want to exploit ESS functions on all three systems sharing a single IODF. For that purpose, you must first upgrade System A to DFSMS/MVS 1.3 or higher.

Figure 4 indicates that you upgrade System A to DFSMS/MVS 1.3. After this upgrade, you can install the exploitation support on Systems A, B, and C. Now you can exploit ESS functions on all three systems.

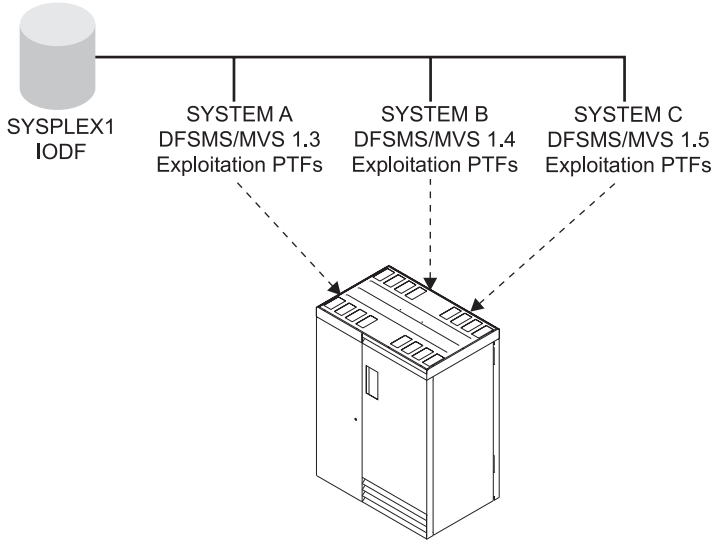


Figure 4. Sysplex with Exploitation Support

Sysplex with Exploitation and Transparency Support

Figure 5 indicates that you want to fully exploit ESS functions *only* on Systems B and C, while using ESS as a standard 3990 Model 3 or 6 on System A. To accomplish this purpose, you need to install transparency support on System A and exploitation support on Systems B and C. You also need to create an IODF for System A and another for Systems B and C.

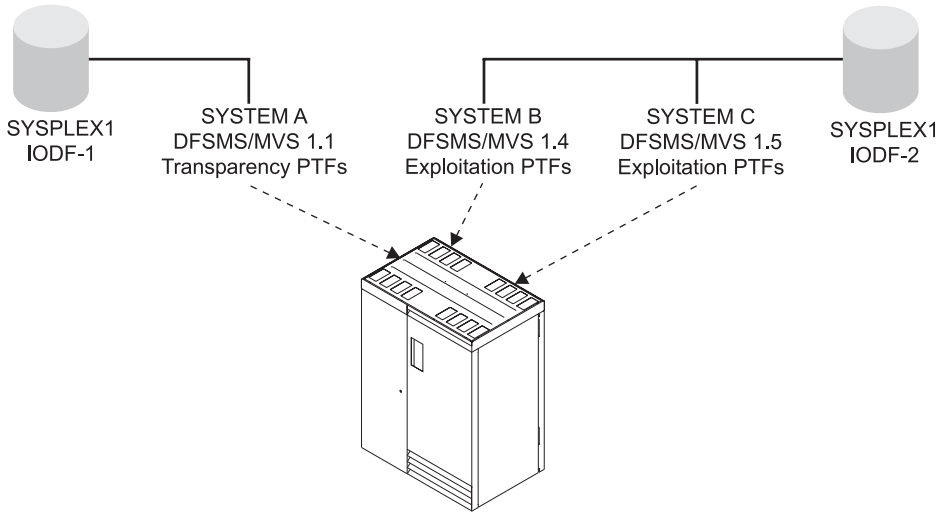


Figure 5. Sysplex with Transparency and Exploitation Support

Installing and Configuring the ESS

Your IBM service support representative will install the ESS hardware for you.

You can now configure the ESS. To successfully configure the ESS, you need to:

- Group and assign disk drive modules (DDMs) to redundant-array-of-independent-disk (RAID) arrays.
- Define logical storage subsystems (LSS).
- Define logical volumes and associated capacities within each LSS and emulation type (3390 or 3380).
- Define PAVs or non-PAVs for each logical volume.

You can display the logical configuration you just defined with the DEVSERV QDASD option.

See *IBM Enterprise Storage Server User's Guide* for a detailed description of how to configure your ESS and *OS/390 MVS System Commands* for additional information about the DEVSERV command.

Removing Unsupported UIMs from the HCD

The DFSMS/MVS exploitation releases do not support the UIMs for the device types in Table 4.

Table 4. Unsupported UIMs in DFSMS/MVS Exploitation Releases

UIM	Device Types	Support Status
CBDUS001	3350, 3340, 3330	The module and associated device types are deleted.
CBDUS002	9345, 3995-151, 3995-153, 3390, 3390A, 3390B, 3380, 3380A, 3380B, 3375	3375 is deleted from this UIM.
CBDUS003	2305-2	The module and the associated device type are deleted.
CBDUS013	3350P, 3351P	The module and associated device types are deleted.

You must delete the device records using CBDUS001, CBDUS003, CBDUS013 and modify those using CBDUS002 in the HCD. For example, if you use CBDUS002 for virtual input/output (VIO), you must modify the VIO definition in the IODF.

Defining the ESS to MVS

Now you need to define the ESS to your MVS system. That is, you need to modify your MVS IODF to match your ESS logical configuration.

To accomplish this task, use the HCD to:

- Define control units and associated unit addresses.
- Define logical volumes and associated device numbers.
- Specify PAVs or non-PAVs for device numbers.

The HCD uses new ESS device types to designate a multiple exposure device. See *IBM Enterprise Storage Server Introduction and Planning Guide* and *OS/390 HCD User's Guide* for more information about defining the ESS to MVS and using the HCD.

Activating the new IODF

Before you initialize your ESS volumes, you must activate the updated IODF. To activate the IODF, initiate an MVS initial program load (IPL) or issue a dynamic I/O command.

See *OS/390 HCD Planning* for a detailed description about how to dynamically activate a configuration.

After you activate the new IODF, you will receive new exposure-specific information in response to the DISPLAY M=DEV(*cuuu*), DISPLAY M=CONFIG(*xx*), and DISPLAY M=CHP(*xx*) commands. You need to understand this information and, if necessary, act accordingly.

See *OS/390 MVS System Commands* for a detailed description of the DISPLAY command.

Initializing ESS Volumes

You can now initialize ESS volumes with the INIT function of ICKDSF.

See APAR PQ26800 in RETAIN for detailed information on ICKDSF support for the ESS.

Migrating your Data

You can migrate your data to ESS volumes according to your storage needs. You can manage your data movement in any of the following ways:

SMS constructs
for temporary work space and new allocations. See *DFSMS/MVS DFSMSdfp Storage Administration Reference* for details.

XRC service
for non-disruptive data movement to ESS volumes. See *IBM Enterprise Storage Server Copy Services* for details.

RAMAC data migrator
for data migration with minimum application disruption. Check the following website for detailed information about the RAMAC data migrator:

`http://ssdweb01.storage.ibm.com/hardsoft/diskdrls/services/migspec.htm`

DFSMSdss
for high speed, batch-oriented data movement. See *DFSMS/MVS DFSMSdss Storage Administration Guide* and *DFSMS/MVS DFSMSdss Storage Administration Reference* for details.

Chapter 4. Parallel Access Volumes

This chapter describes parallel access volumes (PAVs), an advanced ESS capability. First, it defines static and dynamic PAVs. Then, it shows you how to configure and verify PAVs to your MVS system. In doing so, it also documents the updates to DFSMS/MVS device support to make the ESS PAV capability possible.

Understanding Static and Dynamic PAVs

As pointed out in “Chapter 1. Introduction” on page 1 and “Chapter 2. ESS Concepts” on page 5, PAVs allow your system to access volumes in parallel. That is, your system can access a single volume from a single host with multiple concurrent requests. This PAV capability represents a significant performance improvement by the ESS over traditional I/O processing.

You must configure your ESS and MVS system to use PAVs. You can use the logical configuration definition to define PAV-bases, PAV-aliases, and their relationship in the ESS hardware. This unit address relationship creates a single logical volume, allowing concurrent I/O operations.

Use the HCD to define the device number types in your MVS system. In addition, you can specify in the HCD whether PAV-bases and PAV-aliases should be associated statically or dynamically, resulting in static or dynamic PAVs.

Static PAVs are PAVs in which the association between a PAV-base address and its PAV-aliases is pre-defined and fixed. That is, the PAV-aliases of a PAV-base address remain unchanged.

