

IBM TotalStorage



DS Open Application Programming Interface Reference

IBM TotalStorage



DS Open Application Programming Interface Reference

Note:

Before using this information and the product it supports, read the information in the **Safety and environmental notices** and **Notices** sections.

Fourth Edition (May 2005)

© Copyright International Business Machines Corporation 2004, 2005. All rights reserved.

US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Contents

Tables	vii
Figures	ix
About this guide	xi
Who should use this guide	xi
Conventions used in this guide	xi
Safety and environmental notices	xiii
Safety notices	xiii
Environmental notices	xiii
Product recycling	xiii
Disposing of products	xiii
Conventions used in this guide	xiii
Related information	xiv
DS8000 series library	xiv
Other IBM publications	xv
Ordering IBM publications	xx
Web sites	xx
How to send your comments.	xxi
Summary of Changes for GC35-0493-02 IBM TotalStorage DS8000 DS Open Application Programming Interface Reference	xxiii
Chapter 1. Introduction to IBM TotalStorage DS8000 series	1
DS8000 models	1
DS8100 (Model 921)	4
DS8300 (Models 922 and 9A2)	5
Model comparison	5
DS8000 physical footprint	6
DS8000 performance features.	8
Interfaces of the DS8000	8
IBM TotalStorage DS Storage Manager	9
DS Open application programming interface	9
DS command-line interface	9
DS8000 hardware specifics	10
Storage unit structure	10
IBM TotalStorage Management Console.	11
Host systems that the storage unit supports	11
Processor memory	15
Data management features	15
RAID	15
Arrays across loops	15
Storage System LPARs (logical partitions)	15
Copy Services	16
FlashCopy	18
Disaster recovery using Copy Services	19
Comparison of licensed functions	20
Parallel Access Volumes	21
DS8000 limitations	21
Planning data migration.	22
How to select a data migration method	22

Chapter 2. Introduction to IBM TotalStorage DS Open API.	25
DS Open API overview	25
CIM agent overview	25
CIM agent components	27
CIM concepts	27
CIM agent installation requirements	28
Hardware	29
Workstation space	29
Software	29
CIM agent installation methods	29
CIM agent security	30
Chapter 3. CIM agent for AIX	31
Installation overview for AIX	31
Mounting the CD on AIX	31
Installing the CIM agent on AIX in graphical mode	32
Installing the CIM agent on AIX in unattended (silent) mode	40
Verifying the CIM agent installation on AIX	42
Configuring the CIM agent on AIX	43
Configuring the CIM agent to run in unsecure mode	46
Verifying the connection on AIX	46
Removing the CIM agent on AIX	48
Removing the CIM agent from AIX in graphical mode	49
Removing the CIM agent from AIX in unattended (silent) mode	51
Chapter 4. CIM agent for Linux	53
Installation overview for Linux	53
Installing the CIM agent on Linux in graphical mode	53
Installing the CIM agent on Linux in unattended (silent) mode	61
Verifying the CIM agent installation on Linux	63
Configuring the CIM agent on Linux	64
Configuring the CIM agent to run in unsecure mode on Linux	67
Verifying the CIM agent connection on Linux	67
Removing the CIM agent on Linux	69
Removing the CIM agent on Linux in graphical mode	70
Removing the CIM agent on Linux in unattended (silent) mode	73
Chapter 5. CIM agent for Windows	75
Installation overview for Windows	75
Installing the CIM agent on Windows in graphical mode	75
Installing the CIM agent on Windows in unattended (silent) mode	82
Verifying the CIM agent installation on Windows	84
Configuring the CIM agent for Windows	85
Configuring the CIM agent to run in unsecure mode	88
Verifying the CIM agent connection on Windows	88
Removing the CIM agent from Windows	92
Chapter 6. CIM agent installation and configuration commands	99
Overview of the CIM agent commands and subcommands	99
Invoking the CIM agent	99
Conventions used in this chapter	99
Syntax diagrams	99
Special characters	101
Emphasis	101
Anatomy of a command line	101
Configuration commands	102

Description of subcommands	102
setuser	104
adduser	105
chuser	106
lsuser	107
rmuser	107
setentry	108
setoutput	109
setdevice	109
address	110
addressserver	111
chess	112
chessserver	113
lssess	115
lssessserver	115
rmess	116
rmessserver	117
Operational commands	118
startcimom	118
stopcimom	118
Utility commands	119
mkcertificate	119
slpd	120
verifyconfig	120
modifyconfig	121
Chapter 7. DS Open API component definitions	123
Chapter 8. CIM agent communication with the DS Open API	125
CIM agent communication concepts	125
CIM agent communication methods	125
CIM agent functional groups	135
Error codes returned by the CIMOM	136
Chapter 9. CIM agent class information for the DS Open API	141
CIM agent class definitions quick reference	141
Chapter 10. DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services for Windows	151
DS Open API Support for Microsoft's Virtual Disk Service Overview	151
DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Service installation overview.	151
DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services installation requirements.	152
Hardware	152
Software	152
Installing the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services on Windows.	152
Verifying the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services Windows installation	158
Creating the VSS_FREE and VSS_RESERVED pools for Microsoft Volume Shadow Copy Service	158
Verifying DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services Windows configuration	159
DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands	160

Error codes returned by Microsoft Volume Shadow Copy and Virtual Disk Services	162
Uninstalling the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services on Windows.	164
Accessibility	165
Notices	167
Terms and conditions for downloading and printing publications	168
Trademarks.	169
Electronic emission notices	170
Federal Communications Commission (FCC) statement	170
Industry Canada compliance statement	170
European community compliance statement.	170
Japanese Voluntary Control Council for Interference (VCCI) class A statement	171
Korean Ministry of Information and Communication (MIC) statement.	171
Taiwan class A compliance statement	172
Java Compatibility logo	173
Glossary	175
.	175
Index	203

Tables

1. Conventions used in this guide	xi
2. DS8000 model comparison chart	6
3. Comparison of licensed functions	20
4. Summary of CIM agent setuser and setdevice subcommands	103
5. GetClass method parameters	126
6. GetInstance method parameters	126
7. DeleteInstance method parameters	127
8. CreateInstance method parameters	127
9. ModifyInstance method parameters	128
10. EnumerateClasses method parameters	128
11. EnumerateClassNames method parameters	129
12. EnumerateInstances method parameters	129
13. EnumerateInstanceNames method parameters	130
14. ExecQuery method parameters	130
15. Associators method parameters	131
16. AssociatorNames method parameters	131
17. References method parameters	132
18. ReferenceNames method parameters	133
19. GetProperty method parameters	133
20. SetProperty method parameters	134
21. GetQualifier method parameters	134
22. SetQualifier method parameters	134
23. Functional groups for the CIM agent	135
24. Return error codes for the CIMOM	136
25. CIM agent class definitions (quick reference)	141
26. Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands	160
27. Return error codes for Microsoft Volume Shadow Copy and Virtual Disk Services	162

Figures

1.	A base model (with front cover off) and its main components	2
2.	An expansion model (with front cover off) and its main components	3
3.	Maximum configuration for Model 921	4
4.	Maximum configuration for Models 922 and 9A2.	5
5.	DS8000 physical footprint. Dimensions are in centimeters (inches)..	7
6.	How a CIM agent works	26
7.	The MOF compiler stores the model in the CIMOM data store.	28

About this guide

This publication introduces the IBM® TotalStorage® DS Open Application Programming Interface (API) and provides instructions for installing and configuring the Common Information Model (CIM) agent on the following operating systems:

- IBM Advanced Interactive Executive (AIX®)
- Linux
- Microsoft® Windows® 2000 or later

You can install the CIM agent on a host server or on a workstation within a network.

This publication also lists the CIM components and provides descriptions of the commands that you use during the installation and configuration tasks.

Once the CIM agent is installed and configured on your machine, you can implement the DS Open API. This book contains reference material that includes the following information that might assist you in writing your CIM-based applications for the DS Open API:

- DS Open API component definitions
This section describes the elements, the namespace, and the object name for the DS Open API.
- CIM agent communication with the DS Open API
This section describes the concepts and methods for communication between the CIM agent and the DS Open API and lists error codes that the CIM object manager (CIMOM) returns.
- DS Open API object classes
This section provides DS Open API object classes that are used by the CIM agent to manage its model of the storage unit.
- DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services Overview
This section provides instructions for installing and configuring Microsoft Volume Shadow Copy and Virtual Disk Services on Windows.

Who should use this guide

This publication is for system administrators and system and application programmers, or whoever is responsible for implementing the DS Open API and installing and configuring the CIM agent. This publication assumes that you understand the general concepts of the operating system and Internet capabilities for your enterprise.

Conventions used in this guide

This guide uses bold, italic, and other typographic styles to highlight various types of information in the text. See Table 1 for a list of conventions.

Table 1. Conventions used in this guide

bold	Denotes a command, user ID, password, or labels on buttons.
<i>italics</i>	Denotes titles of other manuals or books.

Table 1. Conventions used in this guide (continued)

monospace	Denotes a Web address that needs to be typed in. Also denotes an example.
	Used to show the screen output you should see.
Note	Introduces special considerations about the current topic.
(>) greater than and (<) less than	Shows the optional and substitution parameters in the description of commands. The explanation of the optional or substitution parameters are included following the word "Where."

Safety and environmental notices

This section contains information about safety notices that are used in this guide and environmental notices for this product.

Safety notices

Use this process to find information about safety notices.

To find the translated text for a danger or caution notice:

1. Look for the identification number at the end of each danger notice or each caution notice. In the following examples, the numbers **1000** and **1001** are the identification numbers.

DANGER

A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury.

1000

CAUTION:

A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury.

1001

2. Find the number that matches in the *IBM TotalStorage Solutions Safety Notices for IBM Versatile Storage Server and IBM TotalStorage Enterprise Storage Server, GC26-7229*.

Environmental notices

This section identifies the environmental guidelines that pertain to this product.

Product recycling

This unit contains recyclable materials.

Recycle these materials at your local recycling sites. Recycle the materials according to local regulations. In some areas, IBM provides a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

Disposing of products

This topic contains information about how to dispose of products.

This unit might contain batteries. Remove and discard these batteries, or recycle them, according to local regulations.

Conventions used in this guide

The following typefaces are used to show emphasis:

boldface

Text in **boldface** represents menu items and lowercase or mixed-case command names.

italics Text in *italics* is used to emphasize a word. In command syntax, it is used for variables for which you supply actual values.

monospace

Text in monospace identifies the data or commands that you type, samples of command output, or examples of program code or messages from the system.

Related information

The tables in this section list and describe the following publications:

- The publications that make up the IBM® TotalStorage™ DS8000 series library
- Other IBM publications that relate to the DS8000 series
- Non-IBM publications that relate to the DS8000 series

See “Ordering IBM publications” on page xx for information about how to order publications in the IBM TotalStorage DS8000 series publication library. See “How to send your comments” on page xxi for information about how to send comments about the publications.

DS8000 series library

These customer publications make up the DS8000 series library.

Unless otherwise noted, these publications are available in Adobe portable document format (PDF) on a compact disc (CD) that comes with the storage unit. If you need additional copies of this CD, the order number is SK2T-8803. These publications are also available as PDF files by clicking on the **Documentation link** on the following Web site:

<http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html>

See “Ordering IBM publications” on page xx for information about ordering these and other IBM publications.

Title	Description	Order Number
<i>IBM TotalStorage® DS: Command-Line Interface User's Guide</i>	This guide describes the commands that you can use from the command-line interface (CLI) for managing your DS8000 configuration and Copy Services relationships. The CLI application provides a set of commands that you can use to write customized scripts for a host system. The scripts initiate predefined tasks in a Copy Services server application. You can use the CLI commands to indirectly control Remote Mirror and Copy and FlashCopy® configuration tasks within a Copy Services server group.	SC26-7625 (See Note.)
<i>IBM TotalStorage DS8000: Host Systems Attachment Guide</i>	This guide provides guidelines for attaching the DS8000 to your host system and for migrating to fibre-channel attachment from a small computer system interface.	SC26-7628 (See Note.)
<i>IBM TotalStorage DS8000: Introduction and Planning Guide</i>	This guide introduces the DS8000 product and lists the features you can order. It also provides guidelines for planning the installation and configuration of the storage unit.	GC35-0495

Title	Description	Order Number
<i>IBM TotalStorage Multipath Subsystem Device Driver User's Guide</i>	This publication describes how to use the IBM Subsystem Device Driver (SDD) on open-systems hosts to enhance performance and availability on the DS8000. SDD creates redundant paths for shared logical unit numbers. SDD permits applications to run without interruption when path errors occur. It balances the workload across paths, and it transparently integrates with applications.	SC30-4096
<i>IBM TotalStorage DS8000: User's Guide</i>	This guide provides instructions for setting up and operating the DS8000 and for analyzing problems.	SC26-7623 (See Note.)
<i>IBM TotalStorage DS Application Programming Interface Reference</i>	This publication provides reference information for the IBM TotalStorage DS application programming interface (API) and provides instructions for installing the Common Information Model Agent, which implements the API.	GC35-0493
<i>IBM TotalStorage DS8000 Messages Reference</i>	This publication provides explanations of error, information, and warning messages that are issued from the DS8000 user interfaces.	GC26-7659
Note: No hardcopy book is produced for this publication. However, a PDF file is available from the following Web site: http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html		

Other IBM publications

Other IBM publications contain additional information that is related to the DS product library.

The following list is divided into categories to help you find publications that are related to specific topics. Some of the publications are listed under more than one category. See "Ordering IBM publications" on page xx for information about ordering these and other IBM publications.

Title	Description	Order Number
Data-copy services		
<i>z/OS DFSMS Advanced Copy Services</i>	This publication helps you understand and use IBM Advanced Copy Services functions. It describes three dynamic copy functions and several point-in-time copy functions. These functions provide backup and recovery of data if a disaster occurs to your data center. The dynamic copy functions are peer-to-peer remote copy, extended remote copy, and coupled extended remote copy. Collectively, these functions are known as remote copy. FlashCopy, SnapShot, and concurrent copy are the point-in-time copy functions.	SC35-0428
<i>IBM Enterprise Storage Server</i>	This publication, from the IBM International Technical Support Organization, introduces the Enterprise Storage Server and provides an understanding of its benefits. It also describes in detail the architecture, hardware, and functions, including the advanced copy functions, of the Enterprise Storage Server.	SG24-5465
<i>Implementing Copy Services On S/390</i>	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on an Enterprise Storage Server that is attached to an S/390 or zSeries host system. Copy Services functions include peer-to-peer remote copy, extended remote copy, FlashCopy®, and concurrent copy. This publication describes the functions, prerequisites, and corequisites and describes how to implement each function into your environment.	SG24-5680

Title	Description	Order Number
<i>IBM TotalStorage ESS Implementing Copy Services in an Open Environment</i>	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on UNIX, Windows NT®, Windows 2000, Sun Solaris, HP-UX, Tru64, OpenVMS, and iSeries host systems. The Copy Services functions that are described include peer-to-peer remote copy and FlashCopy. This publication describes the functions and shows you how to implement them into your environment. It also shows you how to implement these functions in a high-availability cluster multiprocessing environment.	SG24-5757
Fibre channel		
<i>Fibre Channel Connection (FICON) I/O Interface: Physical Layer</i>	This publication provides information about the fibre-channel I/O interface. This book is also available as a PDF file from the following Web site: http://www.ibm.com/servers/resourcelink/	SA24-7172
<i>Fibre Transport Services (FTS): Physical and Configuration Planning Guide</i>	This publication provides information about fibre-optic and ESCON-trunking systems.	GA22-7234
<i>IBM SAN Fibre Channel Switch: 2109 Model S08 Installation and Service Guide</i>	This guide describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S08.	SC26-7350
<i>IBM SAN Fibre Channel Switch: 2109 Model S08 User's Guide</i>	This guide describes the IBM SAN Fibre Channel Switch and the IBM TotalStorage ESS Specialist. It provides information about the commands and how to manage the switch with Telnet and the Simple Network Management Protocol.	SC26-7349
<i>IBM SAN Fibre Channel Switch: 2109 Model S16 Installation and Service Guide</i>	This publication describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S16. It is intended for trained service representatives and service providers.	SC26-7352
<i>IBM SAN Fibre Channel Switch: 2109 Model S16 User's Guide</i>	This guide introduces the IBM SAN Fibre Channel Switch 2109 Model S16 and tells you how to manage and monitor the switch using zoning and how to manage the switch remotely.	SC26-7351
<i>Implementing Fibre Channel Attachment on the ESS</i>	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It provides you with a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
Open-systems hosts		
<i>ESS Solutions for Open Systems Storage: Compaq AlphaServer, HP, and Sun</i>	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure the Enterprise Storage Server when you attach Compaq AlphaServer (running Tru64 UNIX), HP, and Sun hosts. This book does not cover Compaq AlphaServer that is running the OpenVMS operating system. This book also focuses on the settings that are required to give optimal performance and on the settings for device driver levels. This book is for the experienced UNIX professional who has a broad understanding of storage concepts.	SG24-6119

Title	Description	Order Number
<i>IBM TotalStorage ESS Implementing Copy Services in an Open Environment</i>	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on UNIX or Windows 2000 host systems. The Copy Services functions that are described include peer-to-peer remote copy and FlashCopy. This publication describes the functions and shows you how to implement them into your environment. It also shows you how to implement these functions in a high-availability cluster multiprocessing environment.	SG24-5757
<i>Implementing Fibre Channel Attachment on the ESS</i>	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It gives you a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
S/390 and zSeries hosts		
<i>Device Support Facilities: User's Guide and Reference</i>	This publication describes the IBM Device Support Facilities (ICKDSF) product that are used with IBM direct access storage device (DASD) subsystems. ICKDSF is a program that you can use to perform functions that are needed for the installation, the use, and the maintenance of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.	GC35-0033
<i>z/OS Advanced Copy Services</i>	This publication helps you understand and use IBM Advanced Copy Services functions. It describes three dynamic copy functions and several point-in-time copy functions. These functions provide backup and recovery of data if a disaster occurs to your data center. The dynamic copy functions are peer-to-peer remote copy, extended remote copy, and coupled extended remote copy. Collectively, these functions are known as remote copy. FlashCopy, SnapShot, and concurrent copy are the point-in-time copy functions.	SC35-0428
<i>DFSMS/MVS V1: Remote Copy Guide and Reference</i>	This publication provides guidelines for using remote copy functions with S/390 and zSeries hosts.	SC35-0169
<i>Fibre Transport Services (FTS): Physical and Configuration Planning Guide</i>	This publication provides information about fibre-optic and ESCON-trunking systems.	GA22-7234
<i>Implementing ESS Copy Services on S/390</i>	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on an Enterprise Storage Server that is attached to an S/390 or zSeries host system. Copy Services functions include peer-to-peer remote copy, extended remote copy, FlashCopy, and concurrent copy. This publication describes the functions, prerequisites, and corequisites and describes how to implement each function into your environment.	SG24-5680
<i>ES/9000, ES/3090: IOCP User Guide Volume A04</i>	This publication describes the Input/Output Configuration Program that supports the Enterprise Systems Connection (ESCON) architecture. It describes how to define, install, and configure the channels or channel paths, control units, and I/O devices on the ES/9000 processors and the IBM ES/3090 Processor Complex.	GC38-0097
<i>IOCP User's Guide, IBM e(logo)server zSeries 800 and 900</i>	This publication describes the Input/Output Configuration Program that supports the zSeries 800 and 900 servers. This publication is available in PDF format by accessing ResourceLink at the following Web site: www.ibm.com/servers/resourcelink/	SB10-7029

Title	Description	Order Number
<i>IOCP User's Guide, IBM e(logo)server zSeries</i>	This publication describes the Input/Output Configuration Program that supports the zSeries server. This publication is available in PDF format by accessing ResourceLink at the following Web site: www.ibm.com/servers/resourceLink/	SB10-7037
<i>S/390: Input/Output Configuration Program User's Guide and ESCON Channel-to-Channel Reference</i>	This publication describes the Input/Output Configuration Program that supports ESCON architecture and the ESCON multiple image facility.	GC38-0401
<i>IBM z/OS Hardware Configuration Definition User's Guide</i>	This guide provides conceptual and procedural information to help you use the z/OS Hardware Configuration Definition (HCD) application. It also explains: <ul style="list-style-type: none"> • How to migrate existing IOCP/MVSCP definitions • How to use HCD to dynamically activate a new configuration • How to resolve problems in conjunction with MVS/ESA HCD 	SC33-7988
<i>OS/390: Hardware Configuration Definition User's Guide</i>	This guide provides detailed information about the input/output definition file and about how to configure parallel access volumes. This guide discusses how to use Hardware Configuration Definition for both OS/390® and z/OS V1R1.	SC28-1848
<i>OS/390 V2R10.0: MVS System Messages Volume 1 (ABA - ASA)</i>	This publication lists OS/390 MVS™ system messages ABA to ASA.	GC28-1784
<i>Using IBM 3390 Direct Access Storage in a VM Environment</i>	This publication provides device-specific information for the various models of the 3390 and describes methods you can use to manage storage efficiently using the VM operating system. It provides guidance on managing system performance, availability, and space through effective use of the direct access storage subsystem.	GG26-4575
<i>Using IBM 3390 Direct Access Storage in a VSE Environment</i>	This publication helps you use the 3390 in a VSE environment. It includes planning information for adding new 3390 units and instructions for installing devices, migrating data, and performing ongoing storage management activities.	GC26-4576
<i>Using IBM 3390 Direct Access Storage in an MVS Environment</i>	This publication helps you use the 3390 in an MVS environment. It includes device-specific information for the various models of the 3390 and illustrates techniques for more efficient storage management. It also offers guidance on managing system performance, availability, and space utilization through effective use of the direct access storage subsystem.	GC26-4574
<i>z/Architecture Principles of Operation</i>	This publication provides a detailed definition of the z/Architecture™. It is written as a reference for use primarily by assembler language programmers and describes each function at the level of detail needed to prepare an assembler language program that relies on a particular function. However, anyone concerned with the functional details of z/Architecture will find this publication useful.	SA22-7832
SAN		

Title	Description	Order Number
<i>IBM OS/390 Hardware Configuration Definition User's Guide</i>	<p>This guide explains how to use the Hardware Configuration Data application to perform the following tasks:</p> <ul style="list-style-type: none"> • Define new hardware configurations • View and modify existing hardware configurations • Activate configurations • Query supported hardware • Maintain input/output definition files (IODFs) • Compare two IODFs or compare an IODF with an actual configuration • Print reports of configurations • Create graphical reports of a configuration • Migrate existing configuration data 	SC28-1848
<i>IBM SAN Fibre Channel Switch: 2109 Model S08 Installation and Service Guide</i>	This guide describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S08.	SC26-7350
<i>IBM SAN Fibre Channel Switch: 2109 Model S08 User's Guide</i>	This guide describes the IBM SAN Fibre Channel Switch and the IBM TotalStorage ESS Specialist. It provides information about the commands and how to manage the switch with Telnet and the Simple Network Management Protocol (SNMP).	SC26-7349
<i>IBM SAN Fibre Channel Switch: 2109 Model S16 Installation and Service Guide</i>	This publication describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S16. It is intended for trained service representatives and service providers.	SC26-7352
<i>IBM SAN Fibre Channel Switch: 2109 Model S16 User's Guide</i>	This guide introduces the IBM SAN Fibre Channel Switch 2109 Model S16 and tells you how to manage and monitor the switch using zoning and how to manage the switch remotely.	SC26-7351
<i>Implementing Fibre Channel Attachment on the ESS</i>	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It provides you with a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
Seascope family		
<i>IBM Enterprise Storage Server</i>	This publication, from the IBM International Technical Support Organization, introduces the Enterprise Storage Server and provides an understanding of its benefits. It also describes in detail the architecture, hardware, and functions, including the advanced copy functions, of the Enterprise Storage Server.	SG24-5465
<i>IBM Enterprise Storage Server Performance Monitoring and Tuning Guide</i>	This guide, from the IBM International Technical Support Organization, provides guidance on the best way to configure, monitor, and manage your Enterprise Storage Server to ensure optimum performance.	SG24-5656
<i>IBM Versatile Storage Server: Introduction and Planning Guide</i>	This publication introduces the IBM Versatile Storage Server™ and lists the features you can order. It also provides planning information for both 2105 Models B09 and 100.	GC26-7223
<i>Implementing the IBM Enterprise Storage Server in Your Environment</i>	This publication, from the IBM International Technical Support Organization, can help you install, tailor, and configure the Enterprise Storage Server in your environment.	SG24-5420
Storage management		

Title	Description	Order Number
<i>Device Support Facilities: User's Guide and Reference</i>	This publication describes the IBM Device Support Facilities (ICKDSF) product used with IBM direct access storage device (DASD) subsystems. ICKDSF is a program that you can use to perform functions that are needed for the installation, the use, and the maintenance of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.	GC35-0033
<i>IBM TotalStorage Solutions Handbook</i>	This handbook, from the IBM International Technical Support Organization, helps you understand what makes up enterprise storage management. The concepts include the key technologies that you must know and the IBM subsystems, software, and solutions that are available today. It also provides guidelines for implementing various enterprise storage administration tasks so that you can establish your own enterprise storage management environment.	SG24-5250

Ordering IBM publications

This section tells you how to order copies of IBM publications and how to set up a profile to receive notifications about new or changed publications.

IBM publications center

The publications center is a worldwide central repository for IBM product publications and marketing material.

The IBM publications center offers customized search functions to help you find the publications that you need. Some publications are available for you to view or download free of charge. You can also order publications. The publications center displays prices in your local currency. You can access the IBM publications center through the following Web site:

<http://www.ibm.com/shop/publications/order>

Publications notification system

The IBM publications center Web site offers you a notification system for IBM publications.

If you register, you can create your own profile of publications that interest you. The publications notification system sends you a daily e-mail that contains information about new or revised publications that are based on your profile.

If you want to subscribe, you can access the publications notification system from the IBM publications center at the following Web site:

<http://www.ibm.com/shop/publications/order>

Web sites

The following Web sites provide information about the IBM TotalStorage DS8000 series and other IBM storage products.

Type of Storage Information	Web Site
Concurrent Copy for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/

Type of Storage Information	Web Site
Copy Services command-line interface (CLI)	http://www-1.ibm.com/servers/storage/support/software/cscli.html
DS8000 series publications	http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html Click Documentation .
FlashCopy for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/
Host system models, operating systems, and adapters that the storage unit supports	http://www.ibm.com/servers/storage/disk/ds8000/interop.html Click Interoperability matrix .
IBM Disk Storage Feature Activation (DSFA)	http://www.ibm.com/storage/dsfa
IBM storage products	http://www.storage.ibm.com/
IBM TotalStorage DS8000 series	http://www-1.ibm.com/servers/storage/disk/ds8000
IBM version of the Java (JRE) that is often required for IBM products	http://www-106.ibm.com/developerworks/java/jdk/
Multiple Device Manager (MDM)	http://www.ibm.com/servers/storage/support/ Click Storage Virtualization .
Remote Mirror and Copy (formerly PPRC) for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/
SAN fibre channel switches	http://www.ibm.com/storage/fcswitch/
Storage Area Network Gateway and Router	http://www-1.ibm.com/servers/storage/support/san/index.html
Subsystem Device Driver (SDD)	http://www-1.ibm.com/servers/storage/support/software/sdd.html
z/OS Global Mirror (formerly XRC) for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/

How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this information or any other DS8000 series documentation, you can submit them in the following ways:

- e-mail

Submit your comments electronically to the following e-mail address:
starpubs@us.ibm.com

Be sure to include the name and order number of the book and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.

- Mail

Fill out the Readers' Comments form (RCF) at the back of this book. Return it by mail or give it to an IBM representative. If the RCF has been removed, you can address your comments to:

International Business Machines Corporation
RCF Processing Department

Department 61C
9032 South Rita Road
TUCSON AZ 85775-4401

Summary of Changes for GC35-0493-02 IBM TotalStorage DS8000 DS Open Application Programming Interface Reference

This document contains terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change. This summary of changes describes new functions that have been added to this release.

New Information

This edition includes no new information:

Changed Information

This edition contains the following changed information:

- The graphical installation instructions for the CIM agent were updated to show the option of selecting to read the post installation readme file upon finishing installation.
- Configuration instructions were updated to define which steps were specific to the ESS and which to the DS storage units.

Deleted Information

This edition had the following information deleted:

- Related tasks at the end of each section were deleted.

Chapter 1. Introduction to IBM TotalStorage DS8000 series

IBM TotalStorage DS8000 is a high-performance, high-capacity series of disk storage that is designed to support continuous operations. DS8000 series models (machine type 2107) use the IBM POWER5™ server technology that is integrated with the IBM Virtualization Engine™ technology. DS8000 series models consist of a storage unit and one or two management consoles, two being the recommended configuration. The graphical user interface (GUI) or the command-line interface (CLI) allows you to logically partition storage and use the built-in Copy Services functions. For high-availability, hardware components are redundant.

You can read the following information to familiarize yourself with the DS8000 series:

- DS8000 series models, including a model comparison chart
- DS8000 series performance features
- DS8000 series interfaces
- DS8000 series hardware specifics
- Supported systems for open systems, S/390®, and zSeries® hosts
- Data management elements
- Copy Services
- Data migration

DS8000 models

The DS8000 series offers various choices of base and expansion models, so you can configure storage units that meet your performance and configuration needs.

DS8100

The DS8100 (Model 921) features a dual two-way processor complex and support for one expansion frame.

DS8300

The DS8300 (Models 922 and 9A2) features a dual four-way processor complex and support for one or two expansion frames. The Model 9A2 supports two IBM TotalStorage System LPARs (Logical Partitions) in one storage unit.

The DS8000 expansion frames (Models 92E and 9AE) expand the capabilities of the base models. You can attach the Model 92E to either the Model 921 or the Model 922 to expand their capabilities. You can attach the Model 9AE to expand the Model 9A2.

Figure 1 on page 2 provides a high-level view at the components for the DS8100 and DS8300 base models (Models 921, 922, and 9A2).