Dynamic PAVs, on the other hand, are PAVs in which the association between a PAV-base address and its PAV-aliases is dynamic. This means that you can configure MVS to associate a base address with different aliases in ″real time.″ Dynamic PAVs are only available on DFSMS/MVS 1.5.0 and OS/390 2.7.

Make sure that the device number types (PAV-alias or PAV-base) match the unit address types as defined in the ESS hardware.

Defining PAVs

You must use the HCD to define PAVs to your MVS system. In order to use PAVs, you need to define the ESS control unit type as 2105 and the appropriate device types as listed in Table 5.

Table 5. Control Unit and Device Types for PAVs

Control Unit Type	**Device Type**	
	Base	Alias
2105	3380B	3380A
	3390B	3390A

For detailed information about how to define PAVs to your MVS system, see *OS/390 HCD User’s Guide*, *IBM Enterprise Storage Server User’s Guide*, and *IBM Enterprise Storage Server Introduction and Planning Guide*.

Configuring PAVs

You must also use the HCD to configure a PAV-base address and its PAV-aliases. Be aware that PAV-aliases are not visible to application programs, and they cannot be varied online.

DFSMS/MVS device support UIMs are changed to support ESS dynamic PAVs. You can now use WLMPAV = YES | NO to configure dynamic PAVs.

The WLM default is WLMPAV = YES. But you can disable dynamic PAVs by specifying WLMPAV = NO in your MVS HCD.

See *OS/390 HCD User's Guide* for a detailed description on how to configure PAVs with HCD.

Verifying PAVs

You can verify your PAV configuration with the following MVS system commands:

- DISPLAY M=DEV
- DISPLAY M=CHP
- DEVSERV QPAVS
- DEVSERV PATHS
- DEVSERV QDASD.

DISPLAY M=DEV

The DISPLAY M is an MVS system command used to display the status of channel paths and devices or to compare the current configuration of the hardware to that in a CONFIGxx member of SYS1.PARMLIB.

You can use the DISPLAY M=DEV(*cuuu*) command, where the *cuuu* represents a 4-hex-digit device number, to display:

- The number of online channel paths to devices
- The number of usable PAV-alias addresses
- The number of PAV-alias addresses defined for a PAV-base address.

Figure 6 provides an example of the DISPLAY M=DEV command. The example shows the status, channel paths, and the number of the PAV-base address and the defined aliases for the device D205.

```
IEE174I  20.57.05  DISPLAY M 848
DEVICE  D205     STATUS=ONLINE
CHP                       0E  0F
PATH ONLINE               Y   Y
CHP PHYSICALLY ONLINE     Y   Y
PATH OPERATIONAL          Y   Y
PAV BASE AND ALIASES      8
```

Figure 6. D M=DEV (D205) Output

Figure 7 shows the status of the device at D2FF, an alias of D205 shown in Figure 6 on page 16.

```
IEE174I  21.02.20  DISPLAY M 504
DEVICE  D2FF     STATUS=ALIAS OF BASE D205
```

Figure 7. D M=DEV (D2FF) Output

Please note that alias unit control blocks (UCBs) are invisible to the DISPLAY M=DEV command.

See *OS/390 MVS System Commands* for further information on the DISPLAY M=DEV command.

DISPLAY M=CHP

You can use the DISPLAY M=CHP(*xx*) command, where *xx* is the channel path number, to display the online and offline status of channel paths. Figure 8 shows the status of all devices on the channel path 0E.

```
IEE174I 15.25.57 DISPLAY M 625
CHPID 0E: TYPE=05, DESC=ESCON SWITCHED POINT TO POINT
DEVICE STATUS FOR CHANNEL PATH 0E
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
D20 +@ +@ +@ +@ +@ +  +  +  +@ +@ +@ +@ +@ +@ +@ +@
D21 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D22 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D23 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D24 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D25 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D26 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D27 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D28 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D29 +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D2A +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D2B +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D2C +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@ +@
D2D +@ +@ +@ +@ +@ +@ UL UL UL UL UL UL UL UL UL UL
D2E UL UL UL UL UL UL UL UL UL UL UL UL UL UL UL UL
D2F UL UL UL UL UL UL UL UL UL AL AL AL AL AL AL AL
************************ SYMBOL EXPLANATIONS ****************
+ ONLINE   @ PATH NOT VALIDATED   - OFFLINE  . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
BX DEVICE IS BOXED           SN SUBCHANNEL NOT AVAILABLE
DN DEVICE NOT AVAILABLE      PE SUBCHANNEL IN PERMANENT ERROR
AL DEVICE IS AN ALIAS        UL DEVICE IS AN UNBOUND ALIAS
```

Figure 8. D M=CHP(0E) Output

See *OS/390 MVS System Commands* for additional information on the DISPLAY M=CHP command.

DEVSERV QPAVS

DEVSERV is an MVS system command used to request basic status information on a device, a group of devices, or storage control units. QPAVS is the new DEVSERV parameter in support of the ESS PAV capability.

You can use the DEVSERV QPAVS command to:

- Describe how a logical subsystem configuration is defined to MVS.
- Highlight the inconsistencies, if any, between the IODF and the LSS configuration.
- Display unbound alias device types with the UCB parameter and, if necessary, ″unbox″ a boxed alias device with the UNBOX parameter.
- Show information on both a PAV-base address and its PAV-aliases by specifying the VOLUME parameter.
- Display information on devices.

Based on your service needs, you can issue the DEVSERV QPAVS command in the following forms:

- DEVSERV QPAVS,*dddd,nn*
- DEVSERV QPAVS,*dddd,tttt*
- DEVSERV QPAVS, SSID=*ssss*

In these forms,

- QPAVS is a required positional keyword.
- *dddd* is a 3 or 4-hex-digit device number.
- *nn* is a decimal number from 1–256 with 1 as the default.
- *tttt* can be UCB, VOLUME, or UNBOX.
- *ssss* is the specified SSID value.

See *OS/390 MVS System Commands* for additional information on the DEVSERV command.

Figure 9 on page 19 shows the display content when you issue the DEVSERV QPAVS command with parameters other than UCB. When you specify the UCB parameter, you will receive additional UCB information. This additional information will be formatted the same way as the output resulting from the existing QDASD parameter.

```
-------------------------------------------------------
---          DS QP  Display Content               ---
-------------------------------------------------------
IEE459I  (time)   DEVSERV QPAVS
    Host                              Subsystem
Configuration                        Configuration
-------------                     --------------------
UNIT                                    UNIT    UA
NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
---- --  ----        ------     ----  ----    --------
dddd aa  BASE        INV-ALIAS  nnnn   uu     BASE
         ALIAS-bbbb  NOT-BASE                ALIAS-bb
         NON-PAV     NOT-ALIAS               NC
                     NOT-NPAV

UNLISTED DEVICES AND REASON CODES X
   nnnn(rc) nnnn(rc) nnnn(rc) ...
```

Figure 9. DEVSERV QPAVS Display Content

X Below are the reason codes for unlisted devices:

```
(01) - DEVICE NOT CONFIGURED, UCB NOT FOUND
(02) - UCB NOT CONNECTED
(03) - DEVICE UNAVAILABLE, SCP ROUTINE IN CONTROL
(04) - SUBCHANNEL ERROR
(05) - DEVICE BOXED
(06) - UCB NOT A DASD
(07) - DEVICE I/O ERROR
(08) - DEVICE IS NOT A DASD
(09) - DSE-1 CCW BUILD FAILED
(0A) - DEVICE IS AN UNBOUND PAV-ALIAS
```

DEVSERV QPAVS Sample Output

The following are examples of DEVSERV QPAVS output.

Figure 10 shows the PAV status for the device at the starting address D123 and the next 2 addresses.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
    Host                              Subsystem
Configuration                        Configuration
-------------                     --------------------
UNIT                                    UNIT    UA
NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
---- --  ----        ------     ----  ----   -------
D123 23  NON-PAV                0101   23     BASE
D124 24  NON-PAV                0101   24     BASE
D125 25  NON-PAV                0101   25     BASE
****     3 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 10. DS QP,D123,3 Output

Figure 11 shows the PAV status for the alias device at the address D2FF, its base, and other associated alias devices of the logical volume.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
    Host                            Subsystem
Configuration                      Configuration
-------------                    --------------------
UNIT                                   UNIT    UA
NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
---- --  ----        ------     ----  ----    --------
D222 22  BASE                   0102   22     BASE
D2FE FE  ALIAS-D222            0102   FE     ALIAS-22
D2FF FF  ALIAS-D222            0102   FF     ALIAS-22
****     3 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 11. DS QP,D2FF,VOLUME Output

Figure 12 shows the PAV status for the base device at the address D222 and its alias volumes.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
    Host                            Subsystem
Configuration                      Configuration
-------------                    --------------------
UNIT                                   UNIT    UA
NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
---- --  ----        ------     ----  ----    --------
D222 22  BASE                   0102   22     BASE
D2FE FE  ALIAS-D222            0102   FE     ALIAS-22
D2FF FF  ALIAS-D222            0102   FF     ALIAS-22
****     3 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 12. DS QP,D222,VOLUME Output

Figure 13 shows that you can ″unbox″ a boxed alias device at the address D6FF.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
 THE DEVSERV QPAV UNBOX COMMAND HAS BEEN EXECUTED SUCCESSFULLY 1
```

```
IEE459I 08.20.32 DEVSERV QPAVS 591
 THE DEVSERV QPAV UNBOX COMMAND HAS BEEN EXECUTED WITH
   RETURN CODE = xx, REASON CODE = yy 2
```

```
IEE459I 10.04.23 DEVSERV QPAVS 699
 D6FF  IS NOT AN UNBOUND PAV-ALIAS DEVICE. 3
   THE DEVSERV QPAV UNBOX COMMAND IS NOT EXECUTED
```

Figure 13. DS QP,D6FF,UNBOX Output

1 You will receive this message if the return code from DEVSERV QPAVS UNBOX is zero.

2 You will receive this message if the return code from DEVSERV QPAVS UNBOX is nonzero.

3 You may also receive this message with the explanation: ″nnnn-IS NOT IN BOX STATE.″

Figure 14 shows the PAV status for an unbound alias device type.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
     Host                              Subsystem
 Configuration                        Configuration
 -------------                     --------------------
 UNIT                                    UNIT    UA
 NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
 ---- --  ----        ------     ----  ----    ---------
   UCB AT V01ED2AA8
 0088FF04D5EF0000 0000000008E4C3C2 3010200E00ED2A81 0000000000000000
 0000000000100000 0000000000000000 0000000000000000
   UCB PREFIX AT V01FF4208
 000C804000000000 000000000001004E 289C1253C00080C0 14F4FFFFFFFFFFF
 0148000000000001
   UCB COMMON EXTENSION AT V01ED2A80
 00000900182A0000 01FF420800000000 0000000000FCD3D8 01ECA90000000000
**** UNLISTED DEVICE(S) AND REASON CODES:
  D5EF(0A)
**** (0A) - DEVICE IS AN UNBOUND PAV-ALIAS
```

Figure 14. DS QP,D5EF,UCB Output

Figure 15 shows the PAV status of the devices that have the same SSID value.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
     Host                              Subsystem
 Configuration                        Configuration
 -------------                     --------------------
 UNIT                                    UNIT    UA
 NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
 ---- --  ----        ------     ----  ----    ---------
 D400 00  NON-PAV                1401   00     BASE
 ....
 D422 22  BASE                   1401   22     BASE
 ....
 D4FF FF  ALIAS-D422             1401   FF     ALIAS-22
****    256 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 15. DS QP,SSID=1401 Output

Figure 16 on page 22 shows the status of NOT-BASE when the address D345 is defined as a PAV-base in the HCD, but not in the ESS logical subsystem.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
     Host                            Subsystem
 Configuration                      Configuration
 -------------                    --------------------
 UNIT                                   UNIT    UA
 NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
 ---- --  ----        ------     ----  ----    --------
 D345 45  BASE        NOT-BASE   0103   45     ALIAS-00
****      1 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 16. DS QP,D345 Output

Figure 17 shows the status of NOT-ALIAS when the address D621 is defined as a PAV-alias in the HCD, but not in the ESS logical subsystem.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
     Host                            Subsystem
 Configuration                      Configuration
 -------------                    --------------------
 UNIT                                   UNIT    UA
 NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
 ---- --  ----        ------     ----  ----   ---------
 D621 21  ALIAS-D600  NOT-ALIAS  0106   21     BASE
****      1 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 17. DS QP,D621 Output

Figure 18 shows the status of INV-ALIAS when the alias address D6F4 for the base volume in the HCD does not match its base address in the ESS logical subsystem.

```
IEE459I 08.20.32 DEVSERV QPAVS 591
     Host                            Subsystem
 Configuration                      Configuration
 -------------                    --------------------
 UNIT                                   UNIT    UA
 NUM. UA  TYPE        STATUS     SSID  ADDR.   TYPE
 ---- --  ----        ------     ----  ----    --------
 D6F4 F4  ALIAS-D600  INV-ALIAS  0106   F4     ALIAS-06
****      1 DEVICE(S) MET THE SELECTION CRITERIA
```

Figure 18. DS QP,D6F4 Output

Figure 19 on page 23 shows the status of NOT-NPAV for the device at the address F60. The device is defined as a NON-PAV device in the HCD, but is given an alias in the ESS logical subsystem.

```
IEE459I 13.20.12 DEVSERV QPAVS 368
     Host                              Subsystem
 Configuration                        Configuration
 -------------                    --------------------
 UNIT                                   UNIT    UA
 NUM. UA  TYPE        STATUS       SSID  ADDR.   TYPE
 ---- --  ------      ------       ----  ----    --------
 0F60 F0  NON-PAV     NOT-NPAV     0101   F0     ALIAS-03
```

Figure 19. DS QP,F60 Output

DEVSERV PATHS

You can issue the DEVSERV PATHS command to display the status of channel paths, the channel path IDs, the logical mode of devices, the number of data sets allocated on volumes, and the volume serial labels. The displayed information can help you solve hardware or configuration problems.

Figure 20 shows the output of the DS P,D300 command.

```
IEE459I 15.08.52 DEVSERV PATHS 179
UNIT DTYPE  M CNT VOLSER  CHPID=PATH STATUS
     RTYPE   SSID CFW TC   DFW   PIN  DC-STATE CCA  DDC   ALT  CU-TYPE
D300,33902  ,O,000,SRK300,0E=+ 0F=+
     933201  8104  Y  YY.  YY.    N   SIMPLEX   00   00        2105
```

Figure 20. DS P,D300 Output

DEVSERV QDASD

You can use the DEVSERV QDASD command to display diagnostic information about the status of direct access storage devices and storage control units. You can also use it to validate MVS storage resident control blocks for extended function status with the data acquired directly from the storage subsystem.

Figure 21 shows the output of the DS QD,D200,RDC command when the ESS is running in exploitation mode.

```
IEE459I 15.10.04 DEVSERV QDASD 183
UNIT VOLSER SCUTYPE DEVTYPE   CYL  SSID SCU-SERIAL DEV-SERIAL EF-CHK
D200 SRK200 2105E20 9332B01 10017  8103 0113-FCA81 0113-FCA81 **OK**
  READ DEVICE CHARACTERISTIC
2105E833900C5E80 FFF720322721000F E000E5A205940222 1309067400000000
0000000000000000 32321B02DFEE0001 06770803007F4200 0035000000000000
```

Figure 21. DS QD,D200,RDC Output: ESS in Exploitation Mode

Figure 22 shows the output of the DS QD,1F40,RDC command when the ESS is running in toleration or transparency mode.

```
IEE459I 15.24.46 DEVSERV QDASD 969
UNIT VOLSER SCUTYPE DEVTYPE   CYL  SSID SCU-SERIAL DEV-SERIAL EF-CHK
1F40 SRK200 2105E20 9332B01 10017  8103 0113-FCA81 0113-FCA81 **OK**
  READ DEVICE CHARACTERISTIC
3990E933900C5800 F1F720322721000F E000E5A205940222 1309067400000000
0000000000000000 32321502DFEE0001 06770803007F4200 1B35000000000000
****      1 DEVICE(S) MET THE SELECTION CRITERIA
****      0 DEVICE(S) FAILED EXTENDED FUNCTION CHECKING
```

Figure 22. DS QD,1F40,RDC Output: ESS in Toleration or Transparency Mode

Chapter 5. ESS Copy Services

This chapter introduces the following copy services provided by the ESS:
- FlashCopy service
- XRC suspend/resume service for unplanned outages
- Enhanced PPRC service.

In support of these ESS services, changes are made to DFSMSdss and the DFSMSdfp system data mover. This chapter documents these changes as appropriate.

See *IBM Enterprise Storage Server Copy Services* for a detailed description of the copy services.