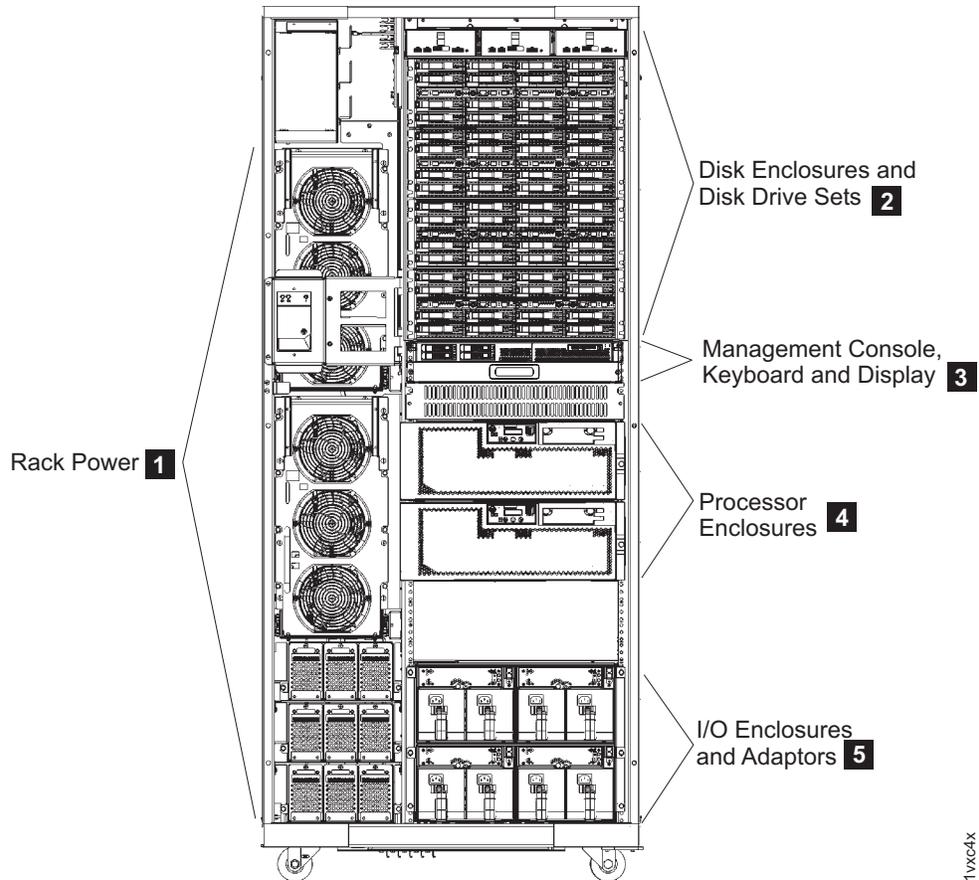
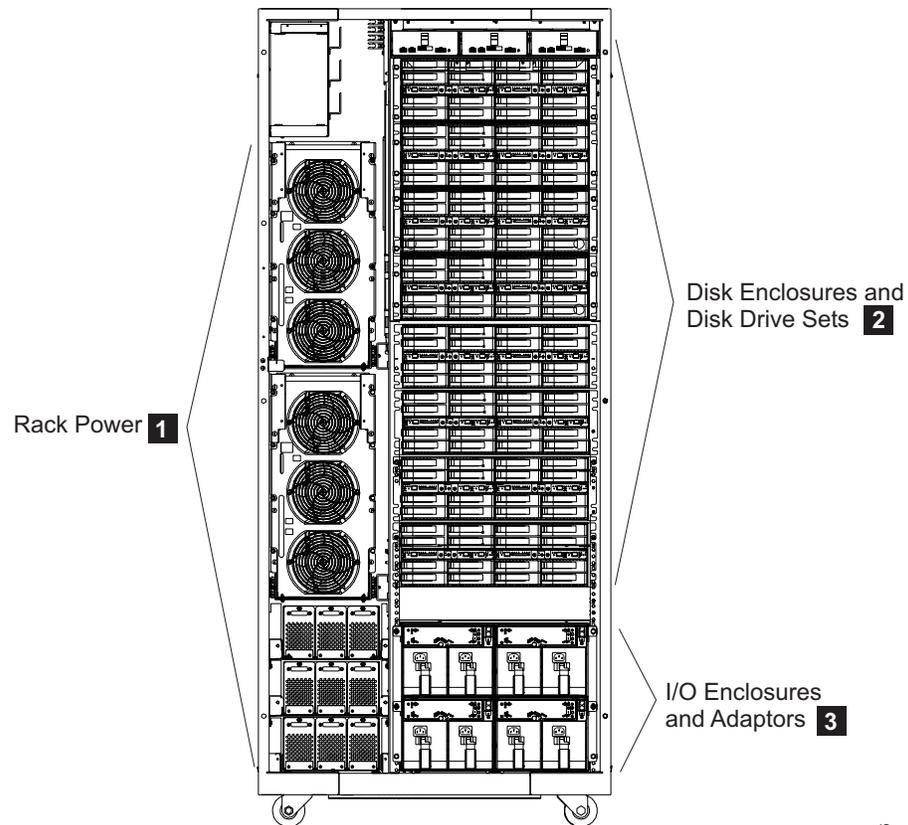


Figure 1. A base model (with front cover off) and its main components

The following notes provide additional information about the labeled components on Figure 1:

1. The rack power area of the base models provides redundant power supplies (two primary power supplies), power control cards, and backup battery assemblies to help protect data in the event of a loss of external power. Model 921 contains two batteries. Model 922 and Model 9A2 contain three batteries to support the 4-way processors.
2. All base models allow up to eight disk enclosures, which contain the disk drives. In a maximum configuration, each base model can hold up to 128 disk drives.
3. All base models contain one management console, a keyboard, and display. The management console is the focal point for configuration, copy services management, and maintenance activities.
4. All base models contain two processor enclosures. The processor enclosures contain the computer electronic complex (CEC). The Model 921 processor enclosures have 2-way processors. Processor enclosures on the Model 922 and Model 9A2 have 4-way processors.
5. All base models contain I/O enclosures and adaptors. The I/O enclosures hold the adaptors and provide connectivity between the adaptors and the processors. Both device adaptors and host adaptors are installed in the I/O enclosure.

Figure 2 on page 3 provides a high-level view at the components for the expansion models (Models 92E and 9AE).



1vxc86

Figure 2. An expansion model (with front cover off) and its main components

The following notes provide additional information about the labeled components on Figure 2:

1. The rack power area of each expansion model provides redundant power supplies (two primary power supplies) and power control cards. If the expansion unit contains I/O enclosures or the extended power line disturbance (PLD) feature, three backup battery assemblies are also installed to help protect data in the event of a loss of external power.
2. All expansion models allow up to 16 disk enclosures, which contain the disk drives. In a maximum configuration, each expansion model can hold 256 disk drives.
3. Expansion models can contain I/O enclosures and adapters if they are the first expansion units that are attached to either a Model 922 or a Model 9A2. The second expansion model in a 922 or 9A2 configuration cannot have I/O enclosures and adapters, nor can any expansion unit that is attached to a Model 921. If the expansion unit contains I/O enclosures, the enclosures provide connectivity between the adapters and the processors. The adapters contained in the I/O enclosures can be either device or host adapters.

DS8100 (Model 921)

The IBM TotalStorage DS8100, which is Model 921, offers many features.

These features include:

- Dual two-way processor complex
- Up to 128 disk drives, for a maximum capacity of 38.4 TB
- Up to 128 GB of processor memory (cache)
- Up to 16 fibre-channel/FICON or ESCON[®] host adapters

The DS8100 model can support one expansion frame. With one expansion frame, you can expand the capacity of the Model 921 as follows:

- Up to 384 disk drives, for a maximum capacity of 115.2 TB

Note: IBM service representatives can upgrade a Model 921 in the field when you order a model conversion to a Model 922 or Model 9A2.

Figure 3 shows the maximum configuration of a Model 921, which is the 921 base model plus one 92E expansion model.

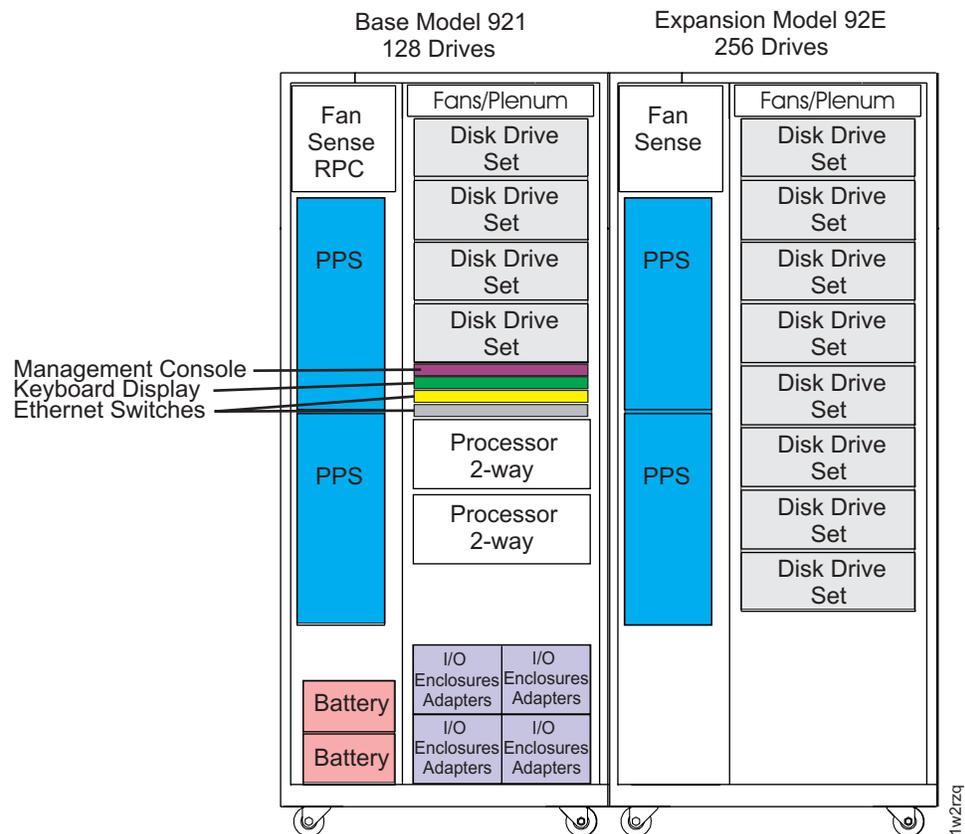


Figure 3. Maximum configuration for Model 921

DS8300 (Models 922 and 9A2)

IBM TotalStorage DS8300 models (Model 922 and Model 9A2) offer higher performance and capacity than the DS8100. The Model 9A2 also enables you to create two storage system LPARs (or images) within the same storage unit.

Both DS8300 models offer the following features:

- Dual four-way processor complex
- Up to 128 disk drives, for a maximum capacity of 38.4 TB
- Up to 256 GB of processor memory (cache)
- Up to 16 fibre-channel/FICON or ESCON host adapters

The DS8300 models can support either one or two expansion frames. With expansion frames, you can expand the Model 922 and 9A2 as follows:

- With one expansion frame, you can support the following expanded capacity and number of adapters:
 - Up to 384 disk drives, for a maximum capacity of 115.2 TB
 - Up to 32 fibre-channel/FICON or ESCON host adapters
- With two expansion frames, you can support the following expanded capacity:
 - Up to 640 disk drives, for a maximum capacity of 192 TB

Figure 4 shows the maximum configuration of a Model 922 and 9A2. Both of these models can attach up to two expansion models. Model 922 uses the 92E expansion model. Model 9A2 uses the 9AE expansion model.

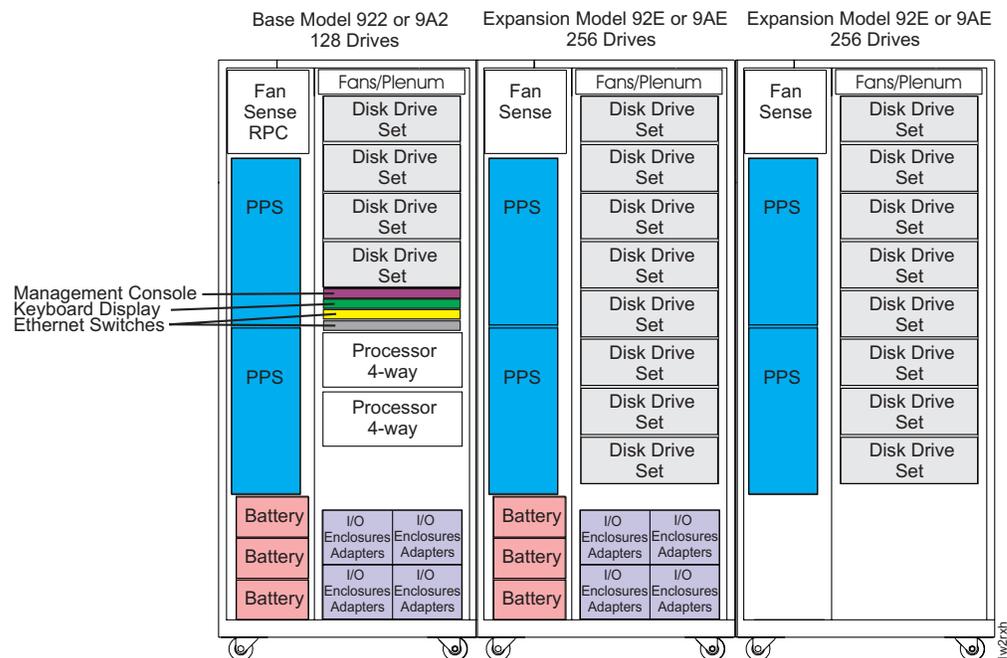


Figure 4. Maximum configuration for Models 922 and 9A2

Model comparison

DS8000 models vary on the processor types that they use, their disk capacity, and other supported features.

Table 2 compares the various supported features that are available on different DS8000 model configurations.

Table 2. DS8000 model comparison chart

Base model	Images (logical partitions)	Expansion models	Processor type	Disk drives	Processor memory	Host adapters
Model 921	1 image	None	2-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 128 GB	Up to 16 host adapters
		With 1 expansion model (92E)	2-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 128 GB	Up to 16 host adapters
Model 922	1 image	None	4-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 256 GB	Up to 16 host adapters
		With 1 expansion model (92E)	4-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 256 GB	Up to 32 host adapters
		With 2 expansion models (92E)	4-way	Up to 640 disks (maximum capacity of 192 TB)	Up to 256 GB	Up to 32 host adapters
Model 9A2	2 images	None	4-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 256 GB	Up to 16 host adapters
		With 1 expansion model (9AE)	4-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 256 GB	Up to 32 host adapters
		With 2 expansion models (9AE)	4-way	Up to 640 disks (maximum capacity of 192 TB)	Up to 256 GB	Up to 32 host adapters

Note: IBM service representatives can upgrade a Model 921 in the field when you order a model conversion to a Model 922 or a Model 9A2.

DS8000 physical footprint

The physical footprint dimensions, caster locations, and cable openings for a DS8000 unit help you plan your installation site.

Figure 5 shows the overall physical footprint of a DS8000 unit.

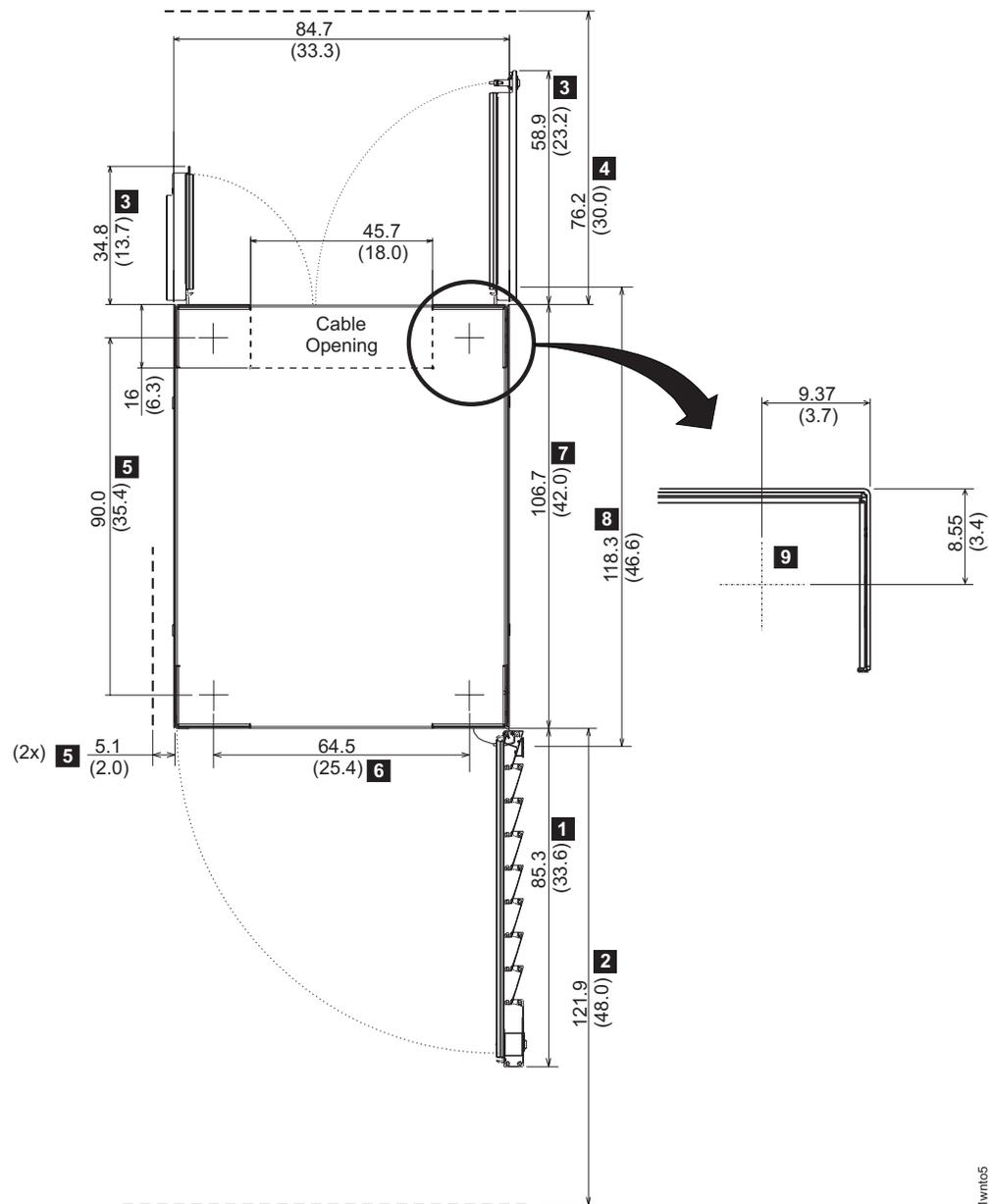


Figure 5. DS8000 physical footprint. Dimensions are in centimeters (inches).

The following dimensions are labeled on Figure 5:

1. Front cover width
2. Front service clearance
3. Back cover widths
4. Back service clearance
5. Clearance to allow front cover to open
6. Distance between casters
7. Depth of frame without covers
8. Depth of frame with covers
9. Minimum dimension between casters and outside edges of frames

DS8000 performance features

The DS8000 series is designed to provide you with high-performance, connectivity, and reliability allowing your workload to be easily consolidated into a single storage subsystem.

The following list provides an overview of some of the features that are associated with the DS8000 series:

POWER5 processor technology

The DS8000 features IBM POWER5 server technology. Depending on workload, the maximum host I/O operations per second of the DS8100 Model 921 is up to three times the maximum operations per second of the ESS Model 800. The maximum host I/O operations per second of the DS8300 Model 922 or 9A2 is up to six times the maximum of the ESS model 800.

Industry standard fibre channel disk drives

The DS8000 series offers a selection of fibre channel disk drives, including 300 GB drives, allowing a DS8100 to scale up to 115.2 TB of capacity and a DS8300 to scale up to 192 TB of capacity.

Four-port fibre channel/FICON adapters

These new adapters not only enhance connectivity, but increase configuration flexibility because the individual ports can be configured to support fibre channel or FICON.

HOST attachments

The DS8100 offers up to 16 host adapters (64 FCP/FICON ports) and the DS8300 offers up to 32 host adapters (128 FCP/FICON ports), further increasing your ability to share your disk storage.

IBM Standby Capacity on Demand

The IBM Standby Capacity on Demand (Standby CoD) offering allows the installation of inactive disk drives that can be easily activated as business needs require. With this offering, up to four Standby CoD disk drive sets (64 disk drives) can be factory or field installed into your system. To activate, you logically configure the disk drives for use—a non-disruptive activity that does not require intervention from IBM. Upon activation of any portion of the Standby CoD disk drive set, you must place an order with IBM to initiate billing for the activated set. At that time, you can also order replacement Standby CoD disk drive sets.

Online Information Center

The online Information Center is an information database that provides you the opportunity to quickly familiarize yourself with the major aspects of the DS8000 and to easily recognize the topics for which you might require more information. It provides information regarding user assistance for tasks, concepts, reference, user scenarios, tutorials, and other types of user information. Because the information is all in one place rather than across multiple publications, you can access the information that you need more efficiently and effectively.

Interfaces of the DS8000

The DS8000 provides management interfaces that contain management tools and utilities to help you increase productivity.

IBM TotalStorage DS Storage Manager

The IBM TotalStorage DS Storage Manager is a program interface that is used to perform logical configurations and Copy Services management functions.

The DS Storage Manager program is installed as a GUI (graphical mode) or as an unattended (silent mode) installation for the supported operating systems. It can be accessed from any location that has network access using a Web browser. It offers you the following choices:

Simulated configuration

You install this component on your PC or the Master Console which provides the ability to create or modify logical configurations when your storage unit is disconnected from the network. After creating the configuration, you can save it and then apply it to a network attached storage unit at a later time.

Real-time configuration

This component is preinstalled on your HMC. It provides you the ability to create logical configurations and use Copy Services features when your storage unit is attached to the network. This component provides you with real-time (online) configuration support.

DS Open application programming interface

The DS Open application programming interface (API) is a nonproprietary storage management client application that supports routine LUN management activities, such as LUN creation, mapping and masking, and the creation or deletion of RAID5 and RAID10 volume spaces. The DS Open API also enables Copy Services functions such as FlashCopy and Remote Mirror and Copy (formally known as peer-to-peer remote copy).

The IBM TotalStorage DS Open API helps integrate DS configuration management support into storage resource management (SRM) applications, which allow customers to benefit from existing SRM applications and infrastructures. The DS Open API also enables the automation of configuration management through customer-written applications. Either way, the DS Open API presents another option for managing storage units by complementing the use of the IBM TotalStorage DS Storage Manager web-based interface and the DS command-line interface.

You must implement the DS Open API through the IBM TotalStorage Common Information Model (CIM) agent, a middleware application that provides a CIM-compliant interface. The DS Open API uses the CIM technology to manage proprietary devices as open system devices through storage management applications. The DS Open API allows these storage management applications to communicate with a storage unit.

DS command-line interface

The IBM TotalStorage DS Command-Line Interface (CLI) enables open systems hosts to invoke and manage FlashCopy and Metro and Global Mirror functions through batch processes and scripts.

The command-line interface provides a full-function command set that allows you to check your storage unit configuration and perform specific application functions when necessary.

The following list highlights a few of the specific types of functions that you can perform with the DS command-line interface:

- Check and verify your storage unit configuration
- Check the current Copy Services configuration that is used by the storage unit
- Create new logical storage and Copy Services configuration settings
- Modify or delete logical storage and Copy Services configuration settings

Note: You cannot install the DS CLI on a Windows 64-bit operating system.

DS8000 hardware specifics

The DS8000 models offer a high degree of availability and performance through the use of redundant components that can be replaced while the system is operating. You can use the DS8000 models with a mix of different operating systems and clustered and nonclustered variants of the same operating systems.

Contributing to the high degree of availability and reliability are the structure of the DS8000 storage unit, the host systems it supports, and its processor memory and processor speeds.

Storage unit structure

The design of the storage unit, which contains the base model and the expansion models, contributes to the high degree of availability that is associated with the DS8000. The primary components that support high availability within the storage unit are the storage server, the processor complex, and the rack power control card.

The storage unit also has redundant fibre switches, with fibre fabric connections to both processor complexes. The entire power system at all levels is fully redundant. There are redundant private LAN networks between each storage unit and the management consoles (even if there is only one management console).

Storage unit

A storage unit consists of a storage server and two or more storage (disk) enclosures that are packaged in one or more racks with associated power supplies, batteries, and cooling.

Storage server

A storage server consists of two processor complexes, two or more I/O enclosures, and a pair of rack power control cards.

Processor complex

A processor complex controls and manages the storage unit to perform the function of the storage server. The two processor complexes form a redundant pair such that if either processor complex fails, the remaining processor complex performs all storage server functions.

Rack power control card

A redundant pair of rack power control (RPC) cards coordinate the power management within the storage unit. The RPC cards are attached to the service processors in each processor complex, the primary power supplies in each rack, and indirectly to the fan/sense cards and storage enclosures in each rack.

Multi-path subsystem device driver

The IBM TotalStorage Multi-path subsystem device driver (SDD) provides load balancing and enhanced data availability capability in configurations with more than one I/O path between the host server and the DS8000

series system. Load balancing can help reduce or eliminate I/O bottlenecks that occur when many I/O operations are directed to common devices that are using the same I/O path. The SDD also helps eliminate a potential single point of failure by automatically rerouting I/O operations when a path failure occurs, thereby supporting enhanced data availability capability.

IBM TotalStorage Management Console

The IBM TotalStorage Management Console is the focal point for configuration, copy services management, and maintenance activities.

The Management Console is a dedicated workstation that is physically located (installed) inside your DS8100 and DS8300 and can automatically monitor the state of your system, notifying you and IBM when service is required. The Management Console can also be connected to your network to enable centralized management of your system using the IBM TotalStorage DS Command-Line Interface or the storage management software that uses the IBM TotalStorage DS Open API.

To provide continuous availability of customer access to the management console functions, having a second management console is recommended. This second management console can be provided in two ways:

- **External** (outside the 2107) - This console is generally installed in the customer-provided rack. It uses the same hardware as the internal management console.
- **Internal** (a second management console that resides within a second 2107) - This console can be cabled together with the primary internal management console of the first 2107.'

Host systems that the storage unit supports

The DS8000 storage unit provides a variety of host attachments so that you can consolidate storage capacity and workloads for open-systems hosts, S/390 hosts, and eServer™ zSeries hosts.

The DS8100 Model 921 supports a maximum of 16 host adapters and 4 device adapter pairs, and the DS8300 Models 922 and 9A2 supports a maximum of 32 host adapters and 8 device adapter pairs.

You can configure the storage unit for any of the following system adapter types and protocols:

- Fibre-channel adapters, for support of fibre-channel protocol (FCP) and fibre connection (FICON®) protocol
- Enterprise Systems Connection Architecture® (ESCON) adapters

For fibre-channel attachments, you can establish zones. The zones must contain a single port that is attached to a system adapter with the desired number of ports that are attached to the storage unit. By establishing zones, you reduce the possibility of interactions between system adapters in switched configurations. You can establish the zones by using either of two zoning methods:

- Port number
- Worldwide port name (WWPN)

You can configure switch ports that are attached to the storage unit in more than one zone. This enables multiple system adapters to share access to the storage

unit fibre-channel ports. Shared access to a storage unit fibre-channel port might come from host platforms that support a combination of bus adapter types and the operating systems.

Attaching a DS8000 series to an open-systems host with fibre channel adapters

You can attach a DS8000 series to an open-systems host with fibre-channel adapters.

Fibre channel is a 1 Gbps or 2 Gbps, full-duplex, serial communications technology to interconnect I/O devices and host systems that are separated by tens of kilometers.

The IBM TotalStorage DS8000 series supports SAN connections at 1 Gbps to 4 Gbps with 2 Gbps host bus adapters. The DS8000 series negotiates automatically and determines whether it is best to run at 1 Gbps link or 2 Gbps link. The IBM TotalStorage DS8000 series detects and operates at the higher link speed.

Fibre channel transfers information between the sources and the users of the information. This information can include commands, controls, files, graphics, video, and sound. Fibre-channel connections are established between fibre-channel ports that reside in I/O devices, host systems, and the network that interconnects them. The network consists of elements like switches, bridges, and repeaters that are used to interconnect the fibre-channel ports.

Fibre-channel (SCSI-FCP) attached open-systems hosts that the storage unit supports

You can attach the DS8000 storage unit to fibre-channel (SCSI-FCP) attached open-systems hosts.

Each storage unit fibre-channel adapter has four ports. Each port has a unique worldwide port name (WWPN). You can configure the port to operate with the SCSI-FCP upper-layer protocol. Shortwave adapters and longwave adapters are available on the storage unit.

Fibre-channel adapters for SCSI-FCP support provide the following configurations:

- A maximum of 64 host ports for DS8100 Model 921 and a maximum of 128 host ports for DS8300 Models 922 and 9A2
- A maximum of 509 host logins per fibre-channel port
- A maximum of 2000 N-port logins per storage image
- Access to all 63.7KB LUNs per target (one target per host adapter), depending on host type
- Either arbitrated loop, switched fabric, or point-to-point topologies

The storage unit supports the following host systems for shortwave fibre-channel attachment and longwave fibre-channel attachment:

- IBM eServer iSeries™ servers that run an IBM OS/400® operating system
- IBM eServer i5 servers that run an IBM i5/OS™ operating system
- IBM RS/6000®, pSeries®, eServer p5, RS/6000 SP™, and pSeries SP server that run an IBM AIX operating system
- IBM zSeries servers that run the Linux™ operating system
- IBM zSeries servers that run the z/VM® operating system
- Apple Macintosh servers

- Fujitsu PRIMEPOWER servers that run the Solaris operating system
- Hewlett-Packard servers that run an HP Tru64 UNIX[®] operating system
- Hewlett-Packard servers that run an HP OpenVMS operating system
- Hewlett-Packard servers that run an HP-UX operating system
- Intel-based servers that run a Microsoft[®] Windows 2000 operating system
- Intel-based servers that run a Microsoft Windows Server 2003 operating system for both 32-bit and 64-bit configurations
- Intel-based servers that run a Novell NetWare operating system
- IBM servers that run the IBM SAN Volume Controller operating system
- IBM servers that run the IBM SAN File System operating system
- iSCSI Gateway servers that run a Microsoft Windows 2000, Microsoft Windows 2003, or UNIX operating system
- Linux servers that run a Red Hat Linux, Red Flag Linux, Asianux, and SUSE Linux operating system
- SGI servers that run an IRIX operating system
- Sun servers that run a Solaris operating system

See the Interoperability Matrix at

<http://www.ibm.com/servers/storage/disk/ds8000/interop.html> for details about types, models, adapters, and the operating systems that the storage unit supports.

ESCON-attached S/390 and zSeries hosts that the storage unit supports

You can attach the DS8000 storage unit to the ESCON-attached S/390 and zSeries hosts.

With ESCON adapters, the storage unit provides the following configurations:

- A maximum of 32 host ports for DS8100 Model 921 and a maximum of 64 host ports for DS8300 Models 922 and 9A2
- A maximum of 64 logical paths per port
- Access to 16 control-unit images (4096 CKD devices) over a single ESCON port on the storage unit
- Zero to 64 ESCON channels; two per ESCON host adapter
- Two ESCON links with each link that supports up to 64 logical paths

A DS8100 storage unit supports up to 16 host adapters that provide a maximum of 32 ESCON links per machine. A DS8300 storage unit supports up to 32 host adapters that provide a maximum of 64 ESCON links per machine.

Note: ESCON host channels limit the number of devices per channel to 1024. To fully access 4096 devices on a storage unit, it is necessary to connect a minimum of four ESCON host channels to the storage unit. You can access the devices through a switch to a single storage unit ESCON port. This method exposes four control-unit images (1024 devices) to each host channel.

The FICON bridge card in ESCON director 9032 Model 5 enables a FICON bridge channel to connect to ESCON host adapters in the storage unit. The FICON bridge architecture supports up to 16 384 devices per channel. This enables you to attach other control units or other storage units to the same host channel up to the limit that the host supports.

The storage unit supports the following operating systems for S/390 and zSeries hosts:

- Transaction Processing Facility (TPF)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA™)
- z/OS®
- z/VM
- Linux

For details about models and the operating system versions and releases that the storage unit supports for these host systems, see the *Interoperability Matrix* at <http://www.ibm.com/servers/storage/disk/ds8000/interop.html>.

FICON-attached S/390 and zSeries hosts that the storage unit supports

You can attach the DS8000 storage unit to FICON-attached S/390 and zSeries hosts.