FlashCopy Service

The FlashCopy service provides the appearance of instantaneous replication of a range of track images. This service requires both the source and target volumes to reside in a single logical subsystem.

You can use the FlashCopy service to create copies for:
- Disaster recovery
- Business intelligence applications
- Data in a test environment
- Instantaneous checkpoints.

As pointed out in “Chapter 3. Migration and Coexistence” on page 7, the FlashCopy service is available only on DFSMS/MVS exploitation releases.

The ESS FlashCopy service is compatible with the existing RAMAC Virtual Array (RVA) SnapShot capability provided by DFSMSdss. Therefore, you can invoke the FlashCopy service on the ESS with DFSMSdss.

Specifically, you can only use the COPY FULL command to request the ESS FlashCopy service. Figure 23 shows that you can use the COPY FULL command to copy the volume CP11S1 to the volume TP11S1.

```
//COPYFULL JOB ,'YESYOU',MSGLEVEL=(1,1),TIME=(5,0),REGION=4096K,
//      MSGCLASS=A,CLASS=A
//*
//STEPT44 EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=V,OUTLIM=3000
//SYSIN    DD *
  COPY FULL -
     INDYNAM ((CP11S1)) OUTDYNAM ((TP11S1)) -
     COPYVOLID
/*
```

Figure 23. COPY FULL with the COPYVOLID Option

After you issue the COPY FULL command, DFSMSdss will check to see if the following conditions are met:

- The source and target volumes support the FlashCopy service.
- The source and target volumes reside on the same LSS.
- The source and target volumes must be online.
- The source and target volumes are the same device type.
- The target volume is not an XRC primary volume.
- The target volume is not a PPRC primary or secondary volume.
- The target volume is not the source of an in-progress, concurrent copy operation.

If the above conditions are met, DFSMSdss will perform the FlashCopy service as requested. If these conditions are not met, but the CC keyword is specified, DFSMSdss will provide the standard concurrent copy service. If these conditions are not met and the CC keyword is not specified, DFSMSdss will use the standard I/O service to copy the volume.

See *DFSMS/MVS DFSMSdss Storage Administration Guide* and *DFSMS/MVS DFSMSdss Storage Administration Reference* for further information about DFSMSdss and its volume copy services.

XRC Suspend/Resume Service for Unplanned Outages

The extended remote copy (XRC) service is a DFSMSdfp function that automatically sends copies of updated data to a remote recovery system with almost no impact to application system operations. DFSMS system data mover, a DFSMSdfp component, provides support for XRC.

You can implement XRC with one or two systems. Let's suppose that you have two systems: an application system at one location and a recovery system at another. With these two systems in place, XRC can automatically update your data on the remote disk storage subsystem as you make changes to it on your application system.

You can use the XRC suspend/resume service for planned outages. You can still use this standard XRC service on systems attached to the ESS if these systems are installed with the toleration or transparency support.

The introduction of the ESS enhances this XRC capability. Now you can use the XRC suspend/resume service to accommodate unplanned outages. With the enhanced XRC suspend/resume service, you do not have to terminate your current XRC sessions during an unplanned outage. Instead, you just ″suspend″ your existing XRC sessions and ″re-start″ them. You can use this ESS copy service on systems with the exploitation support.

The following DFSMSdfp commands are enhanced or added to support the XRC suspend/resume service for unplanned outages:

- XADD
- XQUERY
- XSET.

See *DFSMS/MVS Remote Copy Administrator's Guide and Reference* and *DFSMS/MVS Advanced Copy Services* for additional information about the XADD, XQUERY, and XSET commands.

XADD

The XADD, or XADDPAIR, TSO command specifies the source and target volumes of an XRC volume pair you want to add to an XRC session. You can add up to 50 volume pairs with each XADD command.

The XADD command now includes a new SUSPENDED keyword to support the ESS. You can use the XADD (*session_id*) SUSPENDED command to restore the volumes to the state prior to the suspension.

XQUERY

You can use the XQUERY command to request status information on an active XRC session. In response to your specific request, the XQUERY command generates one of the following reports:

- The session statistics report
- The VOLUME report on volume pair statistics
- The SET report on session default settings
- The CONFIGURATION report on the volume-level status
- The STORAGECONTROL report on XRC-related storage control statistics.

The STORAGECONTROL report now includes information on a storage controller session in a suspended state and the resynchronization percentage for a volume.

XSET

The XSET command provides the capability to dynamically change data mover execution characteristics. It now includes the new RFREQUENCY and RTRACKS keywords.

You can use the RFREQUENCY(*hh.mm.ss*) keyword to specify the frequency used by the DFSMSdfp system data mover to reset the recovery bitmaps. The frequency is specified in hours (*hh*), minutes (*mm*), and seconds (*ss*). The system default is 00.30.00, with 18.00.00 as the maximum value.

You can use the RTRACKS(*nnnnn*) keyword to specify the number of tracks that change before the DFSMSdfp system data mover resets the recovery bitmaps. The number (*nnnnn*) is specified from 1 to full volume, with 7500 tracks as the default.

Peer-to-Peer Remote Copy Service

The peer-to-peer remote copy (PPRC) service is a hardware-based remote copy service that provides a synchronous volume copy across 3990 Model 6 storage subsystems. It is used for disaster recovery, device migration, and workload migration. For example, PPRC enables you to switch to a recovery system in the event of a disaster to an application system.

You can issue the CQUERY command to query the status of one volume of a PPRC volume pair or to collect information about a volume in the simplex state. The CQUERY command is modified and enabled to report on the status of S/390 attached CKD devices.

See *IBM Enterprise Storage Service Copy Services* and *DFSMS/MVS Remote Copy Administrator's Guide and Reference* for further information on the PPRC service and the CQUERY command.

Chapter 6. Logical Subsystem Resource Usage

LISTDATA and SETCACHE are the AMS commands used to display the usage of logical subsystem resources and to control caching functions of IBM storage controllers. Both commands are changed to support ESS exploitation functions. This chapter discusses these changes.

The LISTDATA command now generates a new RAID Rank Counters report and a modified Subsystem Counters report. The SETCACHE command, on the other hand, is updated to produce messages indicating that the ESS does not support the 3990 dual-copy function or the disabling of cache/DFW.

IDCAMS LISTDATA

The IDCAMS LISTDATA command generates reports on the activity within all IBM caching models of the 3880 Storage Control, the 3990 Storage Control with cache, and the RAMAC Array Subsystem.

You can now use the IDCAMS LISTDATA command to request activity information on the ESS. You will receive a modified Subsystem Counters report and a new RAID Rank Counters report when you issue the LISTDATA COUNTS SUBSYSTEM or LISTDATA COUNTS ALL command.

See *DFSMS/MVS Access Method Services for ICF* for additional information on the IDCAMS LISTDATA command.

IDCAMS Subsystem Counters Report

The Subsystem Counters report now includes the RAID rank ID of a logical volume. This identifier is required for a cross reference to the new RAID Rank Counters report.