Each storage unit fibre-channel adapter has four ports. Each port has a unique world wide port name (WWPN). You can configure the port to operate with the FICON upper-layer protocol. When configured for FICON, the fibre-channel port supports connections to a maximum of 128 FICON hosts. On FICON, the fibre-channel adapter can operate with fabric or point-to-point topologies. With fibre-channel adapters that are configured for FICON, the storage unit provides the following configurations:

- Either fabric or point-to-point topologies
- A maximum of 64 host ports for DS8100 Model 921 and a maximum of 128 host ports for DS8300 Models 922 and 9A2
- A maximum of 509 channel connections per fibre-channel port
- A maximum of 2048 logical paths on each fibre-channel port
- Access to all 32 control-unit images (8000 CKD devices) over each FICON port

Note: FICON host channels limit the number of devices per channel to 16 384. To fully access 65 280 devices on a storage unit, it is necessary to connect a minimum of four FICON host channels to the storage unit. You can access the devices through a switch to a single storage unit FICON port. This method exposes 64 control-unit images (16 384 devices) to each host channel.

The storage unit supports the following operating systems for S/390 and zSeries hosts:

- Transaction Processing Facility (TPF)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA)
- z/OS
- z/VM
- Linux

For details about models, versions of operating systems, and releases that the storage unit supports for these host systems, see the *Interoperability Matrix* at <http://www.ibm.com/servers/storage/disk/ds8000/interop.html>.

Processor memory

The DS8100 Model 921 offers up to 128 GB of processor memory and the DS8300 Models 922 and 9A2 offer up to 256 GB of processor memory. The Non-Volatile Storage (NVS) scales to the selected processor memory size, which can also help optimize performance.

Data management features

The DS8000 storage unit is designed with the following management features that allow you to securely process and access your data according to your business needs even if it is 24 hours a day and 7 days a week.

RAID

Redundant array of independent disks (RAID) is a method of configuring multiple disk drives in a storage subsystem for high availability and high performance.

The collection of two or more disk drives presents the image of a single disk drive to the system. In the event of a single device failure, data can be read or regenerated from the other disk drives in the array. With RAID implementation, the storage unit offers fault-tolerant data storage. The storage unit supports RAID implementation on the storage unit device adapters. The storage unit supports groups of disk drive modules (DDMs) in both RAID 5 and RAID 10.

RAID 5

RAID 5 is a method of spreading volume data plus data parity across multiple disk drives. RAID 5 increases performance by supporting concurrent accesses to the multiple DDMs within each logical volume.

RAID 10

RAID 10 implementation provides data mirroring from one DDM to another DDM. RAID 10 stripes data across half of the disk drives in the RAID 10 configuration. The other half of the array mirrors the first set of disk drives. In some cases, RAID 10 offers faster data reads and writes than RAID 5 because it does not need to manage parity. However, with half of the DDMs in the group used for data and the other half used to mirror that data, RAID 10 disk groups have less capacity than RAID 5 disk groups.

Arrays across loops

The arrays across loops helps prevent data loss.

The storage unit provides arrays across loops on open-systems, S/390, and zSeries hosts. For RAID 10, arrays across loops provides mirroring across two loops, which prevents loss of the array during loop failure.

Storage System LPARs (logical partitions)

The DS8300 Model 9A2 exploits LPAR technology, allowing you to run two separate storage server images.

Each Storage System LPAR has access to:

- 50 percent of the processors
- 50 percent of the processor memory

- Up to 16 host adapters
- Up to 320 disk drives (up to 96 TB of capacity)

With these separate resources, each Storage System LPAR can run the same or different versions of microcode, and can be used for completely separate production, test, or other unique storage environments within this single physical system. This may enable storage consolidations where separate storage subsystems were previously required, helping to increase management efficiency and cost effectiveness.

Copy Services

Copy Services is a collection of functions that provides disaster recovery, data migration, and data duplication functions. Copy Services runs on the IBM TotalStorage DS8000 storage unit and supports open systems and zSeries environments.

Many design characteristics and advanced functions of the DS8000 contribute to protection of your data. DS8000 has a number of advanced Copy Services functions that are part of the IBM TotalStorage Resiliency family. These functions are supported also on the previous generation of storage systems called the IBM TotalStorage Enterprise Storage Server (ESS).

Copy Services include the following types of functions:

- FlashCopy, which is a point-in-time copy function
- Remote mirror and copy functions (previously known as Peer-to-Peer Remote Copy or PPRC), which includes:
 - IBM TotalStorage Metro Mirror (previously known as Synchronous PPRC)
 - IBM TotalStorage Global Copy (previously known as PPRC Extended Distance)
 - IBM TotalStorage Global Mirror (previously known as Asynchronous PPRC)
- z/OS Global Mirror (previously known as Extended Remote Copy [XRC])

You can manage Copy Services functions through a command-line interface called the IBM TotalStorage DS CLI and a new Web-based interface called the IBM TotalStorage DS Storage Manager. The DS Storage Manager allows you to set up and manage the following types of data-copy functions from any point from which network access is available:

FlashCopy

The FlashCopy feature enables you to create full volume copies of data.

When you set up a FlashCopy operation, a relationship is established between source and target volumes, and a bitmap of the source volume is created. Once this relationship and a bitmap are created, the target volume can be accessed as though all the data had been physically copied. While a relationship between the source and target volume exists, a background process copies the tracks from the source to the target volume.

FlashCopy is an optional function. To use it, you must purchase the point-in-time 2244 function authorization model, which is 2244 Model PTC.

Remote Mirror and Copy

The remote mirror and copy feature is a flexible data mirroring technology that allows replication between volumes on two or more disk storage systems. You can also use this feature for data backup and disaster recovery.

Remote mirror and copy is an optional function. To use it, you must purchase the remote mirror and copy 2244 function authorization model, which is 2244 Model RMC.

DS8000 storage units can participate in remote mirror and copy solutions with the ESS Model 750, ESS Model 800, and DS6000 storage units.

The remote mirror and copy feature can operate in the following modes:

Metro Mirror

Provides real-time mirroring of logical volumes between two DS8000s that can be located up to 300 km from each other. It is a synchronous copy solution where write operations are completed on both copies (local and remote site) before they are considered to be completed.

Global Copy

Copies data nonsynchronously and over longer distances than is possible with Metro Mirror. When operating in Global Copy mode, the source volume sends a periodic, incremental copy of updated tracks to the target volume instead of a constant stream of updates. This causes less impact to application writes for source volumes and less demand for bandwidth resources, while allowing a more flexible use of the available bandwidth.

Global Mirror

Provides a long-distance remote copy feature across two sites using asynchronous technology. Global Mirror operations provide the following benefits:

- Support for virtually unlimited distance between the local and remote sites, with the distance typically limited only by the capabilities of the network and the channel extension technology. This "unlimited" distance enables you to choose your remote site location based on business needs and enables site separation to add protection from localized disasters.
- A consistent and restartable copy of the data at the remote site, created with minimal impact to applications at the local site.
- Data currency where, for many environments, the remote site lags behind the local site on an average of 3 to 5 seconds, minimizing the amount of data exposure in the event of an unplanned outage. The actual lag in data currency that you experience can depend upon a number of factors, including specific workload characteristics and bandwidth between the local and remote sites.
- Dynamic selection of the desired recovery point objective, based upon business requirements and optimization of available bandwidth.
- Session support whereby data consistency at the remote site is internally managed across up to eight DS8000 machines that are located across the local and remote sites.
- Efficient synchronization of the local and remote sites with support for failover and failback modes, helping to reduce the time that is required to switch back to the local site after a planned or unplanned outage.

z/OS Global Mirror

The z/OS Global Mirror function mirrors data on the storage unit to a

remote location for disaster recovery. It protects data consistency across all volumes that you have defined for mirroring. The volumes can reside on several different storage units. The z/OS Global Mirror function can mirror the volumes over several thousand kilometers from the source site to the target recovery site. DS8000 storage complexes support z/OS Global Mirror only on zSeries hosts.

With z/OS Global Mirror, you can suspend or resume service during an outage. You do not have to end your current data-copy session. You can suspend the session, then restart it. Only data that changed during the outage needs to be resynchronized between the copies.

The z/OS Global Mirror function is an optional function. To use it, you must purchase the remote mirror for z/OS 2244 function authorization model, which is 2244 Model RMZ.

z/OS Metro/Global Mirror (3-site z/OS Global Mirror and Metro Mirror)

This mirroring capability uses z/OS Global Mirror to mirror primary site data to a location that is a long distance away and also uses Metro Mirror to mirror primary site data to a location within the metropolitan area. This enables a z/OS 3-site high availability and disaster recovery solution for even greater protection from unplanned outages.

The z/OS Metro/Global Mirror function is an optional function. To use it, you must purchase both of the following functions:

- Remote mirror for z/OS (2244 Model RMZ)
- Remote mirror and copy function (2244 Model RMC) for both the primary and secondary storage units

FlashCopy

The IBM TotalStorage FlashCopy feature provides a point-in-time copy capability for logical volumes. FlashCopy creates a physical point-in-time copy of the data, with minimal interruption to applications, and makes it possible to access immediately both the source and target copies.

The primary objective of FlashCopy is to create a copy of a source volume on the target volume. This copy is called a point-in-time copy. When you initiate a FlashCopy operation, a FlashCopy relationship is created between the source volume and target volume. A FlashCopy relationship is a "mapping" of a FlashCopy source volume and a FlashCopy target volume. This mapping allows a point-in-time copy of the source volume to be copied to the target volume. The FlashCopy relationship exists between the volume pair from the time that you initiate a FlashCopy operation until the DS8000 copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is a persistent FlashCopy.

The point-in-time copy that is created by FlashCopy is typically used when you need a copy of the production data to be produced with minimal application downtime. It can be used for online back up, testing of new applications, or for creating a database for data-mining purposes. The copy looks exactly like the original source volume and is an instantly available, binary copy.

FlashCopy supports the following copy options:

Data Set FlashCopy

Data Set FlashCopy allows a FlashCopy of a data set in a zSeries environment.

Multiple relationship FlashCopy

Multiple relationship FlashCopy allows a source to have FlashCopy relationships with multiple targets simultaneously. This flexibility allows you to establish up to 12 FlashCopy relationships on a given logical unit number (LUN), volume, or data set, without needing to first wait for or cause previous relationships to end.

Refresh target volume (also known as incremental FlashCopy)

Refresh target volume provides the ability to "refresh" a LUN or volume involved in a FlashCopy relationship. When a subsequent FlashCopy operation is initiated, only data that updates the target and the source to the same point-in-time state is copied. The direction of the "refresh" can also be reversed. The LUN or volume that was defined as the target can now become the source for the LUN or the volume that was defined as the source (now the target).

Persistent FlashCopy

Persistent FlashCopy allows the FlashCopy relationship to remain even after the FlashCopy operation completes. You must explicitly delete the relationship.

Establish FlashCopy on existing Remote Mirror and Copy source

The establish FlashCopy on an existing Remote Mirror and Copy source volume option allows you to establish a FlashCopy relationship where the target volume is also the source of an existing remote mirror and copy source volume. This enables you to create full or incremental point-in-time copies at a local site and then use remote mirroring commands to copy the data to the remote site.

This feature is represented by the **Establish target on existing Metro Mirror source** selection in the GUI.

Consistency group commands

Consistency group commands allow the DS8000 to freeze I/O activity to a LUN or volume until you issue the FlashCopy consistency group command. Consistency groups help create a consistent point-in-time copy across multiple LUNs or volumes, and even across multiple DS8000 systems. This function is available through the use of command-line interface commands.

Inband commands over remote mirror link

In a remote mirror environment, inband commands are issued to a source volume of a remote mirror and copy volume pair on a local storage unit and sent across paths (acting as a conduit) to a remote storage unit to enable a FlashCopy pair to be established at the remote site. This eliminates the need for a network connection to the remote site solely for the management of FlashCopy. This function is available through the use of command-line interface commands.

Disaster recovery using Copy Services

One of the main reasons for using Copy Services functions is in preparation for a possible disaster by backing up, copying, and mirroring your data at the production and recovery sites.

You can create a disaster recovery solution using any of the following functions. These functions help improve a disaster recovery process by allowing a much shorter recovery time with little or no data loss.

Note: In a remote mirror and copy environment, when two storage units are set up in two geographically distinct locations, we refer to the sites as Site A (the production site) and Site B (the recovery site).

Failover and failback operations

A failover is the process of temporarily switching production to a backup facility (normally your recovery site) following a planned outage, such as a scheduled maintenance period or an unplanned outage, such as a disaster. A failback operation is the process of returning production to its original location. These operations use remote mirror and copy functions to help reduce the time that is required to synchronize volumes after sites are switched during planned or unplanned outages.

Global Mirror

The Global Mirror function provides a two-site extended distance remote copy option for disaster recovery and backup solution for the zSeries and open systems environments. This solution is based on existing Global Copy and FlashCopy functions. With Global Mirror, the data that the host writes to the storage unit at the production site is asynchronously shadowed to the storage unit at the recovery site. Global Mirror operates over high-speed, Fibre Channel communication links and is designed to maintain a consistent and restartable copy of data at a recovery site that can be located at virtually unlimited distance from the production site.

Comparison of licensed functions

A key decision that you must make in planning for a disaster is deciding which licensed functions to use to best suit your environment.

Table 3 provides a brief summary of the characteristics of the Copy Services features that are available for the storage unit.

Table 3. Comparison of licensed functions

Licensed function	Description	Advantages	Considerations
Metro Mirror	Synchronous data copy at a distance	No data loss, rapid recovery time for distances up to 300 km.	Slight performance impact.
Global Copy	Continuous copy without data consistency	Nearly unlimited distance, suitable for data migration, only limited by network and channel extenders capabilities.	Copy is normally fuzzy but can be made consistent through synchronization.
Global Mirror	Asynchronous copy	Nearly unlimited distance, scalable, and low recovery point objective (RPO). The RPO is the time needed to recover from a disaster; that is, the total system downtime.	RPO might grow when link bandwidth capability is exceeded.

Table 3. Comparison of licensed functions (continued)

Licensed function	Description	Advantages	Considerations
z/OS Global Mirror	Asynchronous copy controlled by z/OS host software	Nearly unlimited distance, highly scalable, and very low RPO.	Additional host server hardware and software is required. The RPO might grow if bandwidth capability is exceeded or host performance might be impacted.

Parallel Access Volumes

The use of parallel access volumes (PAVs) enables a single zSeries server to simultaneously process multiple I/O operations to the same logical volume, which can help to significantly reduce device queue delays. This is achieved by defining multiple addresses per volume.

With dynamic parallel access volumes, the assignment of addresses to volumes is automatically managed to help the workload meet its performance objectives and minimize overall queuing.

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

The storage unit supports concurrent or parallel data transfer operations to or from the same volume from the same system or system image for S/390 or zSeries hosts. An S/390 with PAV software support enables multiple users and jobs to simultaneously access a logical volume. Read and write operations can be accessed simultaneously to different domains. (The domain of an I/O operation is the specified extents to which the I/O operation applies.)

DS8000 limitations

The following list describes known limitations for the DS8000.

- The 65,520 cylinder 3390 volume is not supported with z/OS Global Mirror and z/OS Metro/Global Mirror.
- The amount of physical capacity within a 2107 system that can be logically configured for use will be enforced by the 2107 licensed machine code (LMC) to maintain compliance with the extent of IBM authorization established for licensed functions activated on the machine. The 2107 LMC will not allow the logical configuration of physical capacity beyond the extent of IBM authorization (except when activating Standby CoD capacity).
- The deactivation of an activated licensed function, or a lateral change or reduction in the license scope, is a disruptive activity and requires a machine IML (Model 921 and Model 922) or reboot of the affected image (Model 9A2). A lateral change is defined as changing the license scope from fixed block (FB) to count key data (CKD) or from CKD to FB. A reduction is defined as changing the license scope from all physical capacity (ALL) to only FB or only CKD capacity.
- The following activities are disruptive:

- Model conversions. In addition, data may not be preserved during the model conversion.
- Field attachment of the first Model 92E expansion unit to a Model 922.
- Field attachment of the first Model 9AE expansion unit to a Model 9A2.
- Removal of an expansion unit model from the base unit model. Data may not be preserved during this activity.
- Some DS8000 functions are not available or supported in all environments. You can find current information about supported environments, prerequisites, and minimum operating systems levels at the following IBM Web site:
<http://www.ibm.com/servers/storage/disk/ds8000/interop.html>

Planning data migration

The planning and methods of data migration for the DS8000 vary by environment. The DS8000 supports over 90 operating systems. You can migrate data to a storage unit from these host and operating system environments.

When you plan for data migration, consider the following factors:

Note: The following lists do not cover every possibility. They provide a high-level view of some of the tools and factors that you can consider when moving data.

- The system:
 - Is it UNIX based? You will probably use some variation of a logical volume manager.
 - Is it a zSeries or S/390? You will probably use IBM® TotalStorage® Global Mirror, Remote Mirror and Copy (when available).
 - Is it z/OS? You will probably use DFDSS, though there are many choices.
 - Is it VM? You might use DASD Dump Restore or PTAPE.
 - Is it VSE? You might use the VSE fastcopy or ditto commands.

Your system administrator selects the data migration method that is the best compromise between efficiency and impact on the users of the system.
- The storage unit:
 - Are the storage units involved the same with the same level of licensed management code?
 - Are the storage units different? In which case you want to ensure that the new configuration is large enough to accommodate the existing data. You also want to ensure that the virtual disks are similar in configuration to the disk drives that they are replacing.
- Time and complexity involved:
 - Typically data migration requires that updates or changes cease while the movement occurs. Also, depending on the amount of data that you are moving and your migrating method, data could be unavailable for an extended period of time, perhaps several hours.
 - Could the complexity and time involved require the services of IBM through International Global Services? Contact your IBM representative for more information.

How to select a data migration method

Your system administrator selects the data migration method that is the best compromise between efficiency and impact on the users of the system.

Most methods of data migration affect the everyday operation of a computer system. When data is moved, the data must be in a certain state, typically requiring that updates or changes cease while the movement occurs. Depending on the amount of data that you are moving and your migrating method, data could be unavailable for an extended period of time, perhaps several hours. The following factors might contribute to the migration time:

- Creating new logical volumes or file systems
- Modifying configuration files
- Receiving integrity checks

The following items are more than likely among the topics considered by your system administrator to determine the best method to use to migrate your data:

- Management software provides simple robust methods that you can generally use during production without disturbing users.
- The AIX logical volume manager (LVM) provides methods that you can use at any time without disrupting user access to the data. You might notice a small performance degradation, but this is preferable to shutting down databases or requiring users to log off the system.

Notes:

- AIX and HP-UX 11.xx ship with logical volume management (LVM) software as part of the base operating system. LVM provides complete control over all disks and file systems that exist on an AIX system. HP-UX has similar volume management software.
- Sun Microsystems has a basic volume management product called Solstice, which is available for the Solaris systems.
- Linux systems also use the LVM.
- Methods that use backup and restore procedures generally have the most impact on the system usage. They require that databases and file systems be in quiescent states to ensure a valid snapshot of the data.

Chapter 2. Introduction to IBM TotalStorage DS Open API

This chapter provides the following information about the IBM TotalStorage DS Open Application Programming Interface (API), Common Information Model (CIM) standards, and CIM agent installation:

- DS Open API overview
- CIM agent overview
- CIM agent components
- CIM concepts
- CIM agent installation requirements
- CIM agent installation methods
- CIM agent security

DS Open API overview

The IBM TotalStorage DS Open API is a nonproprietary storage management client application that supports routine LUN management activities, such as LUN creation, mapping and masking and the creation or deletion of RAID-5 and RAID-10 volume spaces. It also enables Copy Services configuration and use activities, such as FlashCopy, Metro Mirror (PPRC), and Global Mirror (formerly Asynchronous PPRC). The DS Open API supports these activities through the use of the Storage Management Initiative Specification (SMIS), as defined by the Storage Networking Industry Association (SNIA). For more information about Copy Services FlashCopy, Metro Mirror, and Global Mirror, see the *IBM TotalStorage DS8000 Information Center*.

The DS Open API helps integrate configuration management support into storage resource management (SRM) applications, which allow customers to benefit from existing SRM applications and infrastructures. The DS Open API also enables the automation of configuration management through customer-written applications. Either way, the DS Open API presents another option for managing storage units by complementing the use of the IBM TotalStorage DS Storage Manager web-based interface and the IBM TotalStorage DS Command-Line Interface.

You must implement the DS Open API through the IBM TotalStorage Common Information Model (CIM) agent, a middleware application that provides a CIM-compliant interface. The DS Open API uses the CIM technology to manage proprietary storage units as open system storage units through storage management applications. The DS Open API allows these storage management applications to communicate with your storage unit.

The DS Open API supports the IBM TotalStorage DS8000, IBM TotalStorage DS6000, and the IBM TotalStorage Enterprise Storage Server. It is available for the AIX, Linux, and Windows 2000 (or later), operating system environments and must be used on storage units having fibre ports.

CIM agent overview

A Common Information Model (CIM) agent provides a means by which a device can be managed by common building blocks rather than proprietary software. If a device is CIM-compliant, software that is also CIM-compliant can manage the device. Vendor applications can benefit from adopting the common information

model because they can manage CIM-compliant devices in a common way, rather than using device-specific programming interfaces. Using CIM, you can perform tasks in a consistent manner across devices and vendor applications.

A CIM agent consists of the components shown in Figure 6. The main components are the CIM object manager (CIMOM), the service location protocol (SLP), and the device provider. A device can be a storage server such as your IBM TotalStorage storage unit. The CIM agent registers itself with the SLP Service Agent (SLP SA) to enable discovery by the Client application. The SLP DA is a directory service daemon that a client application calls to locate the CIM Object Manager. The client application and the CIMOM communicate through CIM Messages. The CIMOM and device provider communicate through method calls made from the CIMOM to the provider. The device provider communicates with the device through proprietary calls.

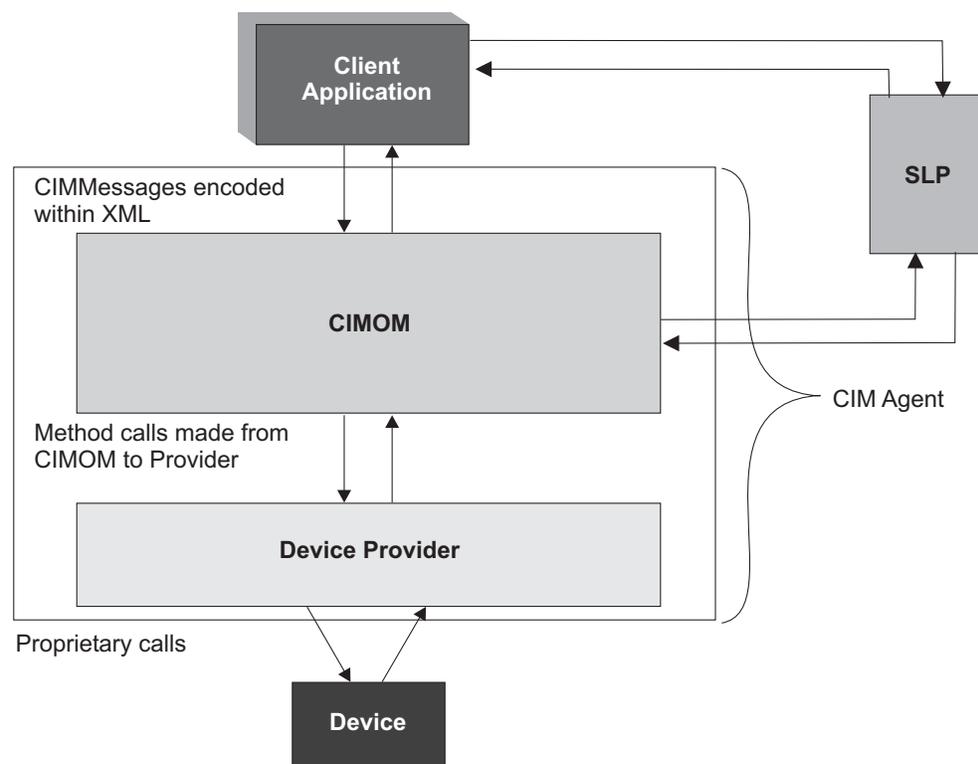


Figure 6. How a CIM agent works

The CIMOM supports the following specifications and standards:

- *Distributed Management Task Force (DMTF) Specification for CIM Operations over HTTP, Version 1.0*
- *Common Information Model (CIM) Specification, Version 2.2*
- *Storage Networking Industry Association (SNIA) Storage Management Initiative (SMI) Specification and the Shared Storage Model, a framework for describing storage architectures, Version 1.0.2*

Conformance to these specifications allows a CIM agent to act as an open-system standards interpreter, allowing other CIM-compliant storage resource management applications (IBM and non-IBM) to interoperate with each other.

When you have installed, configured, and enabled the CIM agent on a host server or an administrator's workstation within your network, that host server or workstation can communicate with your storage unit through the CIM agent. This allows CIM-compliant applications like the DS Open API to manage the data on your storage unit.

CIM agent components

The following list describes the components of a CIM agent:

client application

A storage management API that initiates a request to a device or a data storage unit such as an IBM TotalStorage storage unit

CIM agent

An agent that interprets open-system data as it is transferred between the API and a device or a storage unit.

service location protocol (SLP)

SLP DA is a directory service that a client application calls to locate the CIM Object Manager. SLP SA is a service agent to allow discovery by a client application.

CIM object manager (CIMOM)

A common conceptual framework for data management. Receives, validates, and authenticates client application requests, and then directs requests to the appropriate functional component or to a device provider.

storage unit provider

A storage unit-specific handler that receives client application requests that are destined for its device or storage unit.

storage unit (also known as a storage server)

The final destination of a client application request and the processor of the request.

CIM concepts

The common information model (CIM) is an open approach to the management of systems and networks. The CIM provides a common conceptual framework applicable to all areas of management including systems, applications, databases, networks, and devices. The CIM specification provides the language and the methodology used to describe management data.

The CIM defines a set of classes with properties and associations which in turn provide a conceptual framework. The framework enables the organization of data for a specific managed environment, such as data storage. CIM Schema 2.8 for Managing a Storage Array provides information about enabling management applications to manage data in a common way.

The CIM standards and the DMTF specification provide information about Web-based enterprise management (WBEM) operations over HTTP.

When the CIMOM first starts, it registers itself to the SLP and provides information about its location (IP address and port) and the type of service it provides. A client application finds the location of the CIMOM by calling an SLP directory service. After obtaining this information, the client application opens direct communication with the CIMOM.

A client sends requests to a CIMOM in the context of a CIM model. The model is defined by the CIM schema and loaded into the repository of the CIMOM. Figure 7 shows how the schema is loaded into the data store of the CIMOM. The managed object format (MOF) compilation and creation of the data store is managed automatically during installation.

As requests arrive, the CIMOM validates and authenticates each request. Requests are either directed to the appropriate functional component of the CIMOM or directed to a device-specific handler called a provider.

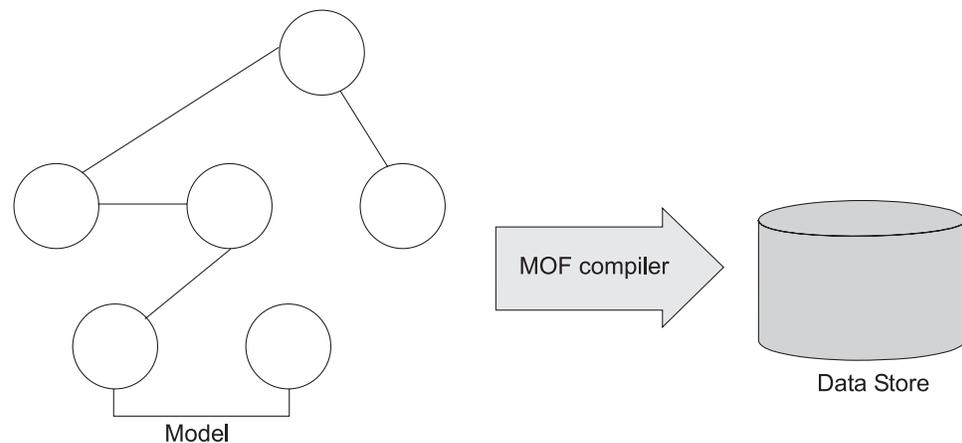


Figure 7. The MOF compiler stores the model in the CIMOM data store.

A provider makes device-unique programming interface calls on behalf of the CIMOM to satisfy a client application request. Such requests generally map a CIM request to the propriety programming interface for a device. A request to get an instance of a class or a property of an instance, for example, might be directed to a provider and a provider might make one or many requests of a device using the unique API for the device. Figure 6 on page 26 shows the communication structure between the device and the client application.

CIM agent installation requirements

Ensure that your system satisfies the following prerequisites for installing the CIM agent on a Windows 2000 or later, AIX, or Linux operating system before you start the installation.

- If you are managing ESS storage units, you must install the ESS command-line interface (CLI) on your operating system *before* you install the CIM agent. The CIM agent installation program checks for the existence of the ESS CLI, and if it is not detected, the installation will complete successfully, but you will **not** be able to manage ESS storage units.

ESS CLI installation is unique for each operating system. See the appropriate chapter in the *IBM TotalStorage Enterprise Storage Server Command-Line Interfaces User's Guide* for the instructions for installing the ESS CLI for your operating system.

Note: If you are managing DS storage units and not managing ESS storage units you do not need to install the ESS CLI or the DS CLI.

- If you are installing a version of the CIM agent that coexists with another version, it must be installed on a separate host system. A storage unit should only be managed by one CIM agent and possibly a backup CIM agent to avoid the double counting of resources.

Hardware

The following hardware is required:

- Personal computer, workstation, or server with Intel® Pentium® III or higher processor (Linux and Windows only)
- CD-ROM drive
- Video graphics adapter display or better

Workstation space

The following space on your workstation is required:

- 1 gigabyte (GB) of random-access memory (RAM) minimum depending on your system configuration
- 1 gigabyte disk space minimum

Note: You might need to increase the total available disk space on your hard drives if the CIM agent and other associated products are split between more than one logical drive. Also, the CIM agent might require additional memory to operate if you configure it to manage many storage units or storage units with large configurations.

- 1 gigahertz processor speed minimum
- Up to 50 megabytes (MB) of temporary disk space for installation purposes

Software

The following software is required:

- Operating systems:
 - Windows 2000 or later
 - AIX 5.1 or later
 - Linux Advanced Server 3.0
- If you are managing ESSs, ESS CLI level 2.4.0.236 is required. This software is on the *ESS CLI* CD.
- Common Information Model (CIM) agent. This software is on the CIM agent CD.
- Transmission Control Protocol/Internet Protocol (TCP/IP)
- Adobe Acrobat Reader version 4.0 or later

You need the Adobe Acrobat Reader to read License Agreement and product information from the CIM agent for the DS Open API LaunchPad. You can download the Adobe Acrobat Reader from the following Web site:

- <http://www.adobe.com/support/downloads/main.html>

CIM agent installation methods

You can choose to install the CIM agent in graphical mode or in unattended mode. In graphical mode, an installation wizard guides you through the installation. In unattended mode, also known as silent mode, you customize a response file and issue a command to run an unattended installation.

Note: You cannot use the `-console` parameter with the installation executable to run the installation in an interactive console mode. If your system does not support the graphical mode, you must use the unattended installation mode.