Figure 24 on page 30 and Figure 25 on page 31 present a sample Subsystem Counters report that includes this identifier.

```
                      2105 STORAGE CONTROL
                    SUBSYSTEM COUNTERS REPORT
                  VOLUME SRK207  DEVICE ID X'07'
                       SUBSYSTEM ID X'8103'
                                  CHANNEL OPERATIONS
                 ......SEARCH/READ.....  ..............WRITE.............
                       TOTAL  CACHE READ       TOTAL      DASDFW CACHE WRITE
REQUESTS
  NORMAL                 39          38         118          82          82
  SEQUENTIAL          20258       20258         394          12          12
  CACHE FAST WRITE        0           0           0         N/A           0
TOTALS                20297       20296         512          94          94
REQUESTS                 CHANNEL OPERATIONS
  INHIBIT CACHE LOADING                    0
  BYPASS CACHE                             0
TRANSFER OPERATIONS              DASD/CACHE   CACHE/DASD
  NORMAL                               4506         5600
  SEQUENTIAL                             54          N/A
DASD FAST WRITE RETRIES                   0
DEVICE STATUS     CACHING:         ACTIVE
                  DASD FAST WRITE: ACTIVE
                  DUPLEX PAIR:     NOT ESTABLISHED
RAID RANK ID X'0201'
IDCAMS  SYSTEM SERVICES                                        TIME: 16:04:33
                              LEGEND
                SUBSYSTEM COUNTERS LEGEND
VOLUME             - VOLUME SERIAL NUMBER FOR WHICH THE DATA IS GATHERED
DEVICE ID          - CHANNEL CONNECTION ADDRESS OF THE DEVICE ON WHICH
                     THE I/O WAS DONE
SUBSYSTEM ID       - SUBSYSTEM TO WHICH THE DEVICE IS ATTACHED
CHANNEL OPERATIONS - A CHANNEL PROGRAM OR PART OF A CHANNEL PROGRAM BEGINNING
                     WITH A LOCATE RECORD OR SEEK COMMAND AND ENDING AT THE
                     NEXT LOCATE RECORD OR SEEK COMMAND OR AT THE END OF THE
                     CHANNEL PROGRAM
    SEARCH/READ    - OPERATIONS CONTAINING AT LEAST ONE SEARCH OR READ
                     COMMAND BUT NO WRITE COMMANDS
      TOTAL        - ALL SEARCH/READ OPERATIONS
      CACHE READ   - ALL SEARCH/READ OPERATIONS WHICH DID NOT REQUIRE DATA
                     MOVEMENT TO OR FROM DASD
    WRITE          - OPERATIONS CONTAINING AT LEAST ONE WRITE COMMAND
      TOTAL - ALL WRITE OPERATIONS
      DASDFW       - WRITE OPERATIONS WHICH ARE ADDRESSED TO A DEVICE IN DASD
                     FAST WRITE MODE AND WHICH DO NOT CONTAIN A DEFINE EXTENT
                     COMMAND OR WHICH DO NOT INHIBIT DASD FAST WRITE IN A
                     DEFINE EXTEND COMMAND
      CACHE WRITE  - ALL CACHE FAST WRITE OR DASD FAST WRITE OPERATIONS
                     WHICH DID NOT REQUIRE CONCURRENT DATA MOVEMENT TO OR
                     FROM DASD
  NORMAL           - OPERATIONS WHICH DO NOT CONTAIN A DEFINE EXTENT COMMAND
                     OR SPECIFY NORMAL CACHE REPLACEMENT IN THE DEFINE EXTENT
                     COMMAND BUT NOT THE CACHE FAST WRITE ATTRIBUTE
  SEQUENTIAL       - OPERATIONS WHICH SPECIFY SEQUENTIAL ACCESS IN THE DEFINE
                     EXTENT COMMAND BUT NOT THE CACHE FAST WRITE ATTRIBUTE
  CACHE FAST WRITE - OPERATIONS WHICH SPECIFY THE CACHE FAST WRITE ATTRIBUTE
                     IN THE DEFINE EXTENT COMMAND BUT NOT THE BYPASS CACHE OR
                     INHIBIT CACHE LOADING ATTRIBUTES
```

Figure 24. IDCAMS Subsystem Counters Report (Part 1)

```
TOTALS             - TOTAL FOR EACH VERTICAL LINE ITEM
INHIBIT CACHE LOADING - OPERATIONS WHICH SPECIFY THE INHIBIT CACHE LOADING
                      ATTRIBUTE IN THE DEFINE EXTENT COMMAND AND CONTAIN AT
                      LEAST ONE SEARCH, READ OR WRITE COMMAND
BYPASS CACHE       - OPERATIONS WHICH SPECIFY THE BYPASS CACHE ATTRIBUTE IN
                     THE DEFINE EXTENT COMMAND AND CONTAIN AT LEAST ONE
                     SEARCH, READ OR WRITE COMMAND
TRANSFER OPERATIONS - THE NUMBER OF TRACKS TRANSFERRED TO OR FROM DASD
  DASD/CACHE       - THE NUMBER OF TRACKS TRANSFERRED FROM THE DASD TO THE
                      CACHE
IDCAMS  SYSTEM SERVICES                                    TIME: 16:04:33
                                  LEGEND
                    SUBSYSTEM COUNTERS LEGEND
  CACHE/DASD       - THE NUMBER OF TRACKS TRANSFERRED FROM THE CACHE TO THE
                      DASD
    NORMAL         - DATA MOVEMENT OPERATIONS EXCLUDING SEQUENTIAL
    SEQUENTIAL     - 'NEXT TRACK' DATA MOVEMENT OPERATIONS IN SEQUENTIAL
                      ACCESS MODE
DASD FAST WRITE RETRIES - NUMBER OF RETRIES REQUIRED BEFORE SPACE WAS
                      AVAILABLE IN THE NVS FOR DASD FAST WRITE DATA
DEVICE STATUS      - STATUS OF THE ADDRESSED DEVICE FOR THE FOLLOWING
   CACHING         - THE DEVICE CACHING STATE, ONE OF THE FOLLOWING
      ACTIVE       - CACHING ACTIVATED
      DEACTIVATION PENDING - TRANSFER OF MODIFIED DATA TO DASD FAILED
      DEACTIVATED  - CACHING DEACTIVATED
   DASD FAST WRITE - THE STATE OF THE FAST WRITE DATA WHICH WILL BE
                      STORED ON DASD, IS ONE OF THE FOLLOWING
      ACTIVE       - DASD FAST WRITE IS ALLOWED
      DEACTIVATION PENDING - TRANSFER OF MODIFIED DATA TO DASD FAILED
      DEACTIVATED  - DASD FAST WRITE IS DISABLED
   DUPLEX PAIR     - THE SIMPLEX/DUPLEX STATUS OF THE DEVICE WITH THE
                      STATE OF THE PAIR WHEN DUPLEX
      NOT ESTABLISHED - DEVICE IS SIMPLEX
      PRIMARY      - DEVICE IS THE PRIMARY OF A DUPLEX PAIR
      SECONDARY    - DEVICE IS THE SECONDARY OF A DUPLEX PAIR
        ACTIVE     - DUPLEX PAIR AVAILABLE
        PENDING    - COPY TO ESTABLISH A DUPLEX PAIR IN PROGRESS
        SUSPENDED  - SUSPENDED DUPLEX BY HOST COMMAND OR BY SUBSYSTEM
    ADDRESS OF PRIMARY|SECONDARY - CHANNEL CONNECTION ADDRESS OF THE
                      OTHER DEVICE IN THE DUPLEX PAIR
   PINNED DATA EXISTS, FAST WRITE SUSPENDED
                    - ONE OR MORE TRACKS FOR THIS VOLUME ARE PINNED AND
                      BOTH CACHE FAST WRITE AND DASD FAST WRITE ARE
                      SUSPENDED FOR THIS VOLUME
   PINNED DATA, FAST WRITE NOT SUSPENDED
                    - ONE OR MORE TRACKS FOR THIS VOLUME ARE PINNED AND
                      BOTH CACHE FAST WRITE AND DASD FAST WRITE ARE
                      NOT SUSPENDED FOR THIS VOLUME
   DATA IN FAILED NVS - DATA FOR THIS DEVICE IS IN THE FAILED NONVOLATILE
                      STORAGE
****               - INDICATION OF AN INVALID OR UNDEFINED BIT
                      COMBINATION IN THE DEVICE STATUS BYTES
RAID RANK ID       - THE RAID RANK ID ASSOCIATED WITH THIS VOLUME
```

Figure 25. IDCAMS Subsystem Counters Report (Part 2)

IDCAMS RAID Rank Counters Report

The RAID Rank Counters report is produced to support the ESS. You can generate this report by issuing the LISTDATA COUNTS SUBSYSTEM or LISTDATA COUNTS ALL command. Produced after the Subsystem Counters report, the RAID Rank Counters report contains data on logical, not physical, volumes in the RAID rank.

Figure 26 shows a sample RAID Rank Counters report.

```
                        2105 STORAGE CONTROL
                      SUBSYSTEM COUNTERS REPORT
                         RAID RANK COUNTERS
                        SUBSYSTEM ID X'8103'
RAID RANK ID X'0201'
DEVICE ADAPTER ID X'03'
NUMBER OF HDDS IN RAID RANK        7
HDD SECTOR SIZE                  524
                                     RAID RANK OPERATIONS
REQUESTS                  I/O REQUESTS    RESP/TIME    SECTOR REQUESTS
  READ                           4531        0.004                  0
  WRITE                          1350        0.026                  0
IDCAMS  SYSTEM SERVICES                                      TIME: 16:04:33
                                  LEGEND
                 RAID RANK COUNTERS LEGEND
SUBSYSTEM ID       - SUBSYSTEM TO WHICH THE RAID RANK IS ATTACHED
NUMBER OF HDDS     - NUMBER OF HARD DISK DRIVES IN THE RAID RANK
HDD SECTOR SIZE    - SIZE IN BYTES OF A PHYSICAL HDD IO REQUEST
RANK OPERATIONS    - OPERATIONS ASSOCIATED WITH A RAID RANK
  I/O REQUESTS     - NUMBER OF I/O REQUESTS
  RESP/TIME        - AVERAGE RESPONSE IN (MS)
  SECTOR REQUESTS  - NUMBER OF PHYSICAL HDD IO REQUESTS
  READ             - OPERATIONS CONTAINING AT LEAST ONE SEARCH OR READ
                           COMMAND BUT NO WRITE COMMANDS
  WRITE            - OPERATIONS CONTAINING AT LEAST ONE WRITE COMMAND
```

Figure 26. IDCAMS RAID Rank Counters Report

IDCAMS SETCACHE

Traditionally, you use the IDCAMS SETCACHE command to allow or prohibit access to IBM caching models of 3880 and 3990 storage controllers. For example, you can use the SETCACHE command to set dual-copy and cache/DFW.