Follow the instructions in the section of the installation chapter appropriate for your operating system.

CIM agent security

The CIM agent can operate in both secure and unsecure modes.

Secure mode

All requests between the client application and the CIMOM are XML encoded requests sent over Hypertext Transfer Protocol (HTTP) or HTTP over Secure Sockets Layer (SSL). The CIMOM, upon receiving a request, parses the request and processes it. Responses, when they are returned to the client application, are transformed into XML-encoded CIM status and returned in HTTP responses to the client. The default of the CIM agent is to run in secure mode using SSL.

Unsecure mode

Some vendor software might not be capable of communicating with the CIM agent in a secure mode. You can still use this vendor software by configuring the CIM agent to run with only basic user name and password security. See the configuration instructions for your operating system for the instructions for configuring the CIM agent for this less secure mode.

Chapter 3. CIM agent for AIX

This chapter includes an overview of the installation process and instructions for installing and configuring the CIM agent on an IBM AIX® operating system.

Installation overview for AIX

This section provides an overview and instructions for installing and configuring the CIM agent on the AIX operating system. You should have some knowledge of how to administer your AIX operating system before you begin to install the CIM agent. You should also become familiar with the command explanations that you use to install and configure the CIM agent.

The following list of installation and configuration tasks are discussed in the order in which they should be performed:

1. Before you install the CIM agent on an AIX operating system, verify the hardware and software requirements.
2. If you are managing ESS storage units, you must install the prerequisite ESS CLI level 2.4.0.236 software. The ESS CLI must be installed first because the CIM agent sets the path information in shell scripts for you based on the location of the ESS CLI. The CIM agent installation wizard checks your system for the existence of the ESS CLI, and the wizard displays a warning message if ESS CLI is not installed. For ESS CLI installation instructions, see the *IBM TotalStorage Enterprise Storage Server Command-Line Interfaces User's Guide*.
Attention: If you are upgrading from a previous version of the CIM agent, you must upgrade the ESS CLI software to the new required level, which is a minimum level of 2.4.0.236.
3. You can choose to install the CIM agent either in graphical mode with the help of a wizard or in unattended mode (also known as silent mode), which involves customizing a response file and issuing a command. If your system does not support the graphical mode you cannot use the `-console` parameter for the executable file to run the installation in an interactive console mode. You must use the unattended installation mode.
4. Verify the CIM agent AIX installation.
5. Configure the CIM agent for AIX. You might want to revisit the configuration section in the future as you add, change, or delete CIMOM authentication and storage unit information.
6. Verify the connection to your storage unit.
7. Optionally, remove the CIM agent. You must perform this optional task only if you get errors during installation verification or if the CIM agent did not set the environment variables.

Mounting the CD on AIX

This section provides instructions about how to mount a CD.

1. Log on as a user with root authority.
2. Create a mount point or choose an existing mount point.

To create a mount point called `/cdrom`, type the following command:

```
# mkdir /cdrom
```

3. Type the following command to mount the CD file system at the desired mount point:

```
# mount -o ro -v cdrfs /dev/cd0 /cdrom
```

4. Change the current directory to the mount point for the CD drive in the AIX subdirectory. For example, if the CD was mounted at the /cdrom mount point, type the following command:

```
# cd /cdrom/AIX
```

Installing the CIM agent on AIX in graphical mode

This section includes the steps to install the CIM agent in your AIX environment using the graphical mode.

You must satisfy all prerequisites before you begin the CIM agent installation.

You can choose to install the CIM agent in graphical mode with the help of an installation wizard or in unattended (silent) mode, which involves customizing a response file and issuing a command. If you want to install the CIM agent in graphical mode, continue with this section. Before you install the CIM agent on AIX, verify that your system meets the hardware and software requirements. After the completion of either kind of installation, you must verify the installation of the CIM agent.

Follow these steps to install the CIM agent.

Note: If you do not have a graphical interface you cannot use the graphical installation mode. You must use the unattended installation mode. If you receive a system message suggesting you try running the installer with the `-console` parameter to run an interactive console mode installation, you **must** use the unattended installation mode.

1. Log on as a user with root authority.
2. You can run the wizard from either the main console or from a remote X server (another UNIX machine or a PC running an X emulator). If you run it from a remote X server, perform the following steps prior to running the wizard:
 - a. Set the `DISPLAY` variable to `hostname:displaynumber.screennumber` where:

hostname

The host name of the platform on which the X server runs and from which the wizard starts.

displaynumber

Use the number 0 if the X server controls more than one keyboard and monitor unit, for instance, a network of X terminals.

screennumber

This specifies which monitor to use in a multiple monitor setup.

```
<hostname>:<displaynumber.screennumber>
```

Note: If you logged on as a root user from the AIX main console, you do not need to perform the next two substeps because the correct settings are automatically set. However, if you did *not* log on as a root user, you must manually specify these settings under the following circumstances:

- 1) If you log on as a nonroot user, switch to the root user (depending on the profile of the root user).

- 2) If you log on using another computer (another UNIX machine or a PC running an X emulator), referred to as an X server, you must properly set the DISPLAY environment variable. Because the X server is acting as a graphical terminal for a UNIX (in this case AIX) computer through a special protocol, the application running on the AIX operating system must know the host name (or IP address), display and screen number (normally 0) of the machine acting as the X server. You make this information available to the application setting the DISPLAY environment variable. The command for this is:

```
export DISPLAY=x_server_hostname:displaynumber.  
screennumber
```

The X server (if it is a UNIX machine) must be configured to allow clients running on remote hosts to access it, using the **xhost** command. The form, **xhost +**, enables any graphical application running on any machine to use the X server. Or you can use a more restrictive command, such as **xhost aix_name_or_ip**, instead.

- b. Run the following command to enable any graphical application running on any host to make connections to the X server.

```
# xhost +
```

3. The CIM agent installation in graphical mode begins with a LaunchPad facility to launch the installation program wizard. The LaunchPad facility provides links for you to view various text files, such as the product overview, product readme, post installation tasks, and various Adobe Acrobat files, such as these installation instructions, product license agreement, and a browser link to the IBM storage product technical support page.

This installation guide and license agreement are in Adobe Acrobat file format (.pdf). In order for the LaunchPad to provide links to the Adobe Acrobat files, your system *must* have Adobe Acrobat Reader installed. In order for the browser to link to the IBM storage product technical support page, you *must* have a browser installed on your system where you start the LaunchPad facility.

If you wish to use the LaunchPad facility links to view the Adobe Acrobat files, you must have the Adobe Acrobat Reader bin location in your PATH environment variable. You can verify this by running the following command:

```
echo $PATH
```

Locate the Adobe Acrobat Reader bin location in the PATH, for example, `usr/lpp/Acrobat5/bin`. If the Adobe Acrobat Reader bin location is not in the environment path, you can set it by typing the following command:

```
export PATH=$PATH:/usr/lpp/Acrobat5/bin
```

where `/usr/lpp/Acrobat5/bin` is the location of the Adobe Acrobat Reader bin directory.

4. Run the wizard launcher, `launchpad_aix`, from the AIX directory of the CD by typing the following command:

```
# ./launchpad_aix
```

This will start the CIM agent LaunchPad, a small program that launches the wizard.

5. Choose from the following options in the LaunchPad window:

CIM Agent overview

Offers information about the CIM agent.

Readme file

Offers any last minute product information that did not make it into the installation guide.

Installation guide

Offers instructions on how to install the CIM agent.

License agreement

Offers information about the license of the CIM agent.

CIM Agent Web site

Offers information from the product Web site.

MOF Documentation

Offers information about MOF documentation.

Installation wizard

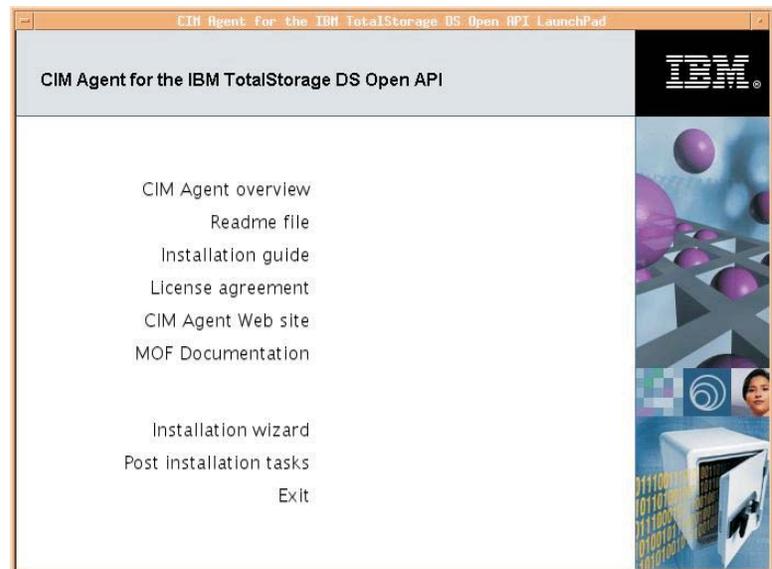
Starts the CIM agent installation program.

Post installation tasks

Offers information about configuring the users and storage unit communications.

Exit Exits the LaunchPad program.

The LaunchPad window remains open (behind the wizard) during the installation. You can access product information after the installation has started. The LaunchPad returns to the foreground when the installation is complete. You can click **Exit** to close the LaunchPad.



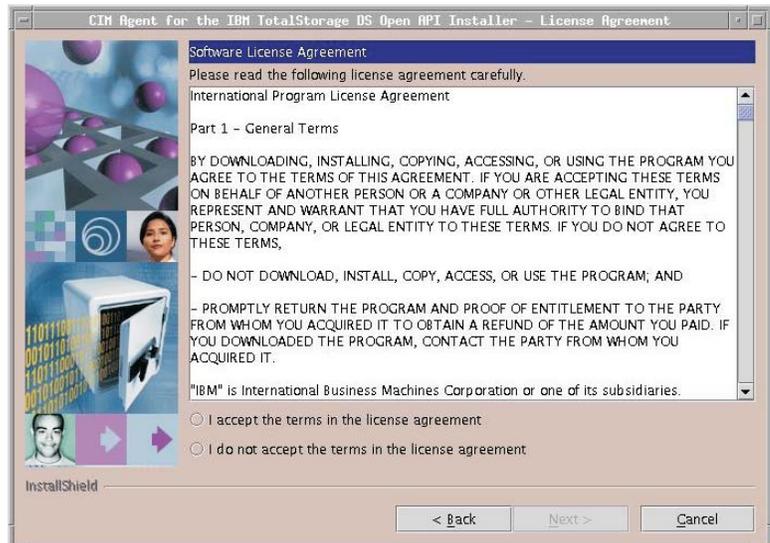
6. Check the readme file by clicking the Readme file on the LaunchPad window or by viewing the README.aix file located in the AIX directory on the CIM agent installation CD. The readme file might provide additional information that supersedes information in this guide.

You can also find this installation guide on the CIM agent CD under the file name installguide.pdf in the doc subdirectory.

7. Click **Installation wizard** to start the installation program.
8. The Welcome window opens and contains text suggesting which documentation to review prior to installation. Click **Next** to continue (License Agreement window opens) or **Cancel** to exit.

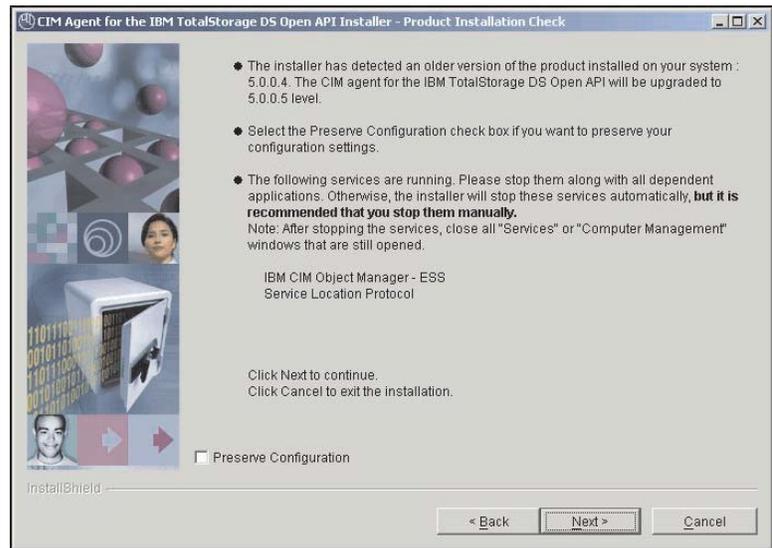


9. Read the license agreement. Click either **I accept the terms of the license agreement** and click **Next** to proceed, or click **I do not accept the terms of the license agreement** and click **Cancel** to cancel the installation.



10. If the installation wizard detects a prior installation of the CIM agent, the Product Installation Check window appears. Check the **Preserve Configuration** check box if you want to preserve your configuration settings. Follow any specific instructions in the window. For example, the figure below

shows a warning to stop running services. Once you have followed all instruction, select **Next**.



11. The IBM ESS CLI Check window opens and the wizard verifies that you have the IBM ESS CLI installed if you are managing ESS storage units.

Note: This wizard is not displayed if you have the required version of the ESS CLI already installed.



12. The Destination Directory window opens. Click **Next** to accept the default directory, or click **Browse** to select a different directory for installation and then click **Next**.

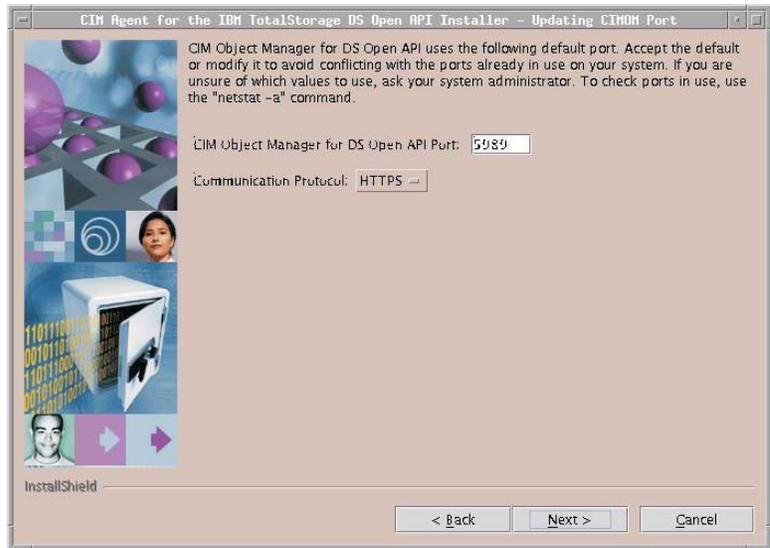


Note:

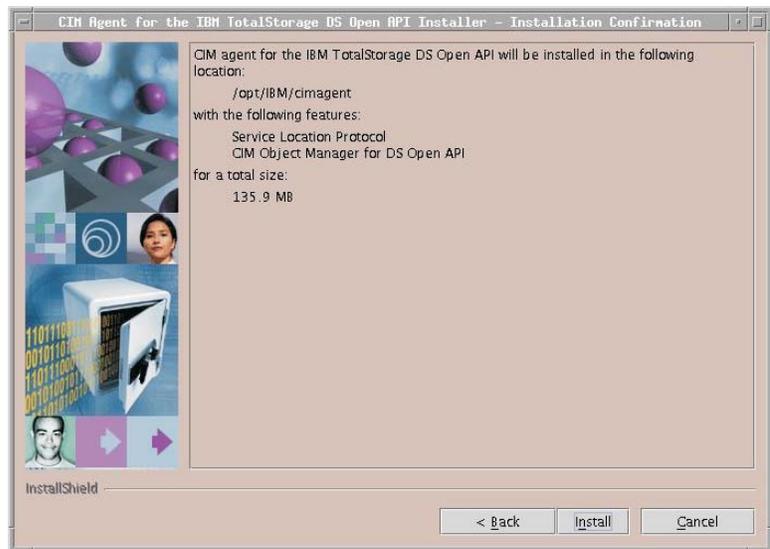
- a. The Destination Directory window is displayed only if the CIM agent is not already installed. Otherwise, the CIM agent is reinstalled or upgraded to the same install location.
 - b. If the wizard detects insufficient space for the CIM agent in the file system containing the chosen directory, you can perform one of the following steps:
 - Free some space in that directory and then click **Next**.
 - Click **Cancel** to exit the wizard, free some space in that filesystem, and then restart the wizard.
 - Click **Back** and choose another filesystem for the product.
13. The Updating CIMOM Port window opens. Click **Next** to accept the default port. If the default port is the same as another port already in use, modify the default port and click **Next**. Use the following command to check which ports are in use:

```
netstat -a
```

Or click **Cancel** to exit the wizard.

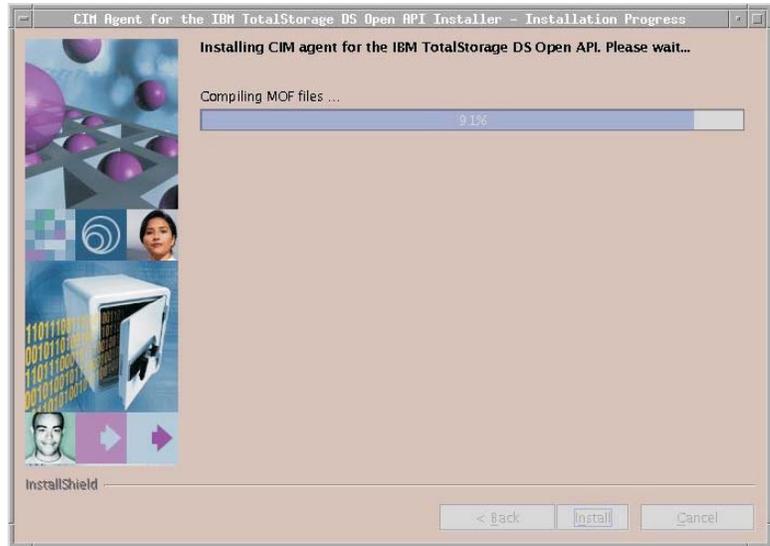


14. The Installation Confirmation window opens. Click **Install** to confirm the installation directory and file size. Or, click **Cancel** to exit the wizard.



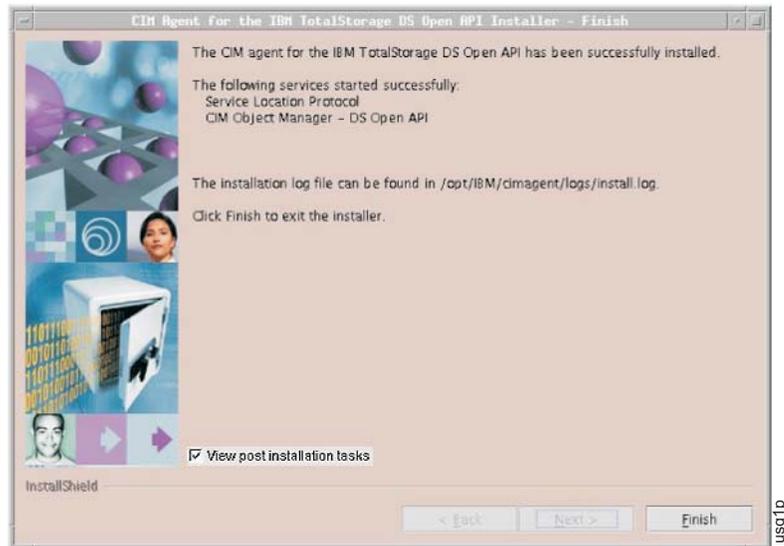
15. The Installation Progress window opens indicating how much of the installation has been completed. Installation usually takes 3 - 10 minutes depending on your machine configuration. If you do not want to continue with the installation, click **Cancel** to exit the installation process.

Note: If you click **Cancel** a popup window opens asking you to confirm the cancellation of the installation wizard: “Cancel the current operation? **Yes No**”. Be aware that if you confirm the cancellation by clicking Yes, the information you entered or selected in previous windows is not saved. You must start the installation again from the first step.



- When the Installation Progress window closes, the Finish window opens. You can choose to view read a text file containing the post installation tasks by selecting the **View post installation tasks** checkbox, or you can deselect the checkbox and continue with the post installation tasks described in this manual. Click **Finish** to exit the wizard.

Note: Before proceeding, you might want to review the log file for any possible error messages. The log file is located in `xxx\logs\install.log`, where `xxx` is the destination directory where the CIM agent for Windows is installed. The `install.log` contains a trace of the installation actions.



- Exit the LaunchPad program by clicking **Exit** on the LaunchPad window. If you have not done so already, continue with the post installation tasks for the CIM agent using the instructions in the following sections.

Installing the CIM agent on AIX in unattended (silent) mode

This section includes the steps to install the CIM agent in your AIX environment using the unattended (silent) mode.

You must satisfy all prerequisites before you begin the CIM agent installation.

You can choose to install the CIM agent in unattended (silent) mode, which involves customizing a response file and issuing a command or in graphical mode with the help of an installation wizard. If you want to install the CIM agent in unattended (silent) mode, continue with this section. After the completion of either kind of installation, you must verify the CIM agent installation.

Context:

The unattended (silent) installation capability enables you to run an installation process unattended. You can create a standard response file to ensure that the product is installed consistently on multiple systems. The responsefile file is a template located on the CIM agent CD that you must copy to disk and modify. To use the silent mode installation method, you must performing the following tasks:

1. Find the responsefile file template on the CIM agent installation compact disk.
2. Copy the responsefile template to your hard disk drive.
3. Customize the responsefile file to your specifications.
4. Save the updated responsefile file.
5. Invoke the response file using the setupaix script.

Steps:

Perform the following steps to install the CIM agent in your AIX environment using the unattended (silent) mode:

1. Log on as a user with root authority.
2. Locate the responsefile file on your CIM agent CD.
3. Retrieve and copy the responsefile file to your hard disk drive by typing the following commands:

```
# mkdir /tmp/cimagent
# cp -p /cdrom/AIX/responsefile /tmp/cimagent
```

You must also modify the responsefile with your desired CIM agent destination directory (<*dest-path*>).

4. To change the permissions on the responsefile, so you can edit and save it to disk, type the following command:

```
chmod 777 /xxx/responsefile
```

5. Customize the responsefile file with your parameters as follows:
Using a text editor such as vi, modify the default options in the responsefile file with your desired values:
 - If you do not want to use the default value, remove the # character from the beginning of the line. Change the default value to the value that you want for that option. You *must* enclose all values in double quotation marks (“ ”).

- The `<product.installLocation>` option defines the default directory where the product will be installed. To use another destination directory, remove the # character from the corresponding line and replace this default directory with the desired directory.
 - The `<-G checkPrerequisite>` option enables checking the prerequisites. To disable checking the prerequisites, remove the # character from the corresponding line and change its value to “no”.
 - The `<-G startUpgrade>` option enables the installation of CIM agent over a previous installation of CIM agent having the same version (reinstall) or lower version (upgrade). To do this, remove the # character from the corresponding line and change its value to “yes”.
 - The `<-G stopProcessesResponse>` option tells the install program whether to automatically stop SLP and CIM agent daemons when you are reinstalling or upgrading the product. By default this option is set to “no”. If you do not change this default value, the reinstallation or upgrade ends when these daemons are running. To automatically stop the SLP and CIMOM, remove the # character from the corresponding line and change its value to “yes”.
 - The `<-G saveConfiguration>` option specifies whether to save the configuration settings (for example, user names, passwords, and storage unit IP addresses) when you are reinstalling or upgrading the product. If you do not want to save the configuration settings, remove the # character from the corresponding line and change the value to “no”.
 - The `<-W cimObjectManagerPorts.port>` option specifies the CIM agent server port. If you want to change the default value during installation, remove the # character from the corresponding line and change the default port value (5989) with the desired port value.
 - The `<-W cimObjectManagerPorts.serverCommunication>` option specifies the CIM agent server communication protocol. If you want to change the default value during installation, remove the # character from the corresponding line and change the default server communication protocol (HTTPS) with HTTP protocol.
6. Save the modified responsefile file in your desired directory.
 7. Type the following command to run the install file:

```
# ./setupaix -options <responsefile-path>/responsefile
```

Note: `<responsefile-path>` is the path of the responsefile file.

8. Wait for the wizard to complete the installation.
9. Check for installation errors in the install.log file. This file can be found in the `<dest-path>/logs` directory. Your install.log file should look similar to the following install.log file:

```

(Oct 12, 2004 4:42:09 PM), This summary log is an overview of the sequence of the
installation of the CIM Agent for the IBM TotalStorage DS Open API 5.0.0.2
(Oct 12, 2004 4:42:13 PM), Checking AIX operating system level.
(Oct 12, 2004 4:42:13 PM), AIX level required:5.1.0.0; AIX level detected:5.1.0.0.
(Oct 12, 2004 4:42:18 PM), CIM agent for the IBM TotalStorage DS Open API
installation process started with the following install parameters:
Target Directory: /opt/IBM/cimagent
(Oct 12, 2004 4:42:25 PM), Copying Service Location Protocol Files ...
(Oct 12, 2004 4:42:26 PM), Copying CIM Object Manager Files ...
(Oct 12, 2004 4:42:51 PM), CIM Object Manager for DS Open API port successfully
updated.
(Oct 12, 2004 4:42:51 PM), CIM Object Manager for DS Open API communication protocol
successfully updated.
(Oct 12, 2004 4:42:51 PM), The file setupCmdLine successfully updated.
(Oct 12, 2004 4:42:51 PM), Compile MOF files started ...
(Oct 12, 2004 4:43:42 PM), MOF files successfully compiled.
(Oct 12, 2004 4:43:42 PM), Generate a certificate store started ...
(Oct 12, 2004 4:43:50 PM), Certificate store called truststore successfully
generated.
(Oct 12, 2004 4:43:50 PM), Updating the Software Vital Product Data.
This action will take several minutes. Please wait...
(Oct 12, 2004 4:44:46 PM), The following services started successfully:
Service Location Protocol
CIM Object Manager - DS Open API
(Oct 12, 2004 4:44:46 PM), INSTSUCC: The CIM agent for the IBM TotalStorage
DS Open API
has been successfully installed.

```

Note: If the installation fails before the target <dest-path> directory is created, you can find the temporary log in /tmp/cimagent/install.log.

10. Close the command prompt window by entering a command, for example **exit**. Continue with the post installation tasks for the CIM agent in the following sections. You can also continue the post installation tasks using the following option:
 - a. Open the LaunchPad from the AIX directory of the CIM agent CD by typing

```
# ./launchpad_aix.
```
 - b. Click **Post installation tasks** on the LaunchPad window. Continue with the post installation tasks for the CIM agent by following the instructions in this file.

Verifying the CIM agent installation on AIX

This section provides the steps to verify that your CIM agent is installed correctly on your AIX operating system.

To verify correct CIM agent installation follow these steps:

1. Verify the installation of the service location protocol (SLP). Open a Command Prompt window and type the following command to verify that SLP is started:

```
# ps -ef | grep slpd
```

If the SLP daemon is started, the following output is displayed:

```

root  26438 26986 0 12:36:44 pts/3 0:00 grep slpd
daemon 20730  1 0 12:51:47 - 0:00 /opt/IBM/cimagent/slp/slpd

```

2. Verify the installation of the CIM agent. Check that the CIMOM daemon is installed and started by typing the following command:

```
# ps -ef | grep CIMOM
```

The following is a sample output:

```

root 32518      1  0 15:52:05      -  0:08 /opt/IBM/cimagent/ibmjava131
/jre/bin/java -Xms128m -Xmx256m -cp /opt/IBM/cimagent/lib/xml4j-4_0_5/xercesImpl.
jar:/opt/IBM/cimagent/lib/xml4j-4_0_5/xmlParserAPIs.jar:/opt/IBM/cimagent/
ibmjava131/jre/lib/ext/ibmjsse.jar:/opt/IBM/cimagent/lib/JCE/IBMJCEfw.jar:/opt/IBM/
cimagent/lib/JCE/IBMJCEProvider.jar:/opt/IBM/cimagent/lib/JCE/local_policy.jar:/opt
/IBM/cimagent/lib/JCE/US_export_policy.jar:/opt/IBM/cimagent/lib/JCE/ibmpkcs.jar:
/opt/IBM/cimagent/ibmjava131/jre/lib/rt.jar:/opt/IBM/cimagent/ibmica.jar
com.ibm.cimom.CIMOM
root 28838 23968  0 15:57:21 pts/0  0:00 grep cimom

```

3. Start the CIMOM, if it is not started, by typing the following command:

```
# <dest-path>/startcimom
```

where <dest-path> is the destination directory where the CIM agent is installed.

Note: If you are currently residing in /cdrom/AIX, you must exit the /cdrom directory by typing `cd /`. You cannot unmount the CD if you are still residing in /cdrom/AIX. When you are finished with the CIM agent CD, you can release the CD with the **umount** command, for example:

```
# umount /dev/cd0
# umount /cdrom
```

If you are able to perform all of the verification tasks successfully, the CIM agent has been successfully installed on your AIX operating system.

Configuring the CIM agent on AIX

This section includes the steps to configure storage units and user accounts for CIM agent after it has been successfully installed.

In addition to the configuration steps below, you can use the `modifyconfig` command (described in Chapter 6) to change the configuration of some of the parameters that were configured during installation. You can change the CIM agent port value, protocol (HTTP/HTTPS), and enable or disable the debug option.

Steps:

Perform the following steps to configure ESS and DS user accounts for the CIM agent:

1. Ping each ESS and DS that the CIM agent will manage by typing the following command:
 - a. Open a command prompt window.
 - b. Issue a **ping** command; for example:

```
# ping 9.11.111.111
```

where 9.11.111.111 is an ESS or DS IP address
 - c. Check that you can see reply statistics from the IP address. The following is example output:

```

Pinging 9.11.111.111 with 32 bytes of data:

Reply from 9.11.111.111: bytes=32 time<10ms TTL=255

```

If you see other messages that indicate that the request has timed out, see your Network Administrator for help on establishing network connectivity before you configure storage units.

2. Type the following command to configure the CIM agent for each ESS or DS server that the CIM agent can access.

```
# <dest-path>/setdevice
```

where <dest-path> is the destination directory where the CIM agent is installed.

The following is example output:

```
Application setdevice started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
>>>
```

- a. For each ESS, type the following command:

```
>>>address <9.111.111.111> <essuser> <esspass>
```

where

- *9.111.111.111* represents the IP address of the ESS
- *essuser* represents an ESS user name
- *esspass* represents the ESS password for the user name

The following is example output:

```
A provider entry for IP 9.111.111.111 successfully added
```

Note: The address command is for ESS units only. For ESS Copy Service servers and for DS servers, use the `addressserver` command below.

- b. Type the following command for each ESS configured for Copy Services and for each DS server:

```
>>> addressserver <9.111.111.111> <essuser> <esspass> <9.222.222.222>
```

where

- *9.111.111.111* represents the IP address of the ESS or DS
- *essuser* represents a server user name
- *esspass* represents the password for the user name
- *9.222.222.222* represents the alternate IP address of the server

Note: Specifying an alternate IP address is optional. The alternate IP address is used if a connection cannot be made using the primary IP address.

The following is example output:

```
An essserver entry for IP 9.111.111.111 successfully added
```

where *9.111.111.111* is the IP address.

- c. Type the **exit** command to exit the CIMOM configuration program. A file that is named `provider-cfg.xml` is created in the destination directory.
3. Once you have defined all of the ESS and DS servers, you must stop and start the CIMOM to make the CIMOM initialize the settings for the storage unit servers.

Note: Because the CIMOM collects and caches the information from the defined storage units at startup time, the CIMOM might take longer to

start the next time you start it. Although you might see a status or a returned prompt implying the CIMOM is restarted, wait a few minutes to make sure that the restart fully processes. You can view the restart status in the `cimom.log` file in the directory where you installed the CIM agent.

4. Configure the CIMOM for each user that you want to have authority to use the CIMOM by running the CIMOM configuration program.

During the CIM agent installation, the default user name to access the CIM agent CIMOM is created. The default user name is "superuser" with a default password of "passw0rd". You must use the default user name and password when you use the **setuser** command for the first time after installation. Once you have added other users, you can initiate the **setuser** command using a user name that you defined instead of using the default.

- a. Start the CIMOM, if it is not started, by typing the following command:

```
# <dest-path>/startcimom
```

where `<dest-path>` is the destination directory where the CIM agent is installed.

- b. Type the following command:

```
# <dest-path>/setuser -u superuser -p passw0rd
```

where `<dest-path>` is the destination directory where the CIM agent is installed.

The following is example output:

```
Application setuser started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
>>>
```

Restriction: You cannot delete or modify the current user using the **setuser** command.

- c. Obtain a user name and password for each user that can manage the CIMOM. Type the following command for each user:

```
>>>adduser <cimuser> <cimpass>
```

where

- *cimuser* represents the new user name to access the CIM agent CIMOM
- *cimpass* represents the password for the new user name to access the CIM agent CIMOM

The following is example output:

```
An entry for user cimuser successfully added
```

where *cimuser* is your new user name.

- d. When you have completed adding new users to access the CIM agent CIMOM, issue the **exit** command.

- e. You can change the default password for "superuser" by starting the **setuser** command for a user that you added in step c above. Issue the following command to change the password:

```
>>>chuser superuser <newpasswd>
```

where *newpasswd* is the new password for the superuser.

You can delete the superuser by issuing the following command:

```
>>>deluser superuser
```

- f. Type the **exit** command to exit the CIMOM configuration program.

If you are able to perform all of the configuring tasks successfully, the CIM agent has been successfully installed on your AIX operating system.

Configuring the CIM agent to run in unsecure mode

Some vendor software might not be capable of communicating with the CIM agent in a secure fashion. You can still use this vendor software by configuring the CIM agent to run with only basic user and password security. Perform the following steps to configure in unsecure mode:

1. Type the **stopcimom** command in the destination directory to stop the CIMOM.
2. Find the `cimom.properties` file and edit it with a tool such as vi editor, setting the properties as shown in the following example:

```
Port=5988
ServerCommunication=HTTP
DigestAuthentication=False
```

Once the CIMOM starts, it accepts requests over HTTP using basic authentication.

Note: To completely disable security checking, set “Authorization=False” in the `cimom.properties` file.

3. Type the **startcimom** command to restart the CIMOM.
4. Verify that the server started on port 5988 by opening the `cimom.log` file.

Verifying the connection on AIX

During this task, the CIM agent software connects to the storage unit that you identified in the configuration task.

Steps:

Perform the following steps to verify the connectivity to an ESS or DS. You also verify the service location protocol (SLP) daemon and the CIMOM are running, since they are needed to connect to an ESS or DS using the CIM agent.

1. If you are managing an ESS, perform the following steps to verify that the configuration file for the ESS CLI (`CLI.CFG`) is set correctly and that you have a connection. If you are not managing an ESS, skip to step 2 to verify that you have a connection.
 - a. Issue the `rsTestConnection` command from a command prompt window to test network connectivity and determine if the `CLI.CFG` is set correctly. The `rsTestConnection` command primarily tests the connection to the Copy Services primary server.

Note: The ESS CLI does not set the `PATH` variable. If you want to update the `PATH` variable with the directory where the CLI for the storage unit is installed, review the instructions from your operating system help for your specific AIX shell.

```
rsTestConnection.sh -s -v primaryservername
```

where:

- *-s primaryservername* represents the IP address or the complete host name of a Copy Services server.
- *-v* designates that all responses from the server be displayed.

The following example is output that you receive if the CLI.CFG is set correctly (sltb0c0 is the primary Copy Services server in this example):

```
[root@bluegrass ibm2105cli]# ./rsTestConnection.sh -v -s sltb0c0
rsWebTest: Using sltb0c0 as server name
rsWebTest: HeartBeat to the server was successful.
rsWebTest: command successful
```

- b. Issue the `esscli list server` command from a command prompt window to confirm connectivity to the rest of the storage units in the domain.

```
esscli -u <essuser> -p <esspass> -s <9.111.111.111> list server
```

where:

- *essuser* is an storage manager user name.
- *esspass* is the storage manager password for that user name.
- *9.111.111.111* is the IP address of the storage server.

A response similar to the following is displayed:

```
Thu Oct 09 13:20:40 PDT 2003 IBM ESSCLI 2.3.0.1

  Server   Model  Mfg      WWN              CodeEC   Cache   NVS   Racks
  -----  -----  ---  -----  -----  -----  ---  -----
  2105.22232  800   013   5005076300C09470  2.4.0.236  8GB    2GB   1
```

2. Before running the command to verify the CIM agent connection, ensure the SLP daemon is started by typing the following command:

```
ps -ef | grep slpd
```

- a. Start the SLP daemon, if it is not started, by typing the following command from a separate window.

```
# /etc/rc.slpd
```

Note: This session remains active until you stop it. Ensure that it is running as long as the CIM agent is running.

3. Before running the command to verify the CIM agent connection, ensure the CIMOM is started by typing the following command:

```
ps -ef | grep CIMOM
```

- a. If the CIMOM is not started, start it by typing the following command:

Note: The default is to start the secure CIMOM. It registers itself with SLP and accept requests on port 5989.

```
# <dest-path>/startcimom
```

Note: The `startcimom` command quickly returns a prompt; however, a returned prompt does not mean that the processing is complete. If there are a large number of LUNs to enumerate in the internal domain, it takes considerable time for the CIMOM to find and enumerate all those disks. Do **not** issue the `verifyconfig` command

until CIMOM processing is complete. You can view the cimom.log in the directory where you installed the CIM agent to verify the CIMOM processing status.

4. You can view CIMOMs registered with SLP using the verifyconfig command. This command locates all WBEM services (for example, CIMOMs) in the local network. Information is displayed for the storage units to which the CIM agents can connect. In the following example, the CIM agent on host 9.111.111.111 connects to two storage units (2107.AZ123x and 2105.2223x).

Run the following command from a command prompt window:

```
# <dest-path>/verifyconfig -u <user> -p <password>
```

Where *<user>* and *<password>* are the user and password of a CIMOM user ID that was created with **setuser** command.

The following is example output of a successful connection:

```
# verifyconfig -u guest -p guest
Verifying configuration of CIM agent for the IBM TotalStorage
DS Open Application Programming Interface...
Communicating with SLP to find WBEM services...
3 WBEM services found
  host=9.111.111.112, port=5989
  host=9.111.111.113, port=5989
  host=9.111.111.114, port=5989
Connecting to CIM agent, host=9.111.111.113, port=5989
Found 2 IBMTSESS_StorageSystem instances:
2107.AZ123x
2105.2223x
Internal Server at 9.111.111.122 configured for 2107.AZ123x
Internal Server at 9.111.111.119 configured for 2105.2223x
Verification Successful
```

If you received similar output verifying a connection, the CIM agent is now running.

Removing the CIM agent on AIX

This optional task provides the steps to remove the CIM agent from your AIX operating system.

Perform the following steps before you start the removal process:

1. Log in as a user with root authority.
2. Stop all the processes (like SLP or CIMOM) and applications that use them that are running on your system before you remove the CIM agent product.

Steps:

Perform the following steps to remove the CIM agent:

1. Log on as a user with root authority.
2. Stop all the processes and applications that use SLP and CIMOM that are running on your system before you remove the CIM agent.
3. Type the following command to stop the CIM Object Manager for DS Open API (CIMOM) daemon.

```
# <dest-path>/stopcimom
```

where *<dest-path>* is the destination directory where the product was installed.

4. Type the following command to see if the SLP daemon is running:

```
# ps -ef | grep slpd
```

If the SLP is running, the following output is displayed:

```
daemon 24452    1  0  Nov 13    -  0:00 /opt/IBM/cimagent/slp/slpd
root 37756 27328    0 14:55:47 pts/1    0:00 grep slpd
```

5. Type the following command to stop the service location protocol (SLP):

```
# kill 24452
```

6. Run the removal program in graphical mode or in unattended (silent) mode to remove the CIM agent and SLP.

Removing the CIM agent from AIX in graphical mode

Perform the following steps to remove the CIM agent using graphical mode:

1. Type the following command to run the removal program from the `_uninst` subdirectory of the `<dest-path>`:

```
# <dest-path>/_uninst/uninstaller
```

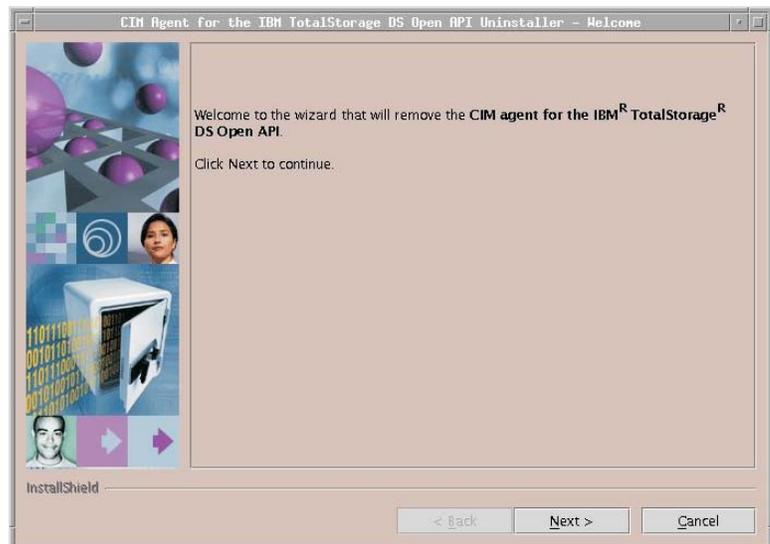
where `<dest-path>` is the destination directory where the CIM agent is installed.

2. If the removal program was not created during the CIM agent installation, type the following command:

```
# <dest-path>/java/jre/bin/java -jar <dest-path>/_uninst/uninstall.jar
```

where `<dest-path>` is the destination directory where the CIM agent is installed.

3. The Welcome window opens. Click **Next** to continue with the removal program, or click **Cancel** to exit the removal program.



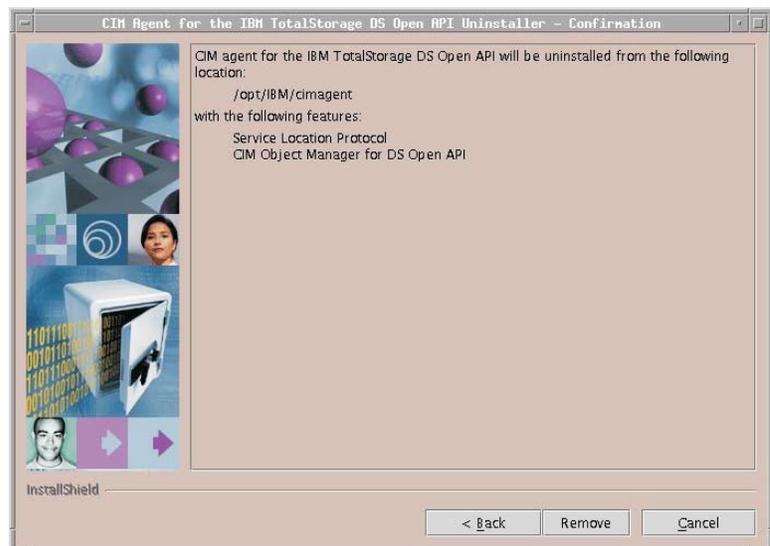
The program detects if the service location protocol (SLP) and the CIM Object Manager (CIMOM) for the DS Open API services are running and displays the following information:

- If the SLP and the CIMOM are running, the Stopping Services window asks if you want to continue with the removal program. In that case, click **Next** to stop the services. Click **Cancel** to stop the services manually, which is recommended.
- If you want to manually stop the services, you must exit the removal program, stop the services and the applications that use them, and then run the removal program again from the beginning.

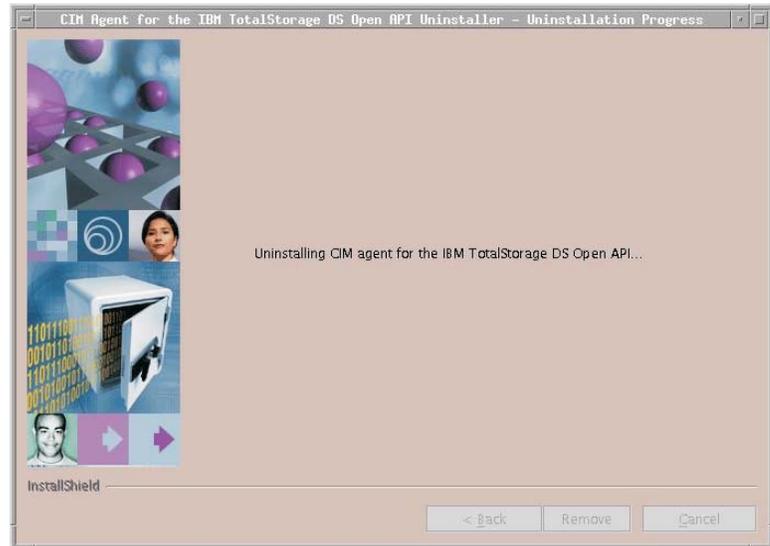
Attention: You must be careful if you have other applications that use the SLP service. If you do, you must stop these applications before you stop the SLP service because the SLP service is deleted during the removal process.



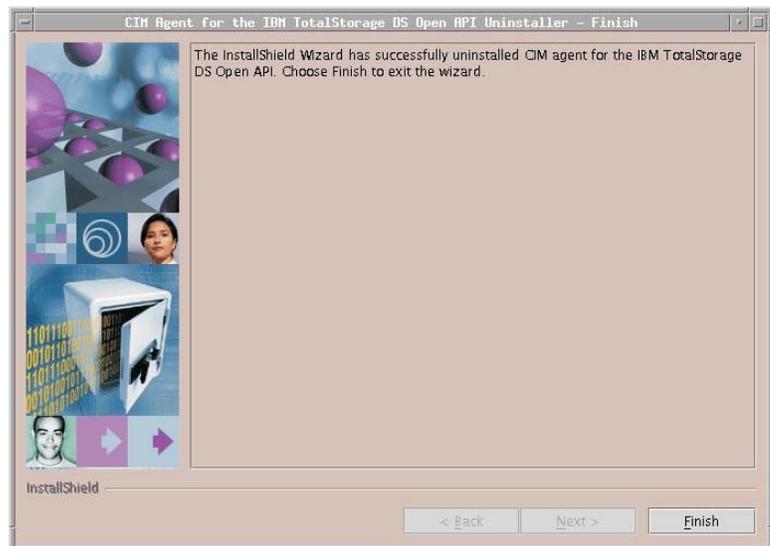
- If neither the SLP service nor the CIMOM service is running, the removal program continues with the Confirmation window.
4. The Confirmation window opens, displaying the location of the product that will be removed. Click **Remove** to continue with the removal program, or click **Cancel** to exit.



5. The Uninstallation Progress window opens. Wait for the program to remove the CIM agent.



6. The Finish window opens and displays information about the result of removal (successfully or failed).



Click **Finish** to end the removal program.

Removing the CIM agent from AIX in unattended (silent) mode

This topic includes instructions to remove the CIM agent from AIX in unattended (silent) mode.

Steps:

Perform the following steps to remove the CIM agent in unattended (silent) mode:

1. Stop SLP, CIMOM, and all related processes.

2. Type the following command to run the removal program from the `_uninst` subdirectory:

```
<dest-path>/_uninst/uninstaller -silent
```

3. If the program detects that the service location protocol (SLP) or the IBM CIM Object Manager (CIMOM) services are running, it displays an error message and the uninstallation fails. You can look for details in the `<dest-path>/logs/uninstall.log` file. However, if you want the program to automatically stop the services, you must set the `stopProcessesResponse` option to `yes` in the command line:

```
<dest-path>/_uninst/uninstaller -silent -G stopProcessesResponse=yes
```

The CIM agent removal process **does not** remove configuration files, logs, and similar files that are created during or after the installation process. They are located in the destination path where CIM agent was installed. For example, the default destination path is `/opt/IBM/cimagent`.

Remove the directory and all of its contents (especially if you plan to reinstall the CIM agent).

Note: If you want to keep the old configuration files, save them in another location on your system before removing them from the installation destination path, so you can restore them later.

To remove the directory, `cimagent`, you must type the following command, for example, from the IBM directory.

```
# rm -r /opt/IBM/cimagent
```

Note: The recursive remove is used in this example because the CIM agent has a deep directory structure. The recursive remove is very powerful and dangerous: make sure you copy any needed files to another directory before running this command. You must use the fully qualified directory name.

Chapter 4. CIM agent for Linux

This chapter includes an overview of the installation process and instructions for installing and configuring the CIM agent on a Linux operating system.

Installation overview for Linux

This section provides an overview and instructions for installing and configuring the CIM agent on the Linux (Advanced Server 3.0) operating system. You should have some knowledge of how to administer Linux operating system before you begin to install the CIM agent. You should also become familiar with the command explanations that you use to install and configure the CIM agent.

The following list of installation and configuration tasks are discussed in the order in which they should be performed:

1. Before you install the CIM agent on a Linux operating system, check the hardware and software requirements.
2. If you are managing ESS storage units, you must install the prerequisite ESS CLI level 2.4.0.236 software. The ESS CLI must be installed first because the CIM agent sets the path information in shell scripts for you based on the location of the ESS CLI. The CIM agent installation wizard checks your system for the existence of the ESS CLI, and the wizard displays a warning message if ESS CLI is not installed. For ESS CLI installation instructions, see the *IBM TotalStorage Enterprise Storage Server Command-Line Interfaces User's Guide*.
Attention: If you are upgrading from a previous version of the CIM agent, you must upgrade the ESS CLI software to the new level required which is a minimum level of 2.4.0.236.
3. You can choose to install the CIM agent either in graphical mode with the help of a wizard or in unattended mode (also known as silent mode), which involves customizing a response file and issuing a command. If your system does not support the graphical mode you cannot use the `-console` parameter for the executable file to run the installation in an interactive console mode. You must use the unattended installation mode.
4. Verify the CIM agent Linux installation.
5. Configure the CIM agent. You might want to revisit this section in the future as you add, change, or delete CIMOM authentication and storage unit information.
6. Enable the CIM agent.
7. Optionally, remove the CIM agent. You only need to perform this optional task if you get errors during installation verification or if the CIM agent did not set the environment variables.

Installing the CIM agent on Linux in graphical mode

This section includes the steps to install the CIM agent in your Linux environment using the graphical mode.

You must satisfy all hardware and software prerequisites before you begin the CIM agent installation.

You can choose to install the CIM agent in graphical mode with the help of an installation wizard or in unattended (silent) mode, which involves customizing a response file and issuing a command. If you want to install the CIM agent in graphical mode, continue with this section. After the completion of either kind of

installation, you must verify the installation of the CIM agent. Before you install the CIM agent on Linux, check the hardware and software requirements.

The description of commands in this task have the convention of optional and substitution parameters between the less than "<" and greater than ">" symbols. You should become familiar with each command's explanation before entering the command. You should have some knowledge about how to administer Linux before you begin installing the CIM agent.

Note: If you do not have a graphical interface you cannot use the graphical installation mode. You must use the unattended installation mode. If you receive a system message suggesting you try running the installer with the `-console` parameter to run an interactive console mode installation, you **must** use the unattended installation mode.

Follow these steps to install the CIM agent.

1. Log on as a user with root authority.
2. Insert the CIM agent CD.
3. Create a mount point or choose an existing mount point.

Type the following command to create a mount point called `/mnt/cdrom`:

```
# mkdir /mnt/cdrom
```

4. Type the following command to mount the CD-ROM file system at the desired mount point:

```
# mount /dev/cdrom /mnt/cdrom
```

5. Change the current directory to the mount point for the CD drive, in the LINUX directory. For example, if the CD was mounted at the `/mnt/cdrom` mount point, type the following command:

```
# cd /mnt/cdrom/LINUX
```

6. Check the `README.linux` file located in the LINUX directory on the CIM agent CD. The `README.linux` file can provide additional information that supersedes information in this guide.

You can also find this installation guide on the CIM agent CD under the file name `installguide.pdf` in the document subdirectory.

7. The CIM agent installation in graphical mode begins with a LaunchPad facility to launch the installation program wizard. The LaunchPad facility provides links for you to view various text files, such as the product overview, product readme, post installation tasks, and various Adobe Acrobat files, such as this installation guide and the product license agreement, and a browser link to the IBM storage product technical support page.

This installation guide and license agreement are in Adobe Acrobat file format (`.pdf`). In order for the LaunchPad to provide links to the Adobe Acrobat files, your system *must* have Adobe Acrobat Reader installed. In order for the browser to link to the IBM storage product technical support page, you *must* have a browser installed on your system where you start the LaunchPad facility.

If you wish to use the LaunchPad facility links to view the Adobe Acrobat files, you must have the Adobe Acrobat Reader bin location in your `PATH` environment variable. You can verify this by running the following command:

```
echo $PATH
```

Locate the Adobe Acrobat Reader bin location in the PATH, for example, `/usr/opt/ Acrobat5/bin`. If the Adobe Acrobat Reader bin location is not in the environment path, you can set it by typing the following command:

```
export PATH=$PATH:/usr/opt/ Acrobat5/bin
```

where `/usr/opt/ Acrobat5/bin` is the location of the Adobe Acrobat Reader bin directory.

8. Run the wizard launcher, `launchpad_linux`, from the Linux directory of the CD by typing the following command:

```
# ./launchpad_linux
```

This command starts the CIM agent LaunchPad, a small graphical program that launches the wizard.

9. The LaunchPad window opens. Choose from the following options:

CIM Agent overview

Offers information about the CIM agent.

Readme file

Offers any last minute product information that did not make it into this installation guide.

Installation guide

Offers instructions on how to install the CIM agent.

License agreement

Offers information about the license of the CIM agent.

CIM Agent Web site

Offers information from the product Web site.

MOF Documentation

Offers information about MOF documentation.

Installation wizard

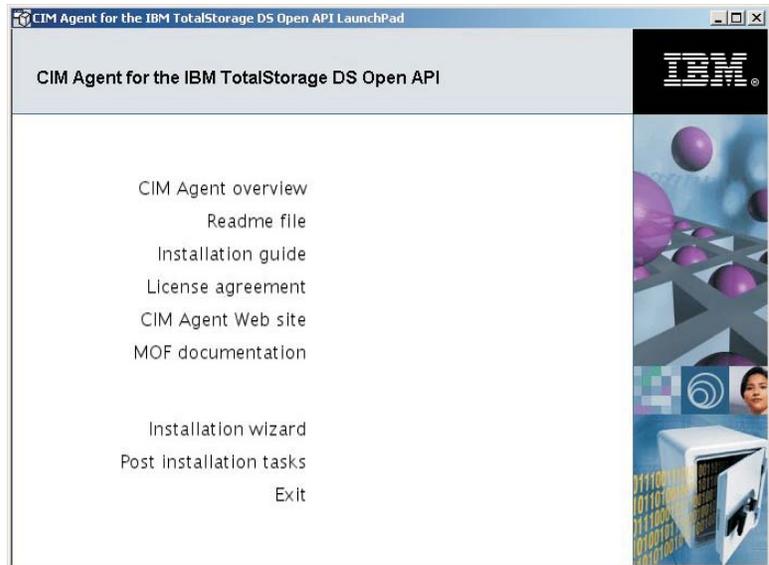
Starts the CIM agent installation program.

Post installation tasks

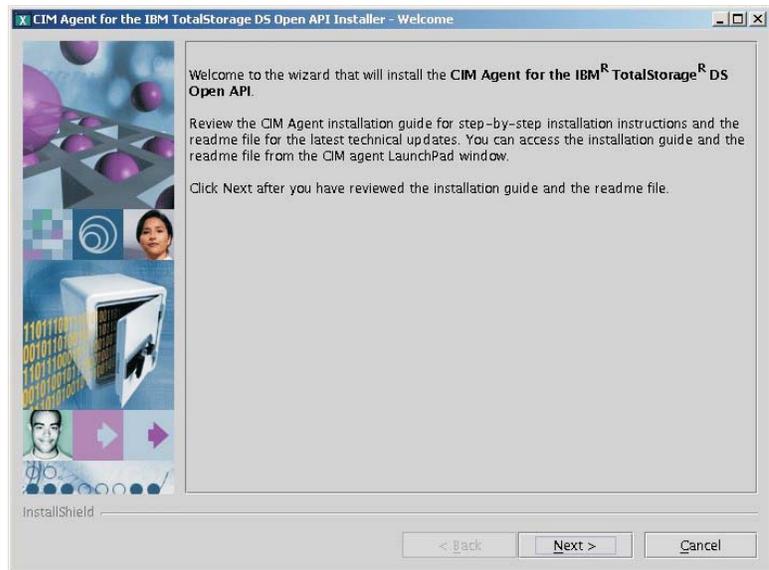
Offers information about configuring the users and storage unit communications.

Exit Exits the Launchpad program.

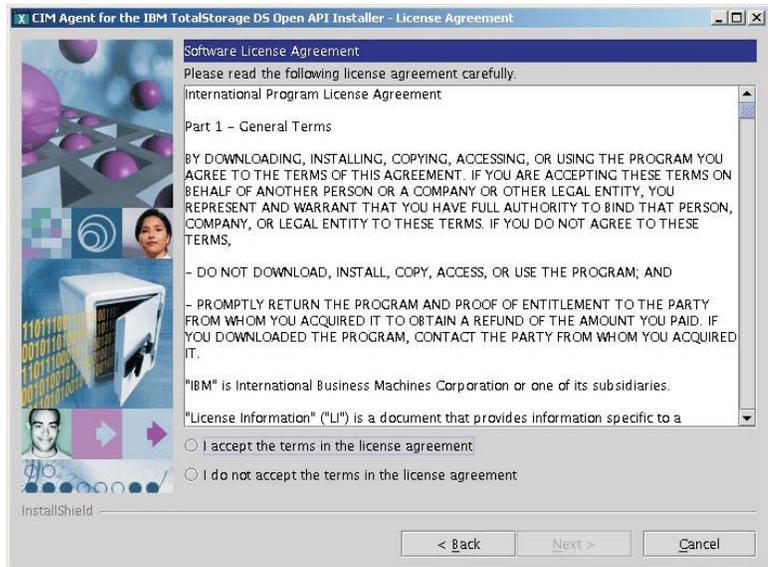
The LaunchPad window remains open (behind the wizard) during the installation. You can access product information after the installation has started. The LaunchPad returns to the foreground when the installation is complete. You can click **Exit** to close the LaunchPad.



10. Click Installation wizard to begin the CIM agent installation.
11. The Welcome window opens suggesting which documentation you should review prior to installation. Click **Next** to continue. You can click **Cancel** at any time while using the wizard to exit the installation. To move back to previous screens while using the wizard, click **Back**.



12. The License Agreement window opens. Read the license agreement information. Click **I accept the terms of the license agreement** and click **Next** to proceed, or click **I do not accept the terms of the license agreement** and click **Cancel** to exit the installation.

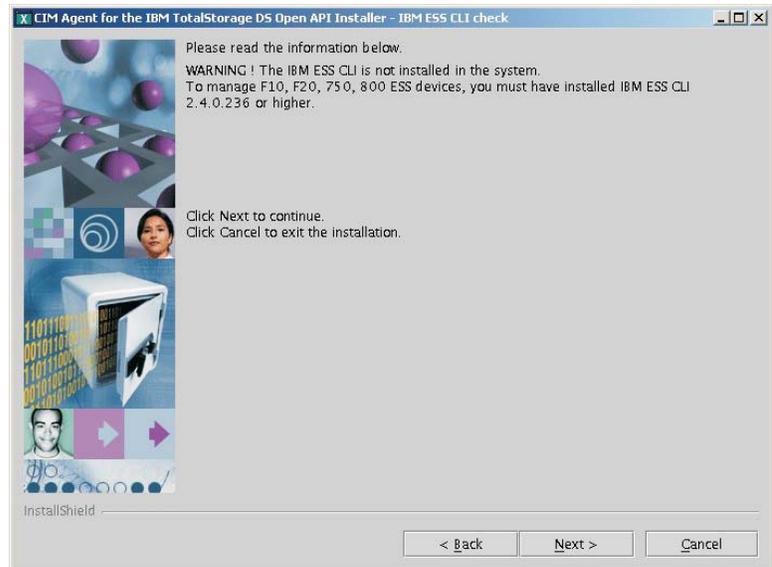


13. If the installation wizard detects a prior installation of the CIM agent, the Product Installation Check window opens. Check the **Preserve Configuration** check box if you want to preserve your configuration settings. Follow any specific instructions in the window. For example, the figure below shows a warning to stop running services. Once you have followed all instruction, select **Next**.

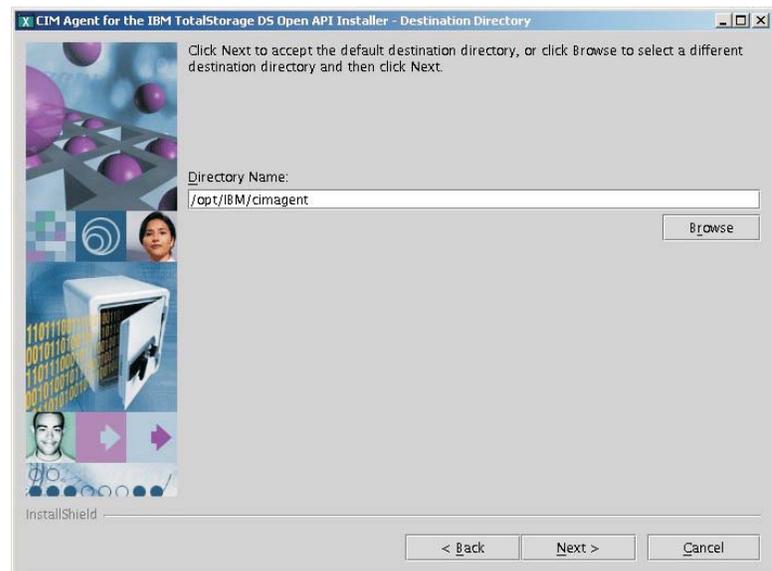


14. The IBM ESS CLI Check window opens. The wizard verifies that you have the IBM ESS CLI installed if you are managing ESS storage units.

Note: The wizard is not displayed if you have the required version of the ESS CLI already installed.



15. The Destination Directory window opens. Click **Next** to accept the default directory where setup will install the files, or click **Browse** to select a different directory for installation and then click **Next**.