However, the ESS cache/DFW is on by default, and you are not allowed to modify it. In addition, the ESS does not support the dual-copy function. You will receive a message, with a condition code 12, indicating these changes if you issue any of the cache/DFW or dual-copy commands.

Figure 27 displays the message in response to the SETCACHE SETSECONDARY command.

```
   SETCACHE SETSECONDARY(D00E) FILE(FILEX)
IDC31562I THE SETSECONDARY PARAMETER IS NOT AVAILABLE FOR THE SPECIFIED
IDC31562I SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 27. SETCACHE SETSECONDARY Response Message

Figure 28 on page 33 contains the message in response to the SETCACHE SUSPENDPRIMARY command.

```
   SETCACHE SUSPENDPRIMARY     FILE(FILEX)
IDC31562I THE SUSPENDPRIMARY PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 28. SETCACHE SUSPENDPRIMARY Response Message

Figure 29 presents the message in response to the SETCACHE SUSPENDSECONDARY command.

```
   SETCACHE SUSPENDSECONDARY   FILE(FILEX)
IDC31562I THE SUSPENDSECONDARY PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 29. SETCACHE SUSPENDSECONDARY Response Message

Figure 30 includes the message in response to the SETCACHE RESETTODUPLEX command.

```
   SETCACHE RESETTODUPLEX      FILE(FILEX)
IDC31562I THE RESETTODUPLEX PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 30. SETCACHE RESETTODUPLEX Response Message

Figure 31 covers the message in response to the SETCACHE REESTABLISHDUPLEX command.

```
   SETCACHE REESTABLISHDUPLEX(D00E) FILE(FILEX)
IDC31562I THE REESTABLISHDUPLEX PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 31. SETCACHE REESTABLISHDUPLEX Response Message

Figure 32 on page 34 shows the message in response to the SETCACHE RESETTOSIMPLEX command.

```
  SETCACHE RESETTOSIMPLEX           FILE(FILEX)
IDC31562I THE RESETTOSIMPLEX PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 32. SETCACHE RESETTOSIMPLEX Response Message

Figure 33 contains the message in response to the SETCACHE DFW OFF command.

```
   SETCACHE DFW OFF FILE(FILEX)
IDC31562I THE DASDFASTWRITE PARAMETER IS NOT AVAILABLE FOR THE
IDC31562I SPECIFIED SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 33. SETCACHE DFW OFF Response Message

Figure 34 includes the message in response to the SETCACHE NVS OFF command.

```
   SETCACHE NVS OFF FILE(FILEX)
IDC31562I THE NVS PARAMETER IS NOT AVAILABLE FOR THE SPECIFIED
IDC31562I SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 34. SETCACHE NVS OFF Response Message

Figure 35 presents the message in response to the SETCACHE DEVICE OFF command.

```
  SETCACHE DEVICE OFF FILE(FILEX)
IDC31562I THE DEVICE PARAMETER IS NOT AVAILABLE FOR THE SPECIFIED
IDC31562I SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 35. SETCACHE DEVICE OFF Response Message

Figure 36 on page 35 displays the message in response to the SETCACHE SUBSYSTEM OFF command.

```
   SETCACHE SUBSYSTEM OFF FILE(FILEX)
IDC31562I THE SUBSYSTEM PARAMETER IS NOT AVAILABLE FOR THE SPECIFIED
IDC31562I SUBSYSTEM OR DEVICE
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Figure 36. SETCACHE SUBSYSTEM OFF Response Message

GTF Trace

Like the system trace service, the MVS generalized trace facility (GTF) gathers information to diagnose problems that occur during the system operation. But unlike the system trace server, GTF can be tailored to record specific system and user program events.

You can run the GTF trace against a PAV-base address to generate information about its aliases. This is because a GTF trace performed on a PAV-base address automatically produces information about its associated alias addresses.

See *OS/390 MVS Diagnosis: Tools and Service Aids* for detailed information about starting or stopping a GTF trace.

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

For license inquiries regarding double-byte (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law:
INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs

and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Corporation
Information Enabling Requests
Dept. DWZA
5600 Cottle Road
San Jose, CA 95193
U.S.A.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement, or any equivalent agreement between us.

Trademarks

The following terms are trademarks of the International Business Machine Corporation in the United States, or other countries, or both:

AnyNet
BookManager
CICS
DFSMS
DFSMS/MVS
DFSMSdfp
DFSMSdss
DFSMShsm
DFSMSrmm
DFSORT
ESCON
FFST
GDDM
IBM
IMS
Language Environment
Magstar
MVS/ESA
OS/2
OS/390
RACF
RMF
Seascape
SOMobjects
SP
System/390
SystemView
VisualLift
VTAM

UNIX is a registered trademark in the United States and/or other countries licensed exclusively through X/Open Company Limited.

Other company, product, and service names may be trademarks or service marks of others.

Glossary

The following terms are defined as they are used in the DFSMS/MVS Library. If you do not find the term you are looking for, see the IBM Software Glossary:

`http://www.networking.ibm.com/nsg/nsgmain.htm`

This glossary is an ever-evolving document that defines technical terms used in the documentation for many IBM software products.

A

access method services (AMS). A facility used to define and reproduce VSAM key-sequenced data sets (KSDS).

ACF. See *automated cartridge facility*.

ACL. See *automatic cartridge loader*.

ACS routines. See *automatic class selection routines*.

alias exposure. A device number associated with a PAV. It is used for data access I/O operations, query, and control operations.

allocation. Generically, the entire process of obtaining a volume and unit of external storage, and setting aside space on that storage for a data set.

AMS. See *access method services*.

APAR. See *authorized program analysis report*.

API. See *application programming interface*.

application programming interface (API). A software interface that enables applications to communicate with each other. An API is the set of programming language constructs or statements that can be coded in an application program to obtain the specific functions and services provided by an underlying operating system or service program.

ATL. See *automated tape library*.

ATLDS. See *automated tape library dataserver*.

authorized program analysis report (APAR). A report of a problem caused by a suspected defect in a current unaltered release of a program.

automatic cartridge loader (ACL). An optional feature of the 3480 magnetic tape subsystem that allows preloading of multiple tape cartridges. This feature is standard in the 3490 magnetic tape subsystem.

automatic class selection (ACS) routines. A procedural set of ACS language statements. Based on a set of input variables, the ACS language statements generate the name of a predefined SMS class, or a list of names of predefined storage groups, for a data set.

automated tape library (ATL). A device consisting of robotic components, cartridge storage areas, tape subsystems, and controlling hardware and software, together with the set of tape volumes that reside in the library and can be mounted on the library tape drives.

automated cartridge facility (ACF). An optional feature for the 3590 tape drive. It allows both the automatic loading of premounted tape cartridges and the manual loading of single tape cartridges.

automated tape library dataserver (ATLDS). An automated tape library consisting of mechanical and robotic mechanisms, cartridge storage frames, IBM tape subsystems, and controlling hardware and software. The 3495 tape library performs tape cartridge mounts and demounts without operator intervention.

B

backup. The process of creating a copy of a data set or object to be used in case of accidental loss.

base exposure. A device number associated with a PAV and used for query, control, and data access operations.

C

cartridge eject. For an IBM 3494 tape library dataserver, IBM 3495 tape library dataserver, or an IBM Model M10 3495 tape library dataserver the act of physically removing a tape cartridge, usually under robot control, by placing it in an output station. The software logically removes the cartridge by deleting or updating the tape volume record in the tape configuration database. For a manual tape library dataserver, the act of logically removing a tape cartridge from the manual tape library dataserver by deleting or updating the tape volume record in the tape configuration database.

cartridge entry. For either an IBM 3494 tape library dataserver, IBM 3495 tape library dataserver, or a IBM Model M10 3495 tape library dataserver, the process of logically adding a tape cartridge to the library by creating or updating the tape volume record in the tape configuration database. The cartridge entry process includes the assignment of the cartridge to a category, either scratch or private, in the library.

cartridge system tape. The base tape cartridge media used with 3480 or 3490 magnetic tape subsystems.