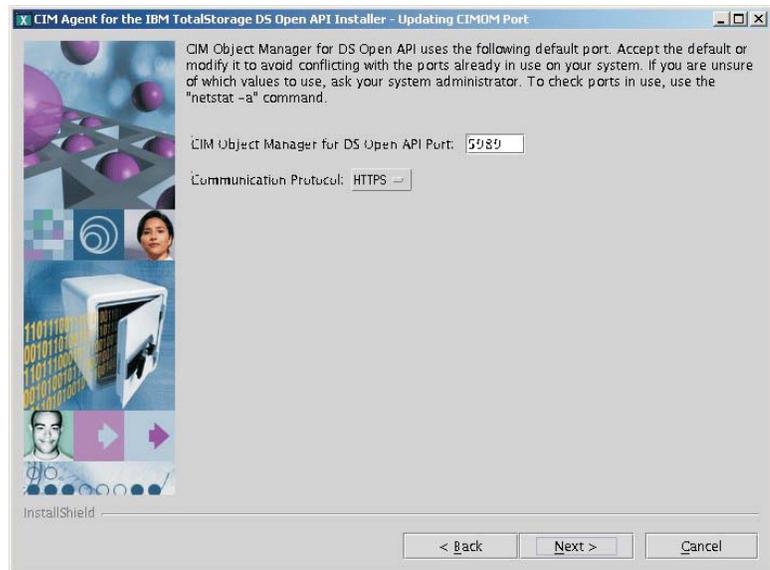
Note:

- a. The Destination Directory window is displayed only if a version of CIM agent is not already installed. Otherwise, the CIM agent will be reinstalled or upgraded to the same install location.
 - b. If the program detects insufficient space for the CIM agent installation in the chosen destination, an error message is displayed. You can free some space on the destination drive and then click **Next** or you can stop the installation program by clicking **Cancel**. You can also go back by clicking **Back**, and choose another destination directory for the product.
16. The Updating CIMOM Port window opens and has two options to define: the Port and the Communications Protocol.

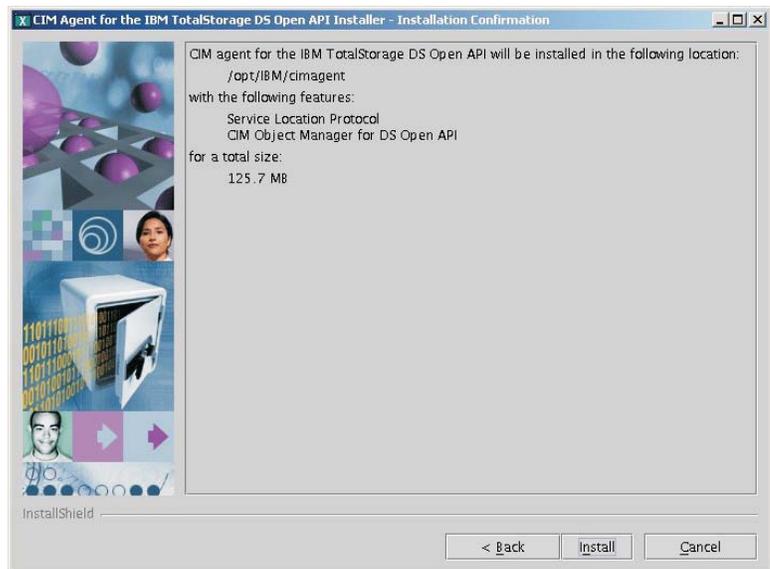
- a. Either accept the default port or, if the default port is the same as another port already in use, modify the default port. Use the following command to check which ports are in use:

```
netstat -a
```

- b. Either accept HTTPS as the communication protocol, or click on **HTTPS** to select the less secure HTTP protocol.
- c. Click **Next** to continue with installation, or click **Cancel** to exit the wizard.

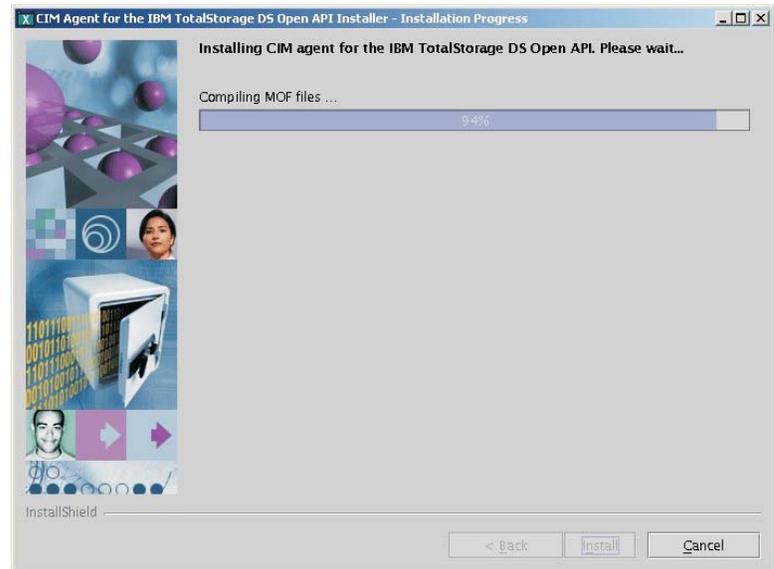


17. The Installation Confirmation window opens. Click **Install** to confirm the installation location and file size. You can click **Cancel** to exit the installation wizard or go back to the previous window by clicking **Back**.



18. The Installation Progress window opens indicating how much of the installation has been completed. Installation usually takes 3 - 10 minutes depending on

your machine configuration. If you do not want to continue with the installation, click **Cancel** to exit.



19. The Finish window opens and notifies you whether the installation was successful. Click **Finish** to exit the wizard. You can choose to view the post installation tasks by selecting the **View post installation tasks** checkbox, or you can deselect the checkbox and continue with the post installation tasks described in this manual. Click **Finish** to exit the installation wizard.

Note: Before proceeding, you might want to review the log file for any possible error messages. The log file is located in `xxx\logs\install.log`, where `xxx` is the destination directory where the CIM agent for Windows is installed. The `install.log` contains a trace of the installation actions.



20. Exit the LaunchPad program by clicking **Exit** on the LaunchPad window. If you have not done so already, continue with the post installation tasks for the CIM agent using the instructions in the following sections or the text file containing the post installation steps.
21. When you are finished with the CIM agent CD, type the following command to remove the CD:

```
# umount /mnt/cdrom
```

Installing the CIM agent on Linux in unattended (silent) mode

This section includes the steps to install the CIM agent in your Linux environment using the unattended (silent) mode.

You must satisfy all prerequisites before you begin the CIM agent installation.

You can choose to install the CIM agent in unattended (silent) mode, which involves customizing a response file and issuing a command or in graphical mode with the help of an installation wizard. If you want to install the CIM agent in unattended (silent) mode, continue with this section. After the completion of either kind of installation, you must verify the CIM agent installation.

The unattended (silent) installation capability enables you to run an installation process unattended. You can create a standard response file to ensure that the product is installed consistently on multiple systems. The responsefile file is a template located on the CIM agent CD that you must copy to disk and modify. To use the silent mode installation method, you will be performing the following tasks:

1. Find the responsefile file template on the CIM agent installation compact disk.
2. Copy the responsefile template to your hard disk drive.
3. Customize the responsefile file to your specifications.
4. Save the updated responsefile file.
5. Invoke the response file using the setuplinux script.

Steps:

Perform the following steps to install the CIM agent in your Linux environment using the unattended (silent) mode:

1. Log on as a user with root authority.
2. Type the following commands to locate the responsefile file on your CIM agent CD.

```
# cd /mnt/cdrom
# cd LINUX
```

3. Copy the responsefile file to your hard disk drive by typing the following command:

```
# cp ./responsefile /root/xxxx
```

where xxxx is your desired directory.

4. Customize the responsefile file with your parameters as follows:

Using a text editor, modify the default options in the responsefile file with your desired values:

- If you do not want to use the default value, remove the # character from the beginning of the line. Change the default value to the value that you want for that option. You *must* enclose all values in double quotation marks (“ ”).
 - Use the option `<-P product.installLocation>` to define the default directory where you want the product installed. To use another destination directory, remove the # character from the corresponding line, and replace this default directory with the desired directory.
 - The option `<-G checkPrerequisite>` enables checking the prerequisites. To disable checking the prerequisites, remove the # character from the corresponding line and change the value of the option to “no”.
 - The option `<-G startUpgrade>` enables the installation of CIM agent over a previous installation of CIM agent having the same version (reinstall) or lower version (upgrade). To do this, remove the # character from the corresponding line and change the value of the option to “yes”.
 - The option `<-G stopProcessesResponse>` tells the install program whether or not to automatically stop SLP and CIM agent services when reinstalling or upgrading the product. By default this option is set to “no”. If you do not change this default value, the reinstallation or upgrade will abort when these service are running.
 - To automatically stop the SLP and CIMOM, remove the # character from the corresponding line and change the value of the option to “yes”.
 - The `<-G saveConfiguration>` option specifies whether to save the configuration settings (for example, user names, passwords, and storage unit IP addresses) when reinstalling or upgrading the product. If you do not want to save the configuration settings when reinstalling or upgrading, remove the # character from the corresponding line and change the value of the option to “no”.
 - The `<-W cimObjectManagerPorts.port>` option specifies the CIM agent server port. If you want to change the default value during installation, remove the # character from the corresponding line and change the default port value (5989) with the desired port value.
 - The `<-W cimObjectManagerPorts.serverCommunication>` option specifies the CIM agent server communication protocol. If you want to change the default value during installation, remove the # character from the corresponding line and change the default server communication protocol (HTTPS) to HTTP protocol.
5. Save the modified responsefile in your desired directory.
 6. To launch the wizard in unattended (silent) mode with the customized responsefile, type the following command from the Linux directory on your CIM agent CD:

```
# ./setuplinux -options <responsefile-path>/responsefile
```

where `<responsefile-path>` is the path of the responsefile file.

7. Wait for the wizard to complete the installation.
8. Check for installation errors in the install.log file. The log file is initially created in `/tmp/cimagent/install.log`. At the end of the installation, the log can be found in `<dest-path>/logs/install.log`, where `<dest-path>` is the destination directory where the CIM agent was installed. If the installation ends before the creation of `<dest-path>`, look in the `/tmp/cimagent/install.log`. Your install.log file should look similar to the following:

```

(Oct 11, 2004 7:03:38 PM), This summary log is an overview of the sequence of the
installation of the CIM Agent for the IBM TotalStorage DS Open API 5.0.0.2
(Oct 11, 2004 7:03:41 PM), The package rpm-build 4.0.4 7x.20 was found on your
LINUX system.
(Oct 11, 2004 7:03:41 PM), The package chkconfig 1.2.24 1 was found on your LINUX
system.
(Oct 11, 2004 7:03:48 PM), CIM agent for the IBM TotalStorage DS Open API installation
process started with the following install parameters:
  Target Directory: /opt/IBM/cimagent
(Oct 11, 2004 7:03:59 PM), Copying Service Location Protocol Files ...
(Oct 11, 2004 7:03:59 PM), Copy file /opt/IBM/cimagent/slp/slp.conf to /etc/slp.conf .
(Oct 11, 2004 7:03:59 PM), Command to be executed:
  /bin/ln -sf libslp.so.1.0.0 /opt/IBM/cimagent/slp/libslp.so
(Oct 11, 2004 7:03:59 PM), Command to be executed:
  /bin/ln -sf libslp.so.1.0.0 /opt/IBM/cimagent/slp/libslp.so.1
(Oct 11, 2004 7:03:59 PM), Copy file /CimAgent_kit/LINUX/startup/slpdRed Hat to
/etc/init.d/slpd.
(Oct 11, 2004 7:03:59 PM), Command to be executed:
  /sbin/chkconfig --add slpd
(Oct 11, 2004 7:03:59 PM), Copying CIM Object Manager Files ...
(Oct 11, 2004 7:04:24 PM), CIM Object Manager for DS Open API port
successfully updated.
(Oct 11, 2004 7:04:24 PM), CIM Object Manager for DS Open API communication protocol
successfully updated.
(Oct 11, 2004 7:04:24 PM), The file setupCmdLine successfully updated.
(Oct 11, 2004 7:04:24 PM), Compile MOF files started ...
(Oct 11, 2004 7:08:19 PM), MOF files successfully compiled.
(Oct 11, 2004 7:08:19 PM), Generate a certificate store started ...
(Oct 11, 2004 7:08:33 PM), Certificate store called truststore successfully generated.
(Oct 11, 2004 7:08:33 PM), Copy file /CimAgent_kit/LINUX/startup/cimomRed Hat to
/etc/init.d/cimom .
(Oct 11, 2004 7:08:33 PM), Command to be executed:
  /sbin/chkconfig --add cimom
(Oct 11, 2004 7:09:27 PM), The following services started successfully:
Service Location Protocol
CIM Object Manager - DS Open API
(Oct 11, 2004 7:09:27 PM), INSTSUCC: The CIM agent for the IBM TotalStorage DS Open API
has been successfully installed.

```

9. Close the command prompt window by entering a command, for example **exit**. Continue with the post installation tasks for the CIM agent in the following sections. You can also continue the post installation tasks using the following option:
 - a. Open the LaunchPad from the Linux directory of the CIM agent CD by typing `# ./launchpad_linux`.
 - b. Click **Post installation tasks** on the LaunchPad window. Continue with the post installation tasks for the CIM agent by following the instructions in this file.

Verifying the CIM agent installation on Linux

This section provides the steps to verify that your CIM agent is installed correctly on your Linux system.

Steps

Perform the following steps to verify your CIM agent installation:

1. Verify the installation of the service location protocol (SLP).
 - a. Open a Command Prompt window and type the following command to verify that SLP is installed:

```
# ps -ef | grep -v grep | grep slpd
```

If the SLP daemon is started, output similar to the following is displayed:

```
daemon 16054      1 0 18:54 ?          00:00:00 /opt/IBM/cimagent/slp/slpd
```

2. Verify the installation of CIM agent.
 - a. Check that the CIMOM daemon is installed and started by typing the following command:

```
# ps -ef --columns 1000 | grep -E "com.ibm.cimom.CIMOM"
```

```
root      27696 27014  0 Oct08 ?          00:00:00 /opt/IBM/cimagent/ibmjava131/jre
/bin/exe/java -Xms128m -Xmx256m -cp /opt/IBM/cimagent/lib/xml4j-4_0_5/xercesImpl
.jar:/opt/IBM/cimagent/lib/xml4j-4_0_5/xmlParserAPIs.jar:/opt/IBM/cimagent/ibmja
va131/jre/lib/ext/ibmjsse.jar:/opt/IBM/cimagent/lib/JCE/IBMJCEfw.jar:/opt/IBM/ci
magent/lib/JCE/IBMJCEProvider.jar:/opt/IBM/cimagent/lib/JCE/local_policy.jar:/op
t/IBM/cimagent/lib/JCE/US_export_policy.jar:/opt/IBM/cimagent/lib/JCE/ibmpkcs.ja
r:/opt/IBM/cimagent/ibmjava131/jre/lib/rt.jar:/opt/IBM/cimagent/ibmica.jar:/opt/
IBM/cimagent/lib/logger.jar:/opt/IBM/cimagent/lib/DSNIClient.jar:/opt/IBM/cimag
ent/lib/DSNICommon.jar:/opt/IBM/cimagent/lib/DSNIServer.jar:/opt/IBM/cimagent/
lib/jlog.jar com.ibm.cimom.CIMOM -Prime
root      666   591  0 14:03 pts/3    00:00:00 grep -E com.ibm.cimom.CIMOM
[root@store03 root]#
```

- b. If the CIMOM is not started, issue the following command to run the **startcimom** file.

```
<dest-path>/startcimom
```

where <dest-path> is the destination directory where the CIM agent is installed.

If you are able to perform all of the verification tasks successfully, the CIM agent has been successfully installed on your Linux system.

Configuring the CIM agent on Linux

This section provides the steps to configure storage units and user accounts for CIM agent after it has been successfully installed.

You can use the `modifyconfig` command (described in Chapter 6) to change the configuration of some of the parameters that were configured during installation. You can change the CIM agent port value, protocol (HTTP/HTTPS), and enable or disable the debug option.

Steps:

Perform the following steps to configure storage units and user accounts for the CIM agent:

1. Ping each ESS and DS that the CIM agent manages by typing the following command:
 - a. Open a command prompt window.
 - b. Issue a **ping** command; for example:

```
ping 9.11.111.111
```

where 9.11.111.111 is the ESS or DS IP address

- c. Check that you can see reply statistics from the IP address. The following is example output:

```
Pinging 9.11.111.111 with 32 bytes of data:
```

```
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255
```

If you see other messages that indicate that the request has timed out, see your Network Administrator for help on establishing network connectivity before you configure storage units.

2. Configure the CIM agent for each ESS or DS server that the CIM agent can access.

- a. Type the following command:

```
# <dest-path>/setdevice
```

where <dest-path> is the destination directory where the CIM agent is installed.

The following is example output:

```
Application setdevice started in interactive mode  
To terminate the application enter: exit  
To get a help message enter: help  
>>>
```

- b. For each ESS, type the following command:

```
>>>address <9.111.111.111> <essuser> <esspass>
```

where

- *9.111.111.111* represents the IP address of the storage unit
- *essuser* represents an ESS user name
- *esspass* represents the ESS password for the user name

Note: The address command is for ESS machines only. For ESS Copy Services servers and for DS servers, use the addressserver command described in step c.

The following is example output:

```
A provider entry for IP 9.111.111.111 successfully added
```

- c. Type the following command for each ESS server configured for Copy Services and for each DS server:

```
>>> addressserver <9.111.111.111> <essuser> <esspass> <9.222.222.222>
```

where

- *9.111.111.111* represents the IP address of the server
- *essuser* represents a server user name
- *esspass* represents the password for the user name
- *9.222.222.222* represents the alternate IP address of the server

Note: Specifying an alternate IP address is optional. The alternate IP address is used if a connection cannot be made using the primary IP address.

The following is example output:

An essserver entry for IP 9.111.111.111 successfully added

where *9.111.111.111* is the IP address.

- d. Type the **exit** command to exit the CIMOM configuration program. A file named `provider-cfg.xml` is created in the destination directory.
3. Once you have defined all of the servers, you must stop and start the CIMOM to make the CIMOM initialize the settings for the servers. Because the CIMOM collects and caches the information from the defined storage units at startup time, the CIMOM might take longer to start the next time that you start it.
4. Configure the CIMOM for each user that you want to have authority to use the CIMOM by running the CIMOM configuration program.

During the CIM agent installation, the default user name to access the CIM agent CIMOM is created. The default user name is “superuser” with a default password of “passw0rd”. You must use the default user name and password when you use the **setuser** command for the first time after installation. Once you have added other users, you can initiate the **setuser** command using a user name that you defined instead of the default.

- a. Start the CIMOM, if it is not started, by typing the following command:

```
# <dest-path>/startcimom
```

where *<dest-path>* is the destination directory where the CIM agent is installed.

- b. Type the following command:

```
# <dest-path>/setuser -u username -p password
```

where *<dest-path>* is the destination directory where the CIM agent is installed.

The following is example output:

```
Application setuser started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
>>>
```

Restriction: You cannot delete or modify the current user using the `setuser` command.

- c. Obtain a user name and password for each user that can manage the CIMOM. Type the following command for each user:

```
>>>adduser <cimuser> <cimpass>
```

where:

- *cimuser* represents the new user name to access the CIM agent CIMOM
- *cimpass* represents the password for the new user name to access the CIM agent CIMOM

The following is example output:

An entry for user cimuser successfully added

where *cimuser* is your new user name.

- d. When you have completed adding new users to access the CIM agent CIMOM, issue the **exit** command.

- e. You can change the default password for “superuser” by starting the **setuser** command and providing a password for a user that was established in step c above. Issue the following command to change the password:

```
>>>chuser superuser <newpasswd>
```

where *<newpasswd>* is the new password for the superuser.

You can remove the superuser by issuing the following command:

```
>>>rmuser superuser
```

- f. Type the **exit** command to exit the CIMOM configuration program.

If you are able to perform all of the configuring tasks successfully, the CIM agent has been successfully installed on your Linux system.

Configuring the CIM agent to run in unsecure mode on Linux

Some vendor software might not be capable of communicating with the CIM agent in a secure fashion. You can still use this vendor software by configuring the CIM agent to run with only basic user and password security. Perform the following steps to configure in unsecure mode:

1. Type the **stopcimom** command in the destination directory to stop the CIMOM.
2. Find the `cimom.properties` file and edit it with a tool such as vi editor, setting the properties as shown in the following example:

```
Port=5988
ServerCommunication=HTTP
DigestAuthentication=False
```

Once the CIMOM starts, it accepts requests over HTTP using basic authentication.

Note: To completely disable security checking, set “Authorization=False” in the `cimom.properties` file.

3. Type the **startcimom** command to restart the CIMOM.
4. Verify that the server started on port 5988 by opening the `cimom.log` file.

Verifying the CIM agent connection on Linux

During this task, the CIM agent software connects to the storage unit that you identified in the configuration task.

Steps:

Perform the following steps to verify the connectivity to an ESS or DS. You also verify the service location protocol (SLP) daemon and the CIMOM are running, since they are needed to connect to a storage unit.

1. If you are managing an ESS, perform step 1 to verify that the configuration file for the ESS CLI (`CLI.CFG`) is set correctly and that you have a connection. If you are not managing an ESS, skip to step 2 to verify that you have a connection.
 - a. Issue the `rsTestConnection` command from a command prompt window to test network connectivity and determine if the `CLI.CFG` is set correctly. The `rsTestConnection` command primarily tests the connection to the Copy Services primary server.

Note: The ESS CLI does not set the PATH environment variable. If you want to update the PATH variable with the directory where the CLI for the storage unit is installed, review the instructions from your operating system help for your specific AIX shell.

```
rsTestConnection.sh -s -v primaryservername
```

where:

- *-s primaryservername* represents the IP address or the complete host name of a Copy Services server.
- *-v* designates that all responses from the server be displayed.

This following example is output that you receive if the CLI.CFG is set correctly (sltb0c0 is the primary Copy Services server in this example):

```
[root@bluegrass ibm2105cli]# ./rsTestConnection.sh -v -s sltb0c0
rsWebTest: Using sltb0c0 as server name
rsWebTest: HeartBeat to the server was successful.
rsWebTest: command successful
```

- b. Issue the `esscli list server` command from a command prompt window to confirm connectivity to the rest of the ESS storage units in the domain.

```
esscli -u <essuser> -p <esspass> -s <9.111.111.111> list server
```

where:

- *essuser* is an storage manager user name.
- *esspass* is the storage manager password for that user name.
- *9.111.111.111* is the IP address of the storage server.

A response similar to the following is displayed:

```
Thu Oct 09 13:20:40 PDT 2003 IBM ESSCLI 2.3.0.1

  Server      Model  Mfg      WWN          CodeEC      Cache      NVS      Racks
  -----
2105.22232   800    013     5005076300C09470  2.4.0.236   8GB       2GB      1
```

2. Before running the command to verify the CIM agent connection, type the following command to see if the SLP daemon is started:

```
ps -ef | grep slpd
```

- a. If the SLP daemon is not started, type the following command from a separate command prompt window:

```
# /etc/init.d/slpd start
```

Note: This session remains active until you stop it. Keep it running as long as the CIM agent is running.

3. Before running the command to verify the CIM agent connection, ensure the CIMOM is started by typing the following command:

```
ps -ef | grep CIMOM
```

- a. If the CIMOM is not started, start it by typing the following command:

Note: The default is to start the secure CIMOM. It registers itself with SLP and accept requests on port 5989.

```
# <dest-path>/startcimom
```

Note: The startcimom command quickly returns a prompt; however, a returned prompt does not mean that the processing is complete. If there are a large number of LUNs to enumerate in the internal domain, it takes considerable time for the CIMOM to find and enumerate all those disks. Do **not** issue the verifyconfig command until CIMOM processing is complete. You can view the cimom.log in the directory where you installed the CIM agent to verify the CIMOM processing status.

4. You can view CIMOMs registered with SLP using the verifyconfig command. This command locates all WBEM services (for example, CIMOMs) in the local network. Information is displayed for the storage units to which the CIM agents can connect. In the following example, the CIM agent on host 9.111.111.111 connects to two storage units (2107.AZ123x and 2105.2223x).

Run the following command from a command prompt window:

```
# <dest-path>/verifyconfig -u <user> -p <password>
```

Where *<user>* and *<password>* are the user and password of a CIMOM user ID that was created with **setuser** command.

The following is example output of a successful connection:

```
# verifyconfig -u guest -p guest
Verifying configuration of CIM agent for the IBM TotalStorage
DS Open Application Programming Interface...
Communicating with SLP to find WBEM services...
3 WBEM services found
  host=9.111.111.112, port=5989
  host=9.111.111.113, port=5989
  host=9.111.111.114, port=5989
Connecting to CIM agent, host=9.111.111.113, port=5989
Found 2 IBMTSESS_StorageSystem instances:
2107.AZ123x
2105.2223x
Internal Server at 9.111.111.122 configured for 2107.AZ123x
Internal Server at 9.111.111.119 configured for 2105.2223x
Verification Successful
```

This completes the steps to verify the connection of the CIM agent to a storage unit.

Removing the CIM agent on Linux

This optional task provides the steps to remove the CIM agent from your Linux system.

Steps:

Perform the following steps to remove the CIM agent:

1. Log on as a user with root authority.
2. If the CIM Object Manager for DS Open API Service and the Service Location Protocol services are started, you must stop them. Type the following two commands to first check if the CIMOM is running and, if so, to stop it:

The follow is example output if the CIMOM is running.

```
# ps -ef --columns 1000 | grep -v "com\.ibm\.cimom\.CIMOM"
```

```

root 52858 1 0 Oct 16 pts/7 2:29 /opt/IBM/ICAT/ibmjava131/jre/bin/
java -Xms128m -Xmx256m -cp /opt/IBM/ICAT/lib/xml4j-4_0_5/xercesImpl.jar:
/opt/IBM/ICAT/lib/xml4j-4_0_5/xmlParserAPIs.jar:/opt/IBM/ICAT/ibmjava131/
jre/lib/ext/ibmjsse.jar:/opt/IBM/ICAT/lib/JCE/IBMJCEfw.jar:/opt/IBM/ICAT/
lib/JCE/IBMJCEProvider.jar:/opt/IBM/ICAT/lib/JCE/local_policy.jar:/opt/
IBM/ICAT/lib/JCE/US_export_policy.jar:/opt/IBM/ICAT/lib/JCE/ibmpkcs.jar:
/opt/IBM/ICAT/ibmjava131/jre/lib/rt.jar:/opt/IBM/ICAT/ibmica.jar com.
ibm.cimom.CIMOM
root 62884 40012 3 18:29:22 pts/7 0:00 grep cimom

```

If the CIMOM is running, stop it by type the following command:

```
# <dest-path>/stopcimom
```

where <dest-path> is the destination directory where the CIM agent is installed.

3. Type the following command to see if the SLP daemon is started:

```
# ps -ef | grep slpd
```

If it is running, output similar to the following is displayed:

```

daemon 61026 1 0 Oct 16 - 0:18 /opt/IBM/ICAT/slp/slpd
root 62884 40012 3 18:29:22 pts/7 0:00 grep slpd

```

Type the following command to stop the SLP daemon, if it's running:

```
# /etc/init.d/slpd stop
```

4. Run the removal program in graphical mode or in unattended (silent) mode to remove the CIM Object Manager for DS Open API Service and Service Location Protocol.

The CIM agent removal process does not remove configuration files, logs, and similar files that are created during or after the installation process. They are located in the destination path where CIM agent component was installed. For example, the default target directory is **/opt/IBM/cimagent**.

Remove the directory and all of its contents (especially if you plan to reinstall CIM agent).

Note: If you want to keep the old configuration files, before removing them from the installation destination path, save them in another location on your system to restore them later.

To remove the cimagent directory you must type the following command:

```
# rm -Rf /opt/IBM/cimagent
```

Note: The recursive remove is used in the example because the CIM agent has a deep directory structure. Make sure you understand a recursive remove: it is very powerful because it removes all subdirectories without prompting you. You must use the fully qualified directory name.

Removing the CIM agent on Linux in graphical mode

Perform the following steps to remove the CIM agent in graphical mode:

1. Type the following command to run the uninstall program from the **_uninst** subdirectory:

```
# cd <dest-path>/_uninst
# ./uninstaller
```

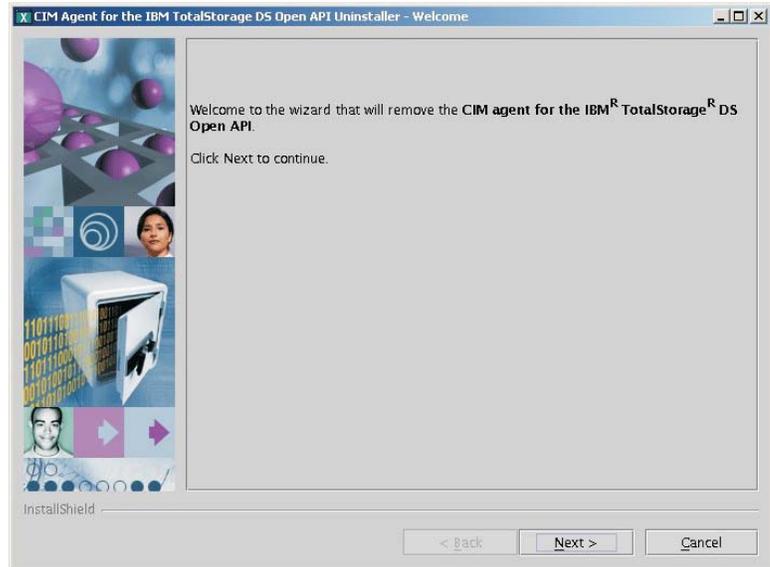
where <dest-path> is the target directory where CIM agent is installed.

2. If the wizard uninstaller launcher was not created during the CIM agent installation, type the following command:

```
# <dest-path>/java/jre/bin/java -jar <dest-path>/_uninst/uninstall.jar
```

where *<dest-path>* is the target directory where the CIM agent is installed.

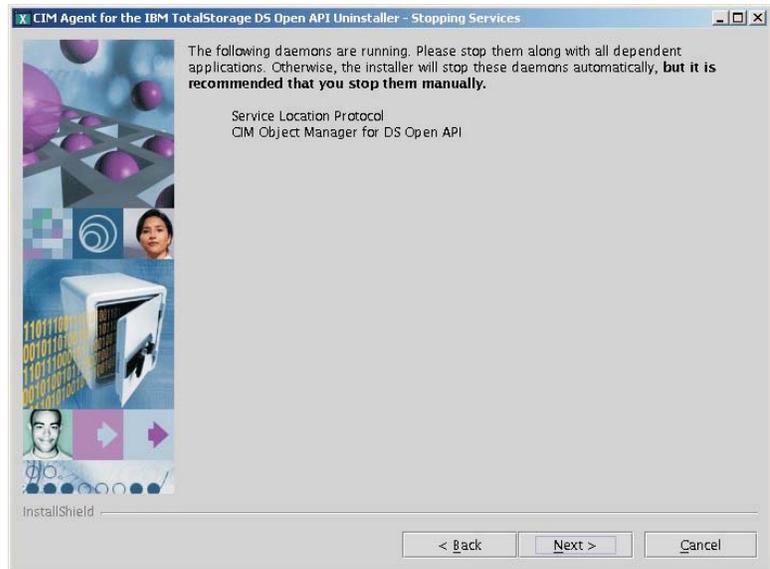
3. The Welcome window opens. Click **Next** to continue with the removal program, or click **Cancel** to exit the removal program.



The program detects if the service location protocol (SLP) and the CIM Object Manager (CIMOM) for DS Open API services are running and displays the following information:

- If the SLP and CIMOM are running, the Stopping Services window asks if you want to continue with the removal program. In that case, click **Next** to stop the services. Click **Cancel** to stop the services yourself (manually).
- If you want to manually stop the services, you must exit the removal program, stop the services and the applications that use them, and then run the removal program again from the beginning.

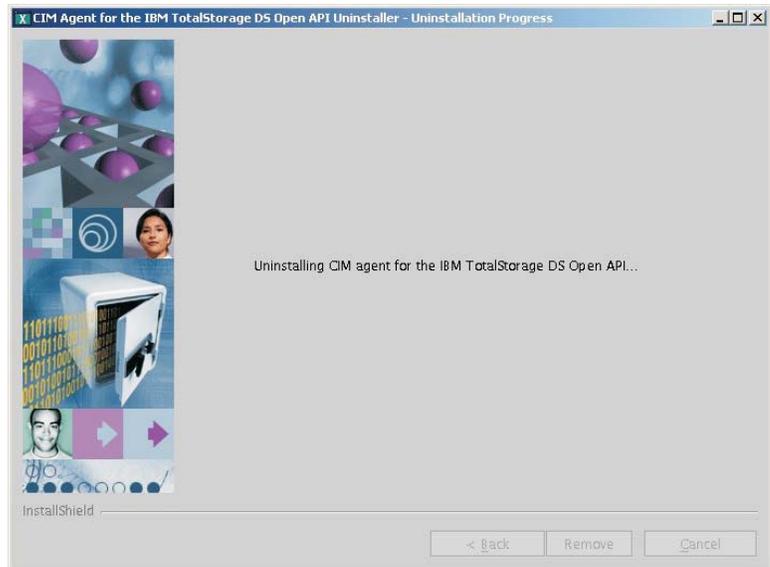
Attention: You must be careful if you have other applications that use the SLP service. If you do, you must stop these applications before you stop the SLP service because the SLP service is deleted during the removal process.



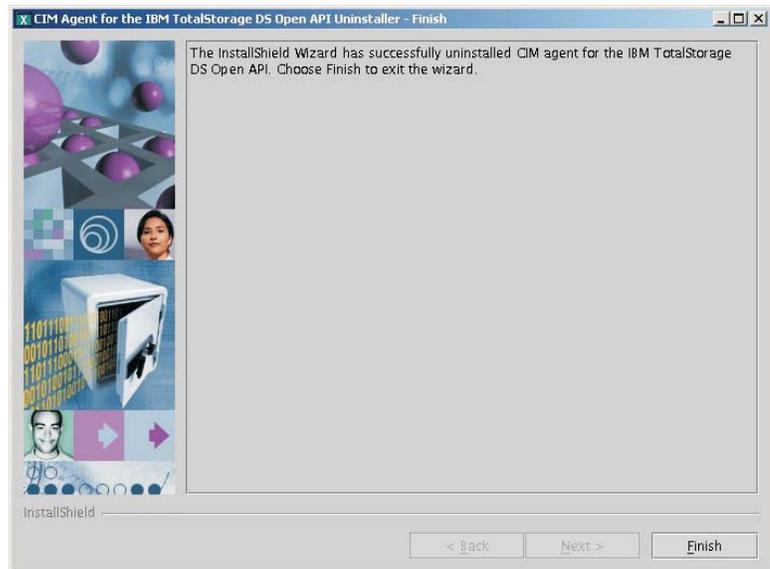
- If neither the SLP service nor the CIMOM service is running, the removal program continues with the Confirmation window.
4. The Confirmation window opens, displaying the location of the product that will be removed. Click **Remove** to continue with the removal program, or click **Cancel** to exit.



5. The Uninstallation Progress window opens. Wait for the program to remove the CIM agent.



6. The Finish window opens displaying information about the result of removal (successfully or failed).



Click **Finish** to end the removal program.

Removing the CIM agent on Linux in unattended (silent) mode

This section allows you to perform an unattended (silent) mode removal in Linux.

Steps:

Perform the following steps to remove the CIM agent in unattended (silent) mode:

1. Stop SLP, CIMOM, and all related processes.
2. Type the following command to run the removal program from the `_uninst` subdirectory:

```
<dest-path>/_uninst/uninstaller -silent
```

3. If the program detects that the service location protocol (SLP) or the IBM CIM Object Manager (CIMOM) services are running, it displays an error message and the uninstallation fails. You can look for details in the <dest-path>/logs/uninstall.log file. However, if you want the program to automatically stop the services, you must set the stopProcessesResponse option to yes in the command line:

```
<dest-path>/_uninst/uninstaller -silent -G stopProcessesResponse=yes
```

The CIM agent removal process does not remove configuration files, logs, and similar files that are created during or after the installation process. They are located in the destination path where CIM agent was installed. For example, the default destination path is /opt/IBM/cimagent.

Remove the directory and all of its contents (especially if you plan to reinstall the CIM agent).

Note: If you want to keep the old configuration files, save them in another location on your system before removing them from the installation destination path, so you can restore them later.

To remove the directory, cimagent, you must type the following command, for example, from the IBM directory.

```
# rm -rf /opt/IBM/cimagent
```

Note: The recursive remove is used in this example because the CIM agent has a deep directory structure. The recursive remove is very powerful and dangerous. You should use the fully qualified directory name.

Chapter 5. CIM agent for Windows

This chapter includes an overview of the installation process and instructions for installing and configuring the CIM agent on a Windows 2000, or later, operating system.

Installation overview for Windows

This section provides an overview of the installation and configuration of the CIM agent on a Windows 2000, or later, operating system. Ensure that you have knowledge of how to administer a Windows 2000, or later, operating system before you install the CIM agent. Also be familiar with the commands that you use during installation and configuration of the CIM agent.

The following list of installation and configuration tasks are in the order in which they should be performed:

1. Before you install the CIM agent for Windows, check the hardware and software requirements.
2. If you are managing ESS storage units, you must install the prerequisite ESS CLI level 2.4.0.236 software. The ESS CLI must be installed first because the CIM agent sets the path information in shell scripts for you based on the location of the ESS CLI. The CIM agent installation wizard checks your system for the existence of the ESS CLI, and the wizard displays a warning message if ESS CLI is not installed. For ESS CLI installation instructions, see the *IBM TotalStorage Enterprise Storage Server Command-Line Interfaces User's Guide*.
Attention: If you are upgrading from a previous version of the CIM agent, you must upgrade the ESS CLI software to the new level required which is a minimum level of 2.4.0.236.
3. You can choose to install the CIM agent either in graphical mode with the help of an installation wizard or in unattended mode (also known as silent mode), which involves customizing a response file and issuing a command.
4. Verify the CIM agent Windows installation.
5. Configure the CIM agent for Windows. You might want to revisit the configuration section in the future as you add, change, or delete CIMOM authentication and storage unit information.
6. Verify the connection to your storage unit.
7. Optionally, remove the CIM agent. You only need to perform this optional task if you get errors during installation verification or if the CIM agent did not set the environment variables.

Installing the CIM agent on Windows in graphical mode

This section includes the steps to install the CIM agent in your Windows environment in graphical mode.

You must satisfy all prerequisites before you begin the CIM agent installation.

You can choose to install the CIM agent in graphical mode with the help of an installation wizard or in unattended (silent) mode, which involves customizing a response file and issuing a command. If you want to install the CIM agent in graphical mode, continue with this section. After the completion of either kind of

installation, you must verify the installation of the CIM agent. Before you install the CIM agent on Windows, verify that your system meets the hardware and software requirements.

1. Log on to your system as the local administrator.
2. Insert the CIM agent CD into the CD-ROM drive.

The CIM agent program should start within 15 - 30 seconds if you have autorun mode set on your system. If the LaunchPad window does not open, perform the following steps:

- a. Use a Command Prompt or Windows Explorer to change to the Windows directory on the CD.
- b. If you are using a Command Prompt window, type:
LaunchPad
- c. If you are using Windows Explorer, double-click on the **LaunchPad.bat** file.

Note: If you are viewing the folder with Windows Explorer with the option selected to hide file extensions for known file types, find the LaunchPad file with the file type of MS-DOS Batch File.

3. The following options are displayed when the LaunchPad window opens:

CIM Agent overview

Offers information about the CIM agent

Readme file

Offers any last minute product information that did not make it into this installation guide

Installation guide

Offers instructions on how to install the CIM agent (a softcopy of this document)

License agreement

Offers information about the license for the CIM agent

CIM Agent Web site

Offers information from the product Web site

MOF Documentation

Offers information about MOF documentation.

Installation wizard

Starts the CIM agent installation program

Post installation tasks

Offers information about configuring users and storage unit communication

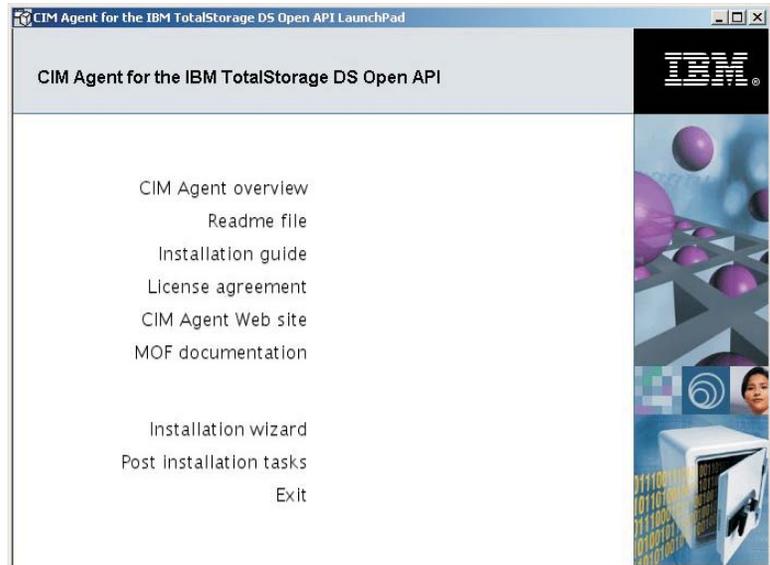
Exit Exits the CIM agent LaunchPad program

4. Click the **Readme file** from the LaunchPad window or from the **README.txt** file located in the doc or Windows directory on the CIM agent CD to check for information that might supersede the information in this guide.
5. Click **Installation wizard** from the LaunchPad window to start the installation.

Note: The LaunchPad window remains open behind the installation wizard so that you can access product information during the installation process. Click **Exit** if you want to close the LaunchPad.

The LaunchPad window remains open (behind the wizard) during the installation. You can access product information after the installation has

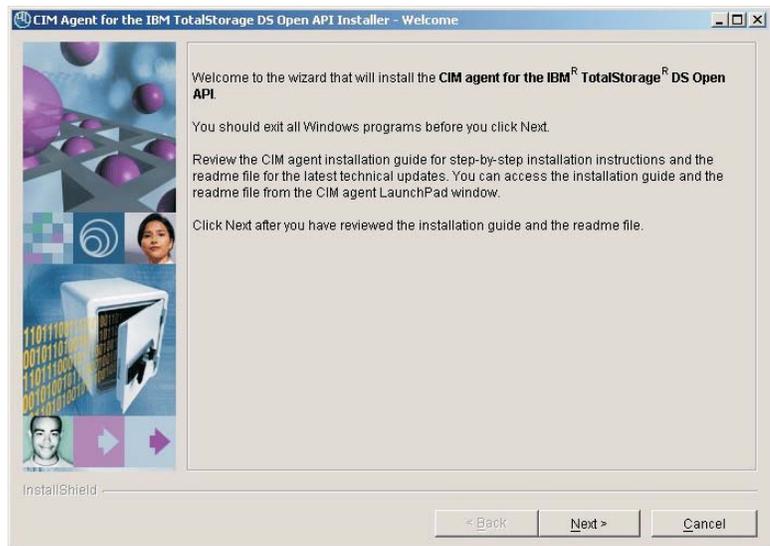
started. The LaunchPad returns to the foreground when the installation is complete. You can click **Exit** to close the LaunchPad.



6. There might be a slight delay while the software loads on your system. After the software loads a DOS prompt window opens to display the following message:

```
Initializing InstallShield Wizard...
Preparing Java (tm) Virtual Machine .....
.....
```

7. The Welcome window opens suggesting what documentation you should review prior to installation. Click **Next** to continue, or click **Cancel** to exit the installation.

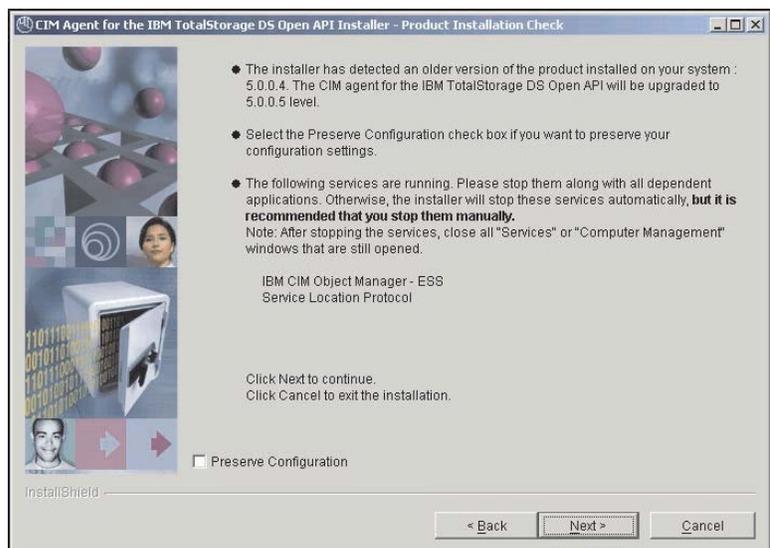


8. The License Agreement window opens. Read the license agreement information. Select **I accept the terms of the license agreement**, then click **Next** to accept the license agreement. Otherwise, keep the selection **I do not**

accept the terms of the license agreement (it is the default) and click **Cancel** to exit the installation.

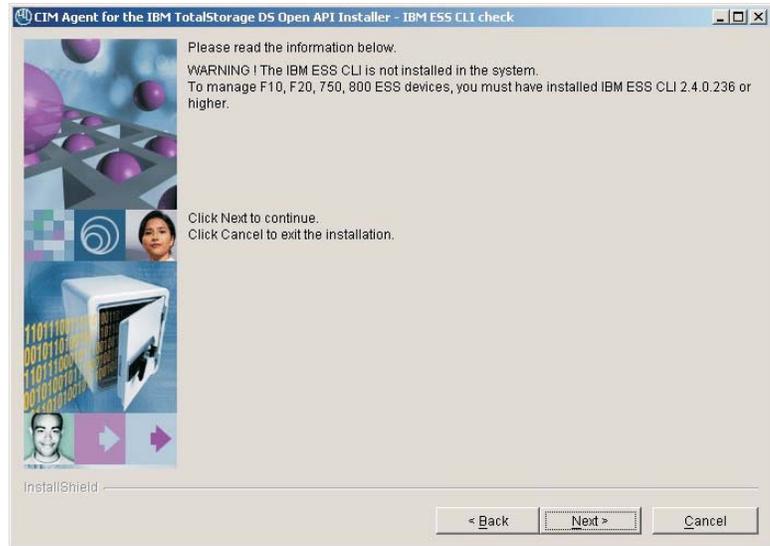


9. If the installation wizard detects a prior installation of the CIM agent, the Product Installation Check window opens. Check the **Preserve Configuration** check box if you want to preserve your configuration settings. Follow any specific instructions in the window. For example, the figure below shows a warning to stop running services. Once you have followed all instruction, select **Next**.

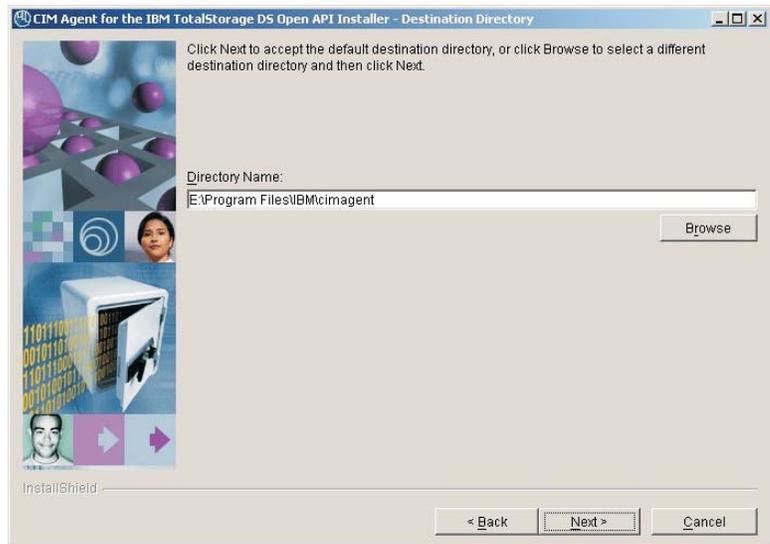


10. The IBM ESS CLI Check window opens. The wizard verifies that you have the IBM ESS CLI installed if you are managing ESS storage units.

Note: The window is not displayed if you have the required version of the ESS CLI already installed.



11. The Destination Directory window opens. Click **Next** to accept the default directory where setup will install the files, or click **Browse** to select a different directory for installation and then click **Next**.



Note:

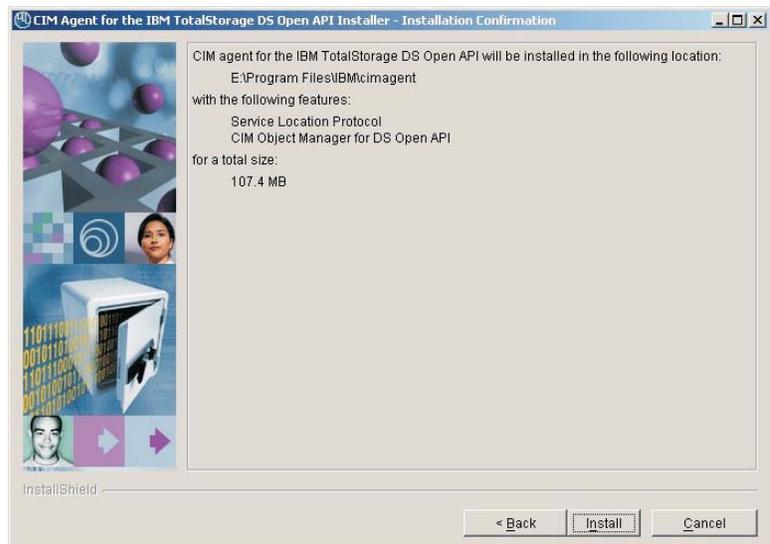
- a. The Destination Directory window is displayed only if a version of CIM agent is not already installed. Otherwise, the CIM agent is reinstalled or upgraded to the same install location.
- b. If the program detects insufficient space for the CIM agent installation in the chosen destination, an error message is displayed. You can free some space on the destination drive and then click **Next** or you can stop the installation program by clicking **Cancel**. You can also go back by clicking **Back**, and choose another destination directory for the product.

12. The Updating CIMOM Port window opens. Click **Next** to accept the default port. If the default port is the same as another port already in use, modify the default port and click **Next**. Use the following command to check which ports are in use:
- Either accept the default port or, if the default port is the same as another port already in use, modify the default port. Use the following command to check which ports are in use:

```
netstat -a
```
 - Either accept HTTPS as the communication protocol or select another protocol.
 - Click **Next** to continue with installation, or click **Cancel** to exit the wizard.



13. The Installation Confirmation window opens. Click **Install** to confirm the installation location and file size. You can click **Cancel** to exit the installation wizard or go back to the previous window by clicking **Back**.



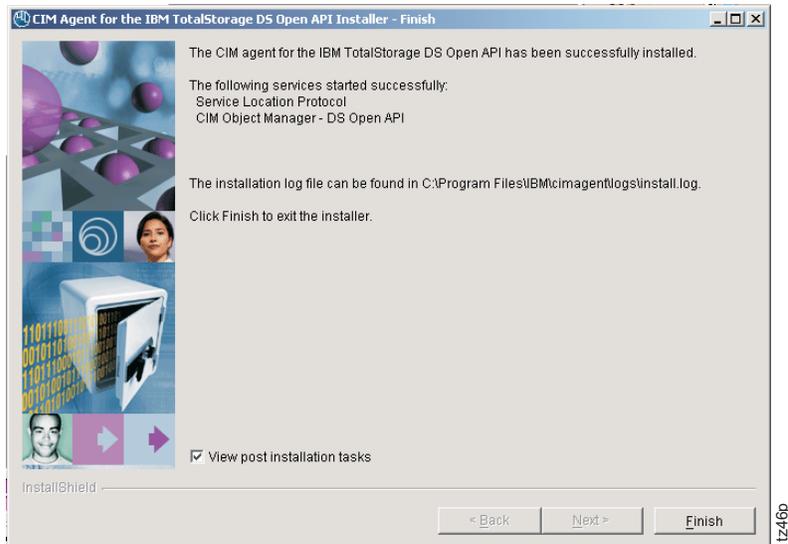
- The Installation Progress window opens indicating how much of the installation has been completed. Installation usually takes 3 - 10 minutes depending on the configuration of your machine. You can click **Cancel** to exit the installation wizard.

Note: If you click **Cancel**, a popup window opens asking you to confirm the cancellation of the installation wizard: "Cancel the current operation? **Yes No**". Be aware that if you confirm the cancellation by clicking Yes, the information you entered or selected in previous windows is not saved. You must start the installation again from the first step.



- When the Installation Progress window closes, the **Finish** window opens. You can choose to view the post installation tasks by selecting the **View post installation tasks** checkbox, or you can deselect the checkbox and continue with the post installation tasks described in this manual. Click **Finish** to exit the installation wizard.

Note: Before proceeding, you might want to review the log file for any possible error messages. The log file is located in `xxx\logs\install.log`, where `xxx` is the destination directory where the CIM agent for Windows is installed. The `install.log` contains a trace of the installation actions.



16. Exit the LaunchPad program by clicking **Exit** on the LaunchPad window. If you have not done so already, continue with the post installation tasks for the CIM agent using the instructions in the following sections.

Note: Ordinarily, you do not need to restart your system during or after the installation of the CIM agent. However, the installation wizard might determine that a restart is necessary. Restart your system if required. After you restart the system, the installation wizard continues with the installation.

Installing the CIM agent on Windows in unattended (silent) mode

This section includes the steps to install the CIM agent in your Windows environment using the unattended (silent) mode.

You must satisfy all prerequisites before you begin the CIM agent installation.

The unattended (silent) install option allows you to run installation unattended. Use this method of installation to customize a response file and issue a command from a command prompt window. The response file is a template on the CIM agent CD. You can also create a standard response file to ensure that the product is installed consistently on multiple systems. After the completion of the installation, you must verify the CIM agent installation.

1. Log on as local administrator user.
2. Insert the CIM agent CD.
3. Locate the response file (named *responsefile*) on your CIM agent CD in the W2K directory.
4. Using Windows Explorer or a command prompt, copy the response file to your hard drive.
5. Using a text editor modify the default options in the response file with the values you want:
 - a. Remove the # character from the beginning of a line if you do not want to use the default value. Change the default value to the value that you want for that option. You *must* enclose all values in double quotation marks ("").

- b. The `<-P product.installLocation>` option defines the default directory where the product is to be installed. To specify a destination directory other than the default, remove the # character from the corresponding line and replace the default directory with the desired directory.
 - c. The `<-G checkPrerequisite>` option checks the prerequisites. If you want to disable this option, remove the # character from the corresponding line and change the value to no.
 - d. The `<-G startUpgrade>` option enables the installation of the CIM agent over a previous installation of CIM agent having the same version (reinstall) or lower version (upgrade). If you want to enable this option, remove the # character from the corresponding line and change the value to yes.
 - e. The `<-G stopProcessesResponse>` option tells the install program whether to automatically stop SLP and CIM agent services when you reinstall or upgrade the product. By default this option is set to no. If you do not change this default value, the reinstallation or upgrade stops when these service are running. If you want to automatically stop the SLP and CIMOM, remove the # character from the corresponding line and change its value to yes.
 - f. The `<-G saveConfiguration>` option specifies whether to save the configuration settings (for example, user names, passwords, and storage unit IP addresses) when reinstalling or upgrading the product. If you do not want to save the configuration settings when reinstalling or upgrading, remove the # character from the corresponding line and change the value to no.
 - g. The `<-W cimObjectManagerPorts.port>` option specifies the CIM agent server port. If you want to change the default value during installation, remove the # character from the corresponding line and change the default port value (5989) with the desired port value.
 - h. The `<-W cimObjectManagerPorts.serverCommunication>` option specifies the CIM agent server communication protocol. If you want to change the default value during installation, remove the # character from the corresponding line and change the default server communication protocol (HTTPS) to HTTP protocol.
6. Save the modifications to the **responsefile** file. Save the file *without* a file extension such as .txt.
 7. From a command prompt window, type the following command:

```
<CD drive path>\W2K\install -options <response file path>\responsefile
```

 where `<CD drive path>` is the path of your CD-ROM drive. `<response file path>` is the path of the responsefile file that you copied in step 4 on page 82 and customized in step 5 on page 82.
 8. During the installation you will see dotted lines scrolling across the screen. When the installation program ends, you see the cursor.
 9. Check for installation errors in the install.log file. After all the prerequisites checks have been performed, the log file is copied to the `<dest-path>\logs` directory. This file can be found in the `<dest-path >\logs\` directory. This file is initially created in the system temporary file under the subdirectory cimagent. The following is an example of an install.log file:

```

(Oct 13, 2004 3:22:19 PM), This summary log is an overview of the sequence of the
installation of the CIM Agent for the IBM TotalStorage DS Open API 5.0.0.2
(Oct 13, 2004 3:22:27 PM), CIM agent for the IBM TotalStorage DS Open API
installation process started with the following install parameters:
Target Directory: "E:\Program Files\IBM\cimagent"
(Oct 13, 2004 3:22:31 PM), Copying Service Location Protocol Files ...
(Oct 13, 2004 3:22:33 PM), Service Location Protocol successfully installed
(Oct 13, 2004 3:22:34 PM), Copying CIM Object Manager Files ...
(Oct 13, 2004 3:22:56 PM), CIM Object Manager for DS Open API port successfully
updated.
(Oct 13, 2004 3:22:56 PM), CIM Object Manager for DS Open API communication protocol
successfully updated.
(Oct 13, 2004 3:22:56 PM), The file setupCmdLine.bat successfully updated.
(Oct 13, 2004 3:22:56 PM), Compile MOF files started ...
(Oct 13, 2004 3:24:01 PM), MOF files successfully compiled.
(Oct 13, 2004 3:24:01 PM), Generate a certificate store started ...
(Oct 13, 2004 3:24:05 PM), Certificate store called truststore successfully
generated.
(Oct 13, 2004 3:24:06 PM), CIM Object Manager - DS Open API successfully installed
(Oct 13, 2004 3:24:18 PM), Command to be executed : net start cimomsrv
(Oct 13, 2004 3:24:33 PM), The following services started successfully:
Service Location Protocol
CIM Object Manager - DS Open API
(Oct 13, 2004 3:24:33 PM), INSTSUCC: The CIM agent for the IBM TotalStorage
DS Open API has been successfully installed.

```

10. Close the command prompt window by entering a command, for example **exit**. Continue with the post-installation tasks for the CIM agent using the instructions in the following sections. You can also continue the post installation tasks using the following option:
 - a. Open the LaunchPad from the command prompt window by typing LaunchPad.
 - b. Click **Post installation tasks** on the LaunchPad window. Continue with the post installation tasks for the CIM agent by following the instructions in this file.

Verifying the CIM agent installation on Windows

This task verifies that your CIM agent is installed correctly on your Windows operating system.

Steps:

Perform the following steps to verify your CIM agent installation on your Windows operating system:

1. Verify the installation of the Service Location Protocol (SLP).
 - a. Verify that SLP is started. Select **Start -> Settings -> Control Panel**. Double-click the **Administrative Tools** icon. Double-click the **Services** icon.
 - b. Find **Service Location Protocol** in the Services window list. For this component, the Status column should be marked **Started** and the Startup Type column should be marked **Manual**. If those conditions are not met, right-click on the SLP and select **Start** from the pop-up menu. Wait for the Status column to be changed to **Started**
 - c. Do not close the Services window because you will also use it to verify the CIM object manager (CIMOM) service.
2. Verify the installation of the CIM agent.
 - a. Verify that the CIMOM service is started. If you closed the Services window, select **Start -> Settings -> Control Panel**. Double-click the **Administrative Tools** icon. Double-click the **Services** icon.

- b. Find **CIM Object Manager - DS Open API** in the Services window list. For this component, the Status column should be marked **Started** and the Startup Type column should be marked **Automatic**. If those two conditions are not met, right click on the **CIM Object Manager - DS Open API** and select **Start** from the pop-up menu. Wait for the Status column to change to **Started**.
- c. Close the Services window.
- d. Close the Administrative Tools window.

If you are able to perform all of the verification tasks successfully, the DS CIM agent has been successfully installed on your Windows system. Next, perform the required configuration tasks.

Configuring the CIM agent for Windows

This task configures the CIM agent after it has been successfully installed. This section repeats the instructions in the Post Installation Tasks option that you open from the LaunchPad window.

You can also use the modifyconfig command (described in Chapter 6) to change the configuration of some of the parameters that were configured during installation. You can change the CIM agent port value, protocol (HTTP/HTTPS), and enable or disable the debug option.

Steps:

Perform the following steps to configure the CIM agent:

1. Ping each ESS and DS that the CIM agent will manage by typing the following command:
 - a. Open a command prompt window and issue a **ping** command; for example:


```
ping 9.11.111.111
```

where 9.11.111.111 is an ESS or DS IP address
 - b. Check that you can see reply statistics from the IP address. The following is example output:

```
Pinging 9.11.111.111 with 32 bytes of data:
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255
```

If you see other messages that indicate that the request has timed out, see your Network Administrator for help on establishing network connectivity before you configure storage units.

2. Configure the CIM agent for each ESS or DS which the CIM agent can access. Change directories into the CIM agent directory; for example: C:\Program Files\IBM\cimagent and type the following command to start the interactive **setdevice** tool to identify servers to the CIMOM:

```
setdevice
```

- a. For each ESS, type the following command:

```
>>>address 9.111.111.111 essuser esspass
```

where

- *9.111.111.111* represents the IP address of the ESS
- *essuser* represents an ESS storage manager user name
- *esspass* represents the password for the user name

The following is example output:

A provider entry for IP 9.111.111.111 successfully added

- b. Type the following command for each ESS configured for Copy Services or for each DS server the CIM agent will access:

```
>>> addressserver 9.111.111.111 essuser esspass 9.222.222.222
```

where

- *9.111.111.111* represents the IP address of the ESS or DS server
- *essuser* represents a user name for the server
- *esspass* represents the password for the user name
- *9.222.222.222* represents the alternate IP address of the server

Note: Specifying an alternate IP address is optional. The alternate IP address is used if a connection cannot be made using the primary IP address.