CCW. See *channel command word*.

channel command word (CCW). A main-storage area that specifies the command to be executed. For commands initiating certain I/O operations, it designates the storage area associated with the operations, the action to be taken whenever transfer to or from the area is completed.

conflict. The inclusion of a Reserve request by a channel program or a Write request to an extent that is in use.

construct. One of the following: data class, storage class, management class, storage group, aggregate group, base configuration.

D

DASD. See *direct access storage device*.

DASD volume. A DASD space identified by a common label and accessed by a set of related addresses.

data class. A collection of allocation and space attributes, defined by the storage administrator, that are used to create a data set.

data facility sort (DFSORT). An IBM licensed program that is a high-speed data processing utility. DFSORT provides an efficient and flexible way to handle sorting, merging, and copying operations, as well as providing versatile data manipulation at the record, field, and bit level.

Data Facility Storage Management Subsystem/Multiple Virtual Storage (DFSMS/MVS). An IBM System/390 licensed program that provides storage, data, and device management functions. When combined with MVS/ESA SP Version 5 it composes the base MVS/ESA operating environment. DFSMS/MVS consists of DFSMSdfp, DFSMSdss, DFSMShsm, and DFSMSrmm.

data set. In DFSMS/MVS, the major unit of data storage and retrieval, consisting of a collection of data in one of several prescribed arrangements and described by control information to which the system has access. In OS/390 non-UNIX environments, the terms *data set* and *file* are generally equivalent and sometimes are used interchangeably. See also *file*. In OS/390 UNIX environments, the terms *data set* and *file* have quite distinct meanings.

DDM. See *disk drive module*.

DDR. See *dynamic device reconfiguration*.

device. This term is used interchangeably with unit. You mount a tape on a unit or device, such as a 3490.

device number. A number assigned to a specific logical volume.

DFSMSdfp. A DFSMS/MVS functional component or base element of OS/390 that provides functions for storage management, data management, program management, device management, and distributed data access.

DFSMSdss. A DFSMS/MVS functional component or base element of OS/390 used for backing up and recovering data, and managing space on volumes in the storage hierarchy.

DFSMS environment. An environment that helps automate and centralize the management of storage. This is achieved through a combination of hardware, software, and policies. In the DFSMS environment for MVS, the function is provided by DFSORT, RACF, and the combination of DFSMS/MVS and MVS.

DFSMShsm. A DFSMS/MVS functional component or base element of OS/390 used for backing up and recovering data, and managing space on volumes in the storage hierarchy.

DFSMShsm-managed volume. (1) A primary storage volume that is defined to DFSMShsm but which does not belong to a storage group. (2) A volume in a storage group that is using DFSMShsm automatic dump, migration, or backup services. Contrast with *system-managed volume* and *DFSMSrmm-managed volume*.

DFSMS/MVS. See *Data Facility Storage Management Subsystem/Multiple Virtual Storage*.

DFSMSrmm. A DFSMS/MVS functional component or base element of OS/390 that manages removable media.

DFSMSrmm control data set. A VSAM key-sequenced data set that contains the complete inventory of your removable media library, as well as the movement and retention policies you define. In the control data set, DFSMSrmm records all changes made to the inventory, such as adding or deleting volumes.

DFSMSrmm-managed volume. A tape volume that is defined to DFSMSrmm. Contrast with *system-managed volume* and *DFSMShsm-managed volume*.

DFSORT. See *Data Facility Sort*.

direct access storage device (DASD). A mass storage medium on which a computer stores data.

disk drive module (DDM). The primary nonvolatile storage medium that you use for any host data stored

within the subsystem. The number and type of storage devices within a storage facility may vary.

dynamic device reconfiguration (DDR). An OS/390 system capability that allows the operator to move or swap a demountable volume from a device.

E

enhanced capacity cartridge system tape. A cartridge system tape with increased capacity that can only be used with 3490E magnetic tape subsystems. Contrast with *cartridge system tape.*

Enterprise Systems Connection (ESCON). A set of IBM products and services that provide a dynamically connected environment within an enterprise.

Environmental Recording, Editing, and Printing (EREP). A program that makes the data contained in the system recorder file available for further analysis.

EREP. See *Environmental Recording, Editing, and Printing*.

ESCON. See *Enterprise Systems Connection*.

exploitation support. A set of PTFs that enable an MVS system to define and recognize both the new ESS control unit type (2105) and the associated device types (3380A, 3380B, 3390A, and 3390B). This support allows you to fully exploit the ESS capabilities, such as PAVs, and copy services, such as the FlashCopy service.

exposure. A device extension that enables MVS to perform multiple concurrent I/O operations to the device.

F

file. A collection of information treated as a unit. In non-OS/390 UNIX environments, the terms *data set* and *file* are generally equivalent and are sometimes used interchangeably. See *data set.*

FlashCopy. An ESS copy service that provides the appearance of instantaneous replication of a range of track images.

G

GB. See *gigabyte*.

generalized trace facility (GTF). An optional OS/VS service program that records significant system events, such as supervisor calls and start I/O operations, for the purpose of problem determination.

gigabyte (GB). One billion (10^9) bytes.

GTF. See *generalized trace facility*.

H

hardware configuration definition (HCD). An interactive interface in the MVS system that enables an installation to define hardware configurations from a single point of control.

HCD. See *hardware configuration definition*.

I

initial program load (IPL). (1) The initialization procedure that causes an operating system to commence operation. (2) The process by which a configuration image is loaded into storage at the beginning of a work day or after a system malfunction. (3) The process of loading system programs and preparing a system to run jobs.

input/output definition file (IODF). A VSAM data set that contains hardware and software configuration definitions.

interactive storage management facility (ISMF). The interactive interface of DFSMS/MVS that allows users and storage administrators access to the storage management functions.

IODF. See *input/output definition file*.

IPL. See *initial program load*.

ISMF. See *interactive storage management facility*.

J

JCL. See *job control language*.

JES. See *Job Entry Subsystem*.

job control language (JCL). A control language used to identify a job to an operating system and to describe the job's requirements.

Job Entry Subsystem (JES). An IBM licensed program that receives jobs into the system and processes all output data produced by the jobs.

K

keyword. A predefined word that is used as an identifier.

L

logical subsystem (LSS). The logical functions of a storage controller that allow one or more host I/O interfaces to access a set of devices. The controller aggregates the devices according to the addressing mechanisms of the associated I/O interfaces. One or

more logical subsystems exist on a storage controller. In general, the controller associates a given set of devices with only one logical subsystem.

LSS. See *logical subsystem*.

M

management class. A collection of management attributes defined by the storage administrator. It is used to control:
- The release of allocated but unused space
- The retention, migration, and backup of data sets
- The retention and backup of aggregate groups
- The retention, backup, and class transition of objects.

MB. See *megabyte*.

media position. Decimal value N, representing the numerator in the fraction N/256. This fraction represents the ratio of the distance from the beginning of the volume to the current tape position rounded down to the nearest 1/256th.

megabyte (MB). 1) For processor storage, real and virtual storage, and channel volume, 2^{20} or 1 048 576 bytes. (2) For disk storage capacity and communications volume, 1 000 000 bytes.

multiple allegiance. An ESS capability of concurrently accessing a volume from multiple hosts.

Multiple Virtual Storage (MVS). The short name for MVS/390, MVS/XA, MVS/ESA, or the MVS element of the OS/390 operating system.

MVS. See *Multiple Virtual Storage*.

MVS configuration program (MVSCP). A single-step, batch program that defines the input/output configuration to MVS.

MVSCP. See *MVS configuration program*.

MVS/ESA. An environment in the MVS operating system that supports ESA/390.

MVS/ESA SP. An IBM licensed program used to control the MVS operating system. MVS/ESA SP together with DFSMS/MVS compose the base MVS/ESA operating environment. See *Operating System/390*.

O

OAM. See *object access method*.

object access method (OAM). An access method that provides storage, retrieval, and storage hierarchy management for objects and provides storage and retrieval management for tape volumes contained in system-managed libraries.

Operating System/390 (OS/390). OS/390 is a network computing-ready, integrated operating system consisting of more than 50 base elements and integrated optional features delivered as a configured, tested system. See *MVS/ESA SP*.

OS/390. See *Operating System/390*.

P

parallel access volume (PAV). An ESS capability of multiple concurrent accesses to a single volume from a single host.

PAV. See *parallel access volume*.

PAV-alias. A device number through which a PAV is accessed.

PAV-base. A device number associated with the attributes and status of a PAV. It is the only device number used for accessing a PAV if aliases are not enabled.

peer-to-peer remote copy (PPRC). A hardware-based remote copy option that provides a synchronous volume copy across 3990 Model 6 storage subsystems for disaster recovery, device migration, and workload migration.

performance. (1) A measurement of the amount of work a product can produce with a given amount of resources. (2) In the DFSMS environment, a measurement of effective data processing speed with respect to objectives set by the storage administrator. Performance is largely determined by throughput, response time, and system availability.

PPRC. See *peer-to-peer remote copy*.

private tape volume. A volume assigned to specific individuals or functions.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

PTF. See *program temporary fix*.

R

RACF. See *Resource Access Control Facility*.

RAID. See *redundant array of independent disk*.

RAMAC Virtual Array (RVA) system. An online, random access disk array storage system composed of disk storage and control unit combined into a single frame.

recording format. For a tape volume, the format of the data on the tape, for example, 18, 36, 128, or 256 tracks.

recovery. The process of rebuilding data after it has been damaged or destroyed, often by using a backup copy of the data or by reapplying transactions recorded in a log.

redundant array of independent disk (RAID). A disk subsystem architecture that combines two or more physical disk storage devices into a single logical device to achieve data redundancy.

Resource Access Control Facility (RACF). An IBM-licensed program or a base element of OS/390, that provides for access control by identifying and verifying the users to the system, authorizing access to protected resources, logging the detected unauthorized attempts to enter the system, and logging the detected accesses to protected resources.

restructured extended executor (REXX). A general-purpose, procedural language for end-user personal programming, designed for ease by both casual general users and computer professionals. It is also useful for application macros. REXX includes the capability of issuing commands to the underlying operating system from these macros and procedures. Features include powerful character-string manipulation, automatic data typing, manipulation of objects familiar to people, such as words, numbers, and names, and built-in interactive debugging.

REXX. See *restructured extended executor*.

RVA. See *RAMAC Virtual Array system*.

S

SCDS. See *source control data set*.

scratch. The status of a tape volume that is available for general use, because the data on it is incorrect or is no longer needed. You request a scratch volume when you omit the volume serial number on a request for a tape volume mount.

scratch volume. A tape volume that contains expired data only. See *scratch*.

SCSI. See *small computer system interface*.

SFI. See *structured field introducer*.

small computer system interface (SCSI). A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

source control data set (SCDS). An online, random access disk array storage system composed of disk storage and control unit combined into a single frame.

storage administrator. A person in the data processing center who is responsible for defining, implementing, and maintaining storage management policies.

storage class. A collection of storage attributes that identify performance goals and availability requirements, defined by the storage administrator, used to select a device that can meet those goals and requirements.

storage group. A collection of storage volumes and attributes, defined by the storage administrator. The collections can be a group of DASD volumes or tape volumes, or a group of DASD, optical, or tape volumes treated as a single object storage hierarchy. See *tape storage group*.

storage management. The activities of data set allocation, placement, monitoring, migration, backup, recall, recovery, and deletion. These can be done either manually or by using automated processes. The Storage Management Subsystem automates these processes for you, while optimizing storage resources. See also *Storage Management Subsystem*.

Storage Management Subsystem (SMS). A DFSMS/MVS facility used to automate and centralize the management of storage. Using SMS, a storage administrator describes data allocation characteristics, performance and availability goals, backup and retention requirements, and storage requirements to the system through data class, storage class, management class, storage group, and ACS routine definitions.

storage subsystem. A storage control and its attached storage devices. See also *tape subsystem*.

structured field introducer (SFI). An 8-byte entity that introduces either the beginning of a group of data or the output data immediately following the introducer.

system-managed storage. Storage managed by the Storage Management Subsystem. SMS attempts to deliver required services for availability, performance, and space to applications. See also *DFSMS environment*.

system-managed tape library. A collection of tape volumes and tape devices, defined in the tape configuration database. A system-managed tape library can be automated or manual. See also *tape library*.

system programmer. A programmer who plans, generates, maintains, extends, and controls the use of an operating system and applications with the aim of improving overall productivity of an installation.

T

tape configuration database. One or more volume catalogs used to maintain records of system-managed tape libraries and tape volumes.

tape library. A set of equipment and facilities that support an installation's tape environment. This can include tape storage racks, a set of tape drives, and a set of related tape volumes mounted on those drives. See *system-managed tape library*.

tape storage group. A type of storage group that contains system-managed private tape volumes. The tape storage group definition specifies the system-managed tape libraries that can contain tape volumes. See also *storage group*.

tape subsystem. A magnetic tape subsystem consisting of a controller and devices, which allows for the storage of user data on tape cartridges. Examples of tape subsystems include the IBM 3490 and 3490E Magnetic Tape Subsystems.

tape volume. A tape volume is the recording space on a single tape cartridge or reel. See also *volume*.

toleration support. A set of PTFs designed for use on an MVS system that cannot exploit the ESS capabilities. This support allows the MVS system to define and recognize both the new ESS control unit type (2105) and the associated device types (3380A, 3380B, 3390A, and 3390B). As a result, this MVS system can share an IODF created by other systems, including ESS exploiting systems. However, it will see an ESS as a 3990 control unit and the attached devices as regular 3380s and 3390s.

transparency support. A set of PTFs that allow an MVS system to use an ESS as a regular 3990 control unit. The MVS system cannot recognize the new ESS control unit type (2105) or the associated device types (3380A, 3380B, 3390A, or 3390B). In addition, it will not be able to share an IODF that contains the new ESS control unit type and the associated device types.

U

UCB. See *unit control blocks*.

UIM. See *unit information module*.

unit address. A number assigned to a specific logical device.

unit control blocks (UCB). A data area used by MVS for allocating devices and controlling input/output operations.

unit information module (UIM). A module that performs the device-dependent part of the operating system configuration definition. There is a UIM for each supported device or device group. Each UIM recognizes and processes the values coded for its device or device group. The HCD routines load all UIMs, either IBM or customer-supplied, into virtual storage and make calls to the UIMs during:

- An initialization
- The processing of an Add device or Change device request
- The generation of a print report
- An IPL.

V

VIO. See *virtual input/output*.

virtual input/output (VIO). A type of storage group that allocates data sets to paging storage, which simulates a DASD volume. VIO storage groups do not contain any actual DASD volumes.

volume. The storage space on DASD, tape, or optical devices, which is identified by a volume label.

volume serial number. An identification number in a volume label that is assigned when a volume is prepared for use on the system. For standard label volumes, the volume serial number is the VOL1 label of the volume. For volumes without labels, the volume serial number is the name the user assigns to the volume.

X

XRC. See *extended remote copy*.

extended remote copy (XRC). A hardware- and software-based remote copy option that provides an asynchronous volume copy across storage subsystems for disaster recovery, device migration, and workload migration.

Index

V

W

X

Readers' Comments — We'd Like to Hear from You

DFSMS/MVS
Software Support for
IBM Enterprise Storage Server

Publication No. SC26-7318-00

Overall, how satisfied are you with the information in this book?

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	☐	☐	☐	☐	☐

How satisfied are you that the information in this book is:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Accurate	☐	☐	☐	☐	☐
Complete	☐	☐	☐	☐	☐
Easy to find	☐	☐	☐	☐	☐
Easy to understand	☐	☐	☐	☐	☐
Well organized	☐	☐	☐	☐	☐
Applicable to your tasks	☐	☐	☐	☐	☐

Please tell us how we can improve this book:

Thank you for your responses. May we contact you? ☐ Yes ☐ No

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate without incurring any obligation to you.

Name _____ Address _____

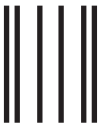
Company or Organization _____

Phone No. _____

Readers' Comments — We'd Like to Hear from You
SC26-7318-00

Cut or Fold
Along Line

Fold and Tape | **Please do not staple** | Fold and Tape



NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 40 ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

IBM Corporation
RCF Processing Department
M86/050
5600 Cottle Road
SAN JOSE, CA 95193-0001

Fold and Tape | **Please do not staple** | Fold and Tape

Cut or Fold
Along Line

Program Number: 5695-DF1

Printed in the United States of America
on recycled paper containing 10%
recovered post-consumer fiber.

SC26-7318-00