The following is example output:

An essserver entry for IP 9.111.111.111 successfully added

3. Repeat step 2 on page 85 for each additional storage unit that you want to configure.
4. Close the **setdevice** interactive session by typing **exit**.
5. Once you have defined all the servers, you must stop and restart the CIMOM to make the CIMOM initialize the information for the servers. Because the CIMOM collects and caches the information from the defined servers at startup time, the starting of the CIMOM might take a longer period of time the next time you start it.

Perform the following steps to use the Windows Start Menu facility to stop and restart the CIMOM:

- a. Stop the CIMOM by selecting **Start -> Programs -> CIM agent for IBM TotalStorage DS Open API -> Stop CIMOM service**. A command prompt window opens to track the stoppage of the CIMOM.

Note: You might see an error message pop-up window that is labeled “java.exe - Application Error”. You must click **OK** to close that window to continue.

If the CIMOM has stopped successfully, the following message is displayed:

The CIM Object Manager for DS Open API service was stopped successfully.

Press any key to close the command prompt window.

- b. Restart the CIMOM by selecting **Start -> Programs -> CIM agent for IBM TotalStorage DS Open API -> Start CIMOM service**. A command prompt window opens to track the progress of the CIMOM start process.

The restarting of the CIMOM can take a while because it is connecting to the defined servers and is caching that information for future use. If the CIMOM has started successfully, the following message is displayed:

The CIM Object Manager for DS Open API service was started successfully.

Press any key to close the command prompt window.

6. Use the **setuser** interactive tool to configure the CIMOM for the users with authority to use the CIMOM.

Note: The users you configure to use the CIMOM are uniquely defined to the CIMOM software and have no required relationship to operating system user names, the DS Storage Manager user names, or the Copy Services user names.

Upon installation of the CIM agent, the provided default user name is “superuser” with a default password of “passw0rd”. The first time that you use the **setuser** tool, you must use this user name and password combination. Once you have defined other user names, you can start the **setuser** command by specifying other defined CIMOM user names.

Note: The CIMOM must be running before you can use the **setuser** command.

- a. Open a Command Prompt window and change directory to the CIM agent directory; for example:

```
C:\Program Files\IBM\cimagent
```

- b. Type the following command at the command prompt to start the **setuser** interactive session to identify users to the CIMOM:

```
setuser -u superuser -p passw0rd
```

- c. Type the following command in the **setuser** interactive session to define new users:

```
>>>adduser cimuser cimpass
```

where

- *cimuser* represents the new user name that can access the CIM agent CIMOM
- *cimpass* represents the password for the new user name that can access the CIM agent CIMOM

The following is example output:

An entry for user cimuser successfully added

where *cimuser* is the new user name.

7. Repeat step 6c for each additional user name that you want to configure.
8. You can change the default password for “superuser” by starting the **setuser** command and by providing a user name and password. Issue the **setuser** interactive session command to change the password for the superuser:

```
>>>chuser superuser newpasswd
```

where newpasswd is the new password for the superuser.

You can also delete the superuser by issuing the following **setuser** interactive session command:

```
>>>rmuser superuser
```

9. Close the **setuser** interactive session by typing **exit**.

Note: Unlike the **setdevice** actions, you are required to stop and restart the CIMOM to make the **setuser** actions take effect.

If you were able to perform all of the configuring tasks successfully, the CIM agent has been successfully installed and configured on your Windows system.

Configuring the CIM agent to run in unsecure mode

Some vendor software might not be capable of communicating with the CIM agent in a secure fashion. You can still use this vendor software by configuring the CIM agent to run with only basic user and password security. Perform the following steps to configure the CIM agent to run in unsecure mode:

1. Using the Windows Start Menu facility, stop the CIMOM by selecting **Start -> Programs -> CIM agent for IBM TotalStorage DS Open API-> Stop CIMOM service**.
2. Using the Windows Services facility, stop and start the Service Location Protocol (SLP) service by selecting **Start -> Settings -> Control Panel**. Double-click **Administrative Tools** and double click **Services**. Right click **Service Location Protocol** in the Name column and select **Stop** in the menu. After the SLP stops, start it again by right-clicking on Service Location Protocol in the Name column and selecting **Start** in the menu. After the SLP starts, close the Services Window and the Administrative Tools Window.
3. Find the cimom.properties file and edit it with a tool such as notepad, setting the properties as shown in the following example:

```
Port=5988
ServerCommunication=HTTP
DigestAuthentication=False
```

Once the CIMOM starts, it accepts requests over HTTP using basic authentication.

Note: To completely disable security checking, set “Authorization=False” in the cimom.properties file.

4. Using the Windows Start Menu facility, restart the CIMOM by selecting **Start -> Programs -> CIM agent for IBM TotalStorage DS Open API-> Start CIMOM service**. The CIMOM registers itself with SLP using the revised attributes.
5. Close this window by pressing any key when you are prompted by the following display:

```
The CIM Object Manager service is starting .....
The CIM Object Manager service was started successfully
Press any key to continue ...
```

Verifying the CIM agent connection on Windows

During this task, the CIM agent software connects to the storage unit that you identified in the configuration task.

If you are managing an ESS, perform the following steps to verify that the configuration file for the ESS CLI (CLI.CFG) is set correctly and that you have a connection. If you are not managing an ESS, skip to step 4 on page 90 to verify that you have a connection.

1. Verify that you have network connectivity to the ESS from the system where the CIM agent is installed. To do this, perform the following steps:
 - a. Open a command prompt window.
 - b. Issue a **ping** command to the ESS; for example:

```
ping 9.11.111.111
```

where 9.11.111.111 is the ESS IP address

- c. Check that you can see reply statistics from the ESS IP address. The following is example output:

```
Pinging 9.11.111.111 with 32 bytes of data:  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255  
Reply from 9.11.111.111: bytes=32 time<10ms TTL=255
```

If you see other messages that indicate that the request has timed out, see your Network Administrator for help on establishing network connectivity from the system where the CIM agent is installed.

2. Verify that the ESS CLI is operational and can connect to the storage unit. To do this, perform the following steps:

- a. Open a command prompt window.
b. Issue the following command:

```
esscli -u essuser -p esspass -s 9.111.111.111 list server
```

where

- 9.111.111.111 represents the IP address of the Enterprise Storage Server
- *essuser* represents the DS Storage Manager user name
- *esspass* represents the DS Storage Manager password for the user name

The following is an example of a successful response:

```
Thu Oct 09 11:22:28 PDT 2003 IBM ESSCLI 2.4.0.236  
Server Mode Mfg WWN CodeEC Cache NVS Racks  
-----  
2105.22232 800 013 5005076300C09470 2.4.0.236 8GB 2GB
```

- c. Verify that the CLI.CFG) file is set correctly. From the command prompt window, issue the following command:

```
rsTestConnection.exe /s /v primaryservername
```

where

- */s primaryservername* represents the IP address or the complete host name of an ESS Copy Services server.
- */v* designates that all responses from the server be displayed.

Note: In some cases the ESS CLI does not work correctly unless the system has been rebooted following the new installation of the ESS CLI.

3. Using the Windows Services Facility, verify that the SLP is active by selecting **Start -> Settings -> Control Panel**. Double-click the **Administrative Tools** icon. Double-click the **Services** icon.

- a. Find the Service Location Protocol (SLP) in the Name column.

For this component, the Status column should be marked **Started** and the Startup Type column should be marked **Manual**. If either of those conditions are not met, right click on **Service Location Protocol** and click **Start** from the pop-up menu. Wait for the Status to change to **Started**

- b. Do not close the Services window, because you use it in the next step to verify that the CIMOM is started.

4. Verify that the CIMOM is active by finding **CIM Object Manager - DS Open API** in the Name column of the Services window.

For this component, if the Status column is not marked **Started**, right click on **CIM Object Manager - DS Open API** and click **Start** from the pop-up menu. Wait for the Status to change to **Started**.

5. Verify CIMOM registration with SLP by selecting **Start-> Programs-> CIM agent for IBM TotalStorage DS Open API-> Check CIMOM Registration**. The window closes when you press any key, as instructed in the output:

```
service: wbem:http://tpc035/ 5988, 65535
press any key to continue...
```

Note: If the verification of the CIMOM registration is not successful, stop and restart the SLP and CIMOM services.

6. Use the **verifyconfig** command to locate all WBEM services in the local network. This command verifies that you have configured the CIM agent and can connect to at least one ESS.

Type the **verifyconfig** command in another command prompt window in the directory where the CIM agent was installed; for example:

```
c:\program files\ibm\cimagent
verifyconfig -u <username> -p <password>
```

where *username* is the user name and *password* is the password for the user name that you configured to manage the CIMOM.

If the command is successful, output similar to the following is displayed:

```
C:\program files\ibm\cimagent>verifyconfig -u guest -p guest
Verifying configuration of CIM agent for the IBM TotalStorage
DS Open Application Programming Interface...
Communicating with SLP to find WBEM services...
3 WBEM services found
  host=9.111.111.111, port=5989
  host=9.111.111.112, port=5989
  host=9.111.111.113, port=5989
Connecting to CIM agent, host=9.111.111.112, port=5989
Found 2 IBMTSESS_StorageSystem instances:
2107.AZ123x
2105.2223x
Internal Server at 9.111.111.122 configured for 2107.AZ123x
Internal Server at 9.111.111.119 configured for 2105.2223x
Verification Successful
```

You might run into the following errors:

- Error Type 1. E CMMOM0002E CIM_ERR_ACCESS_DENIED

If you enter CIMOM user name or password that is not valid or forget to type the CIMOM user name or password when you issue the **verifyconfig** command, the following message series is displayed near the end of the output messages:

```

E CMMOM0002E CIM_ERR_ACCESS_DENIED
  at com.ibm.http.HTTPClient.sendRequest(Unknown Source)
  at com.ibm.http.HTTPClient.sendRequest(Unknown Source)
  at com.ibm.xml.XMLOperationGeneric.intrinsicMethod(Unknown Source)
  at com.ibm.xml.XMLOperationGeneric.intrinsicMethod(Unknown Source)
  at com.ibm.xml.XMLEnumerateInstances.enumInstances(Unknown Source)
  at com.ibm.xml.CIMOMHandleXML.enumInstances(Unknown Source)
  at com.ibm.cim.CIMClient.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.main(Unknown Source)
FAILED requesting IBMTSESS_StorageSystem instances

```

- Error Type 2. CIM agent not correctly configured

If any of the following are true:

- You have never used the **setdevice** tool to define a storage unit to the CIMOM
- You made an error in the IP address, user name, or password
- You did not restart the CIMOM after adding the ESS

The following message series is displayed near the end of the output messages:

```

Connecting to CIM agent, host=1.11.111.111, port=5689
Found 0 IBMTSESS_StorageSystem instances
CIM agent not correctly configured

```

You can find more information about the possible cause of this error message by examining the cimomx.log (where x can be a number from 1 - 9).

If you have a network connection problem or you have set an incorrect IP address for the ESS using the setdevice tool, the ESS CLI cannot connect to the ESS. A message pair similar to the following can appear in the log:

```

2003-10-30 08:37:03,PST-08:00 E CIMOM[com.ibm.provider.ess.EssCLICmdHandler.
outputEssCliError(Unknown Source)]: ESSCLI Error
[Ljava.lang.Object{esscli 204: The connection to the specified server was
not established.}]

2003-10-30 08:37:03,PST-08:00 E CIMOM[com.ibm.provider.ess.EssProvider.initialize
(Unknown Source)]: esscli list server failed for 9.111.111.112,
trying again... [Ljava.lang.Object{Operation Failed. RC=2}]

```

If you have entered an incorrect user name or password for the ESS using the **setdevice** tool, the ESS CLI can connect to the ESS but cannot authenticate. A message pair similar to the following can appear in the log:

```

2003-10-30 10:32:53,PST-08:00 E CIMOM[com.ibm.provider.ess.EssCLICmdHandler.
outputEssCliError(Unknown Source)]: ESSCLI Error
[Ljava.lang.Object{esscli 510: Access was denied by the server.}]

2003-10-30 10:32:53,PST-08:00 E CIMOM[com.ibm.provider.ess.EssProvider.initialize
(Unknown Source)]: esscli list server failed for 9.111.111.112,
trying again... [Ljava.lang.Object{Operation Failed. RC=5}]

```

If you did not reboot after you installed the ESS CLI or before you ran the CIM agent **verifyconfig** program, the ESS CLI will have a problem finding an environmental variable. A message similar to the following can appear in the log:

```
2003-10-29 17:26:02.608-08:00 [java.lang.Object{esscli: No value is
specified for the <INSTALL> system variable.}] I
CIMOM[com.ibm.provider.ess.EssProvider.initialize(Unknown Source)]:
store01.storage.sanjose.ibm.com IP esscli list server failed, tryin again...
```

- Error Type 3. E CMMOM0001E CIM_ERR_FAILED(E CMMOM0001E CIM_ERR_FAILED)

If you have not installed the ESS CLI on your system, the following message series is displayed near the end of the output messages:

```
Connecting to CIM agent, host=1.11.111.11, port=5689
E CMMOM0001E CIM_ERR_FAILED(E CMMOM0001E CIM_ERR_FAILED)
  at com.ibm.xml.XMLOperationGeneric.processReturnStream(Unknown Source)
  at com.ibm.xml.XMLOperationGeneric.intrinsicMethod(Unknown Source)
  at com.ibm.xml.XMLOperationGeneric.intrinsicMethod(Unknown Source)
  at com.ibm.xml.XMLEnumerateInstances.enumInstances(Unknown Source)
  at com.ibm.xml.CIMOMHandleXML.enumInstances(Unknown Source)
  at com.ibm.cim.CIMClient.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.enumInstances(Unknown Source)
  at com.ibm.cimom.install.VerifyConfig.main(Unknown Source)
FAILED requesting IBMTSESS_StorageSystem instances
```

- Error Type 4. No CIM agent running or registered with SLP on current host
If the CIM agent is not started or it has not registered with SLP on the current host, the following message is displayed in the output messages in the Command Prompt window:

```
No CIM agent running or registered with SLP on current host
```

This completes the verification of the connection to the ESS.

Removing the CIM agent from Windows

This optional task provides instructions for removing the CIM agent from your Windows operating system.

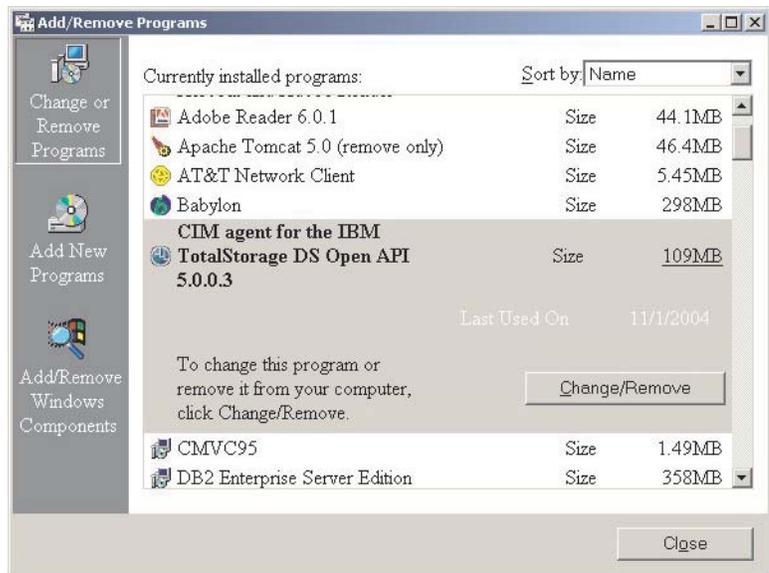
Steps:

Perform the following steps to remove the CIM agent from your Windows operating system:

1. Log on to the system where the CIM agent is installed. Log on with a user name that is a local system administrator.
2. Stop the CIMOM and the SLP services if they are started.
 - a. Click **Start -> Settings -> Control Panel**. In the Control Panel window, double-click on the **Administrative Tools** icon and then double-click the **Services** icon. The Services window opens.
 - b. Stop the SLP service if it has already been installed by the CIM agent installer:
 - 1) In the Services window, scroll to **CIM Object Manager for DS Open API**. Click on the service to select it.
 - 2) If the Status column shows Started, right-click the service, and then click **Stop** on the menu.
 - c. Stop the SLP service:

Note: You must be careful if you have other applications that use SLP service. In this case, you must stop these applications before you stop SLP service, because the SLP service is deleted during the removal process. You must also stop the configuration utilities for the CIM agent, if they are running.

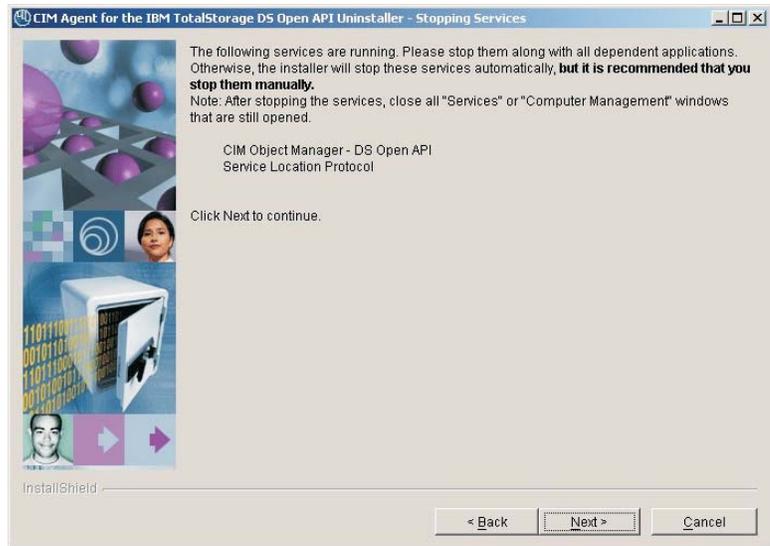
- 1) In the Services window, scroll to **Service Location Protocol**. Click on this service to select it.
 - 2) If it is running (the Status column shows Started), right-click the service, and then click **Stop** on the menu.
(If you did not stop the CIM Object Manager service, the system now asks if you want to stop the CIM Object Manager service. Because CIM Object Manager service is dependent on the Service Location Protocol service which you just stopped, you must click **Yes** to stop the CIM Object Manager service.)
 - 3) Wait for the services to stop.
 - 4) Close the Services window.
 - 5) Close the Administrative Tools window.
3. Use the Windows Add/Remove Programs facility to remove the CIM agent and the Service Location Protocol components.
- a. From the Windows menu bar, click **Start -> Settings -> Control Panel**. Double-click **Add/Remove Programs**.
 - b. Click **CIM agent for the IBM TotalStorage DS Open API** from the list of currently installed programs and click **Remove** to remove the product.



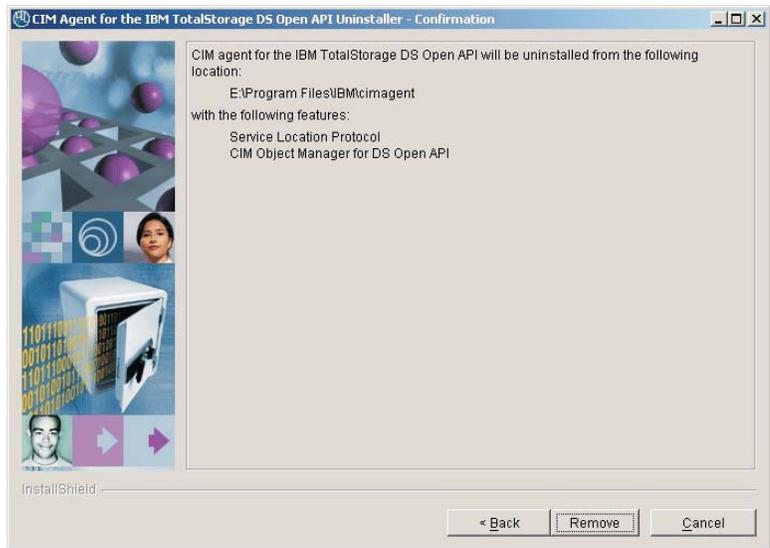
4. The Welcome window for the Uninstaller opens. Click **Next** to continue or click **Cancel** to stop the removal of the CIM agent.



5. The program detects whether the SLP and the CIMOM services are running.
 - a. You should consider at this point whether applications other than the CIM agent are dependent on the services.
 - 1) Click **Next** to have the program stop the services for you.
 - 2) Click **Cancel** to exit the removal process if you wish to manually stop the services and any dependent applications, which is recommended. Instructions for stopping the services are described in step 2 on page 92. You must then restart the removal process from the Windows Add/Remove facility.
 - b. If the CIMOM and SLP services are not started, the program continues with a Confirmation window for the Uninstaller. The Confirmation window displays the location form which the CIM agent and the SLP and CIMOM for DS Open API features will be removed.
- Note:** If the SLP service was installed by a CIM agent other than the CIM agent for DS Open API, only the SLP files that were copied during the CIM agent for DS Open API installation are removed and the SLP Windows service will not be uninstalled.



6. Click **Remove** to continue or click **Cancel** to stop the removal of the CIM agent. Click **Back** to return to the previous window.



7. The Uninstallation Progress window opens. Wait for the program to remove the CIM agent product.



8. The Finish window for the Uninstaller opens. This window indicates the result of the removal process (successful or failed). Click **Finish** to complete the removal process and exit the wizard.



If the program could not remove some information from the system, the Restart window opens. You will need to restart your system. At the restart, the previously locked files are released and automatically deleted.

9. Close the Add/Remove Programs window.
10. Restart the system (now or later) to complete the removal process.

Perform the following steps to complete the removal process:

1. If the system has not been restarted since CIM agent was removed, do so now.
2. Log on as a local administrator.
3. Remove other files and folders for CIM agent, as the removal process does not delete configuration files, logs, and similar files that were created during or after the installation process. The files are located in the destination path where you installed the CIM agent. An example of the default destination path is:

C:\Program Files\IBM\cimagent. Remove the cimagent folder and all of its contents (especially if you plan to reinstall CIM agent).

Note: If you want to keep the old configuration files, save them in another location on your system to restore them later before removing them from the installation destination path.

4. Perform other cleanup tasks:
 - a. Close both the Services and the Add/Remove Program windows if you have not already done so.
 - b. Empty your Windows Recycle Bin to reclaim the disk space that was made available during the removal process.

Chapter 6. CIM agent installation and configuration commands

This chapter includes information about the commands that you use when you install and configure the CIM agent on a server or workstation running a Linux, UNIX, or Windows 2000 (or later) operating system. This chapter also presents a complete character syntax of the programs, commands, flags, and values that you can use for each command. There is also a section that shows examples of commands and the output that results from issuing the command.

Overview of the CIM agent commands and subcommands

This section briefly introduces the CIM agent commands and provides general guidelines for using the commands.

Before you use the commands, refer to the appropriate installation and configuration chapters for your operating system for information about how to install or configure and enable the CIM agent:

Invoking the CIM agent

There are two ways to invoke the CIM agent:

- Single command-line invocation
You can invoke a command by including all the relevant subcommands, parameters and values on one command line.
- Interactive mode
You can invoke a program which opens an interactive session and displays the following command prompt >>> at the beginning of each line.

Conventions used in this chapter

This section describes the notational conventions that are used in this chapter for the syntax diagrams.

Syntax diagrams

A syntax diagram uses symbols to represent the elements of a command and to specify the rules for using these elements. This section shows you how to read the syntax diagrams that represent the CIM agent commands. In doing so, it defines the symbols that represent the CIM agent command elements.

Main path line



Begins on the left with double arrowheads (>>) and ends on the right with two arrowheads facing each other (><). If a diagram is longer than one line, each line to be continued ends with a single arrowhead (>) and the next line begins with a single arrowhead. Read the diagrams from left-to-right, top-to-bottom, following the main path line.

Keyword

▶▶ `setuser` ▶▶

Represents the name of a command, flag, parameter, or argument. A keyword is not in italics. Spell a keyword exactly as it is shown in the syntax diagram.

Required keywords

▶▶ `adduser` ▶▶

Indicate the parameters or arguments you must specify for the command. Required keywords appear on the main path line. Required keywords that cannot be used together are stacked vertically.

Optional keywords

▶▶

<code>--h</code>
<code>--help</code>
<code>--?</code>

 ▶▶

Indicate the parameters or arguments you can choose to specify for the command. Optional keywords appear below the main path line. Optional keywords that cannot be used together are stacked vertically.

Default value

▶▶ `-cre`

<code>on</code>
<code>off</code>

 ▶▶

Appears above the main path line.

Repeatable keyword or value

▶▶ `newports`

<code>ALL</code>
<code>PortId1,PortId2,...</code>

 ▶▶

Represents a parameter or argument that you can specify more than once. A repeatable keyword or value is represented by an arrow returning to the left above the keyword or value.

parameter values

▶▶ `user` `password` ▶▶

Represents the value you need to supply for a parameter or argument, such as a file name, user name, or password. Variables are in italics.

Space separator

▶▶ `chuser` `password` ▶▶

Adds a blank space on the main path line to separate keywords, parameters, arguments, or variables from each other.

Syntax fragment

▶▶ | Fragment name |—————▶▶

Fragment

|—(*—fragment details—*)—————|

Breaks up syntax diagrams that are too long, too complex, or repetitious. The fragment name is inserted in the main diagram, and the actual fragment is shown below the main diagram.

Special characters

The following special characters are used in the command examples:

- (minus) or / (slash) sign

Flags are prefixed with a - (minus) or / (slash) sign. Flags define the action of a command or modify the operation of a command. You can use multiple flags, followed by parameters, when you issue a command.

[] square brackets

Optional values are enclosed in square brackets.

{ } braces

Required or expected values are enclosed in braces.

| vertical bar

A vertical bar signifies that you choose only one value.

For example, [a | b] indicates that you can choose a, b, or nothing. Similarly, { a | b } indicates that you must choose either a or b.

... ellipsis

An ellipsis signifies the values that can be repeated on the command line.

Emphasis

The following typefaces are used to show emphasis:

boldface

Text in **boldface** represents menu items and command names.

italics Text in *italics* is used to emphasize a word. In command syntax, it is used for variables for which you supply actual values.

monospace

Text in monospace identifies the data or command instances that you type, samples of command output, examples of program code or messages from the system, or names of command flags, parameters, arguments, and name-value pairs.

Anatomy of a command line

This section describes the parts of a command line string and also shows an example of a command line string

The command-line string, as discussed in this document, consists of the following parts:

Command name

Name of the command, such as **setuser**, that the user invokes to use the command line interface

Subcommand name

Name of the command that the user executes, such as **adduser** or **address**.

Command options

Options that modify the behavior of the command. Command options can be required or optional.

Flags Command options marked with dash before the name, such as **-create**. Sometimes flags require extra parameters and sometimes they do not.

Values

Command options that set the value of a flag.

Arguments

Required target (object) of the command and are always the last items, not associated with an option, on the command line

This is an example of a command line string.

```
setuser -u userlogin -p loginpassword
```

Configuration commands

The following sections describe the following CIM agent configuration commands that you can invoke in interactive mode:

- **setuser**
- **setdevice**
- **modifyconfig**

Description of subcommands

You can use several subcommands on the CIM agent configuration commands to perform various configuration tasks within the CIM agent. Table 4 on page 103 describes of the subcommands that you can use with the CIM agent configuration commands in interactive mode:

Table 4. Summary of CIM agent *setuser* and *setdevice* subcommands

Command	Subcommands and description
setuser	<p data-bbox="805 275 1458 331">adduser Adds a user entry to the password file.</p> <p data-bbox="805 348 1458 380">chuser Changes the user entry in the password file.</p> <p data-bbox="805 396 1458 453">lsuser Lists the users that currently exist in the password file.</p> <p data-bbox="805 470 1458 527">rmuser Removes the user from the password file.</p> <p data-bbox="805 543 1458 632">setentry Lists or sets the -create, -quiet, or -equiv options globally.</p> <p data-bbox="805 648 1458 705">setoutput Lists or sets the -hdr option globally.</p> <p data-bbox="805 722 1458 779">exit Terminates the interactive session and exits from the application.</p> <p data-bbox="805 795 1458 852">help or ? Lists the available subcommands.</p>

Table 4. Summary of CIM agent *setuser* and *setdevice* subcommands (continued)

Command	Subcommands and description
setdevice	<p>address Adds the specified storage unit provider entry to the configuration file.</p> <p>addressserver Adds the specified storage unit server entry to the configuration file.</p> <p>chess Changes the specified storage unit provider entry in the configuration file.</p> <p>chessserver Changes the specified storage unit server entry in the configuration file.</p> <p>lssess Lists the storage unit provider entries that currently exist in the configuration file and meet the optional search criteria.</p> <p>lssessserver Lists the storage unit server entries that currently exist in the configuration file and that meet the optional search criteria.</p> <p>rmess Removes the specified storage unit provider entry from the configuration file.</p> <p>rmessserver Removes the specified storage unit server entry from the configuration file.</p> <p>setentry Lists or sets the -create, -quiet, or -equiv options globally.</p> <p>setoutput Lists or sets the -hdr option globally.</p> <p>exit Terminates the interactive session and exits from the application.</p> <p>help or ? Lists the available subcommands.</p>
modifyconfig	There are no subcommands for the modifyconfig command.

setuser

Description

Use the **setuser** command in interactive mode to update the configuration file containing the user names and encrypted passwords for the users allowed to access the CIM agent CIMOM. You can list one or all users, add a user, change a user password, or remove a user.

You can use the following subcommands with the **setuser** command:

- **adduser**
- **chuser**
- **lsuser**

- **rmuser**
- **setentry**
- **setoutput**
- **exit**
- **help** or ?

Syntax

►► `setuser` `--u user` `--p password` ►►

This section describes the syntax for the options and values that you can use with the **setuser** subcommand.

Parameters

[-u]

Use -u with your username to log on to CIMOM and modify accounts.

[-p]

Use -p with your password to log on to CIMOM and modify accounts.

Example

When you type the following subcommand, using the **setuser** command in interactive mode,

```
>>>adduser jsmith abcdef
```

The following output displays on your screen:

An entry for user jsmith successfully added

adduser

Use the **adduser** subcommand to add a user entry to the password file.

Syntax

►► `adduser` `-h` `-help` `-q` `-quiet` `on` `off` ►►

► `user` `password` ►►

Parameters

This section describes the syntax for the options and values you can use with the **adduser** subcommand.

[-h | -help]

Displays a help message.

[-q[uiet] on | off]

Use -q or -quiet to prevent the dialog for confirmation or parameter input if it is to replace an existing entry.

If you set the value to on, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to off, you get a prompt that requests that you confirm the parameter input if it is to replace an existing entry.

Example

When you type the following subcommand, using the **setuser** command in interactive mode,

```
>>>adduser jsmith abcdef
```

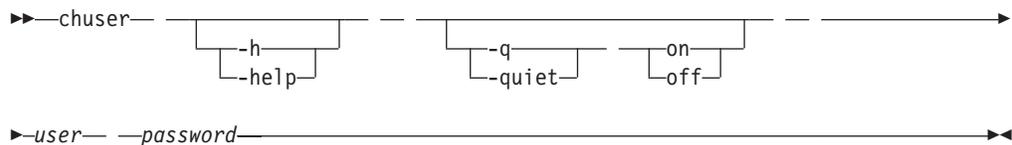
The following output displays on your screen:

```
An entry for user jsmith successfully added
```

chuser

Use the **chuser** subcommand to change the user entry in the password file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **setuser** subcommand.

[-h | -help]

Displays a help message.

[-q[uiet] on | off]

Use **-q** or **-quiet** to prevent the dialog for confirmation or parameter input.

If you set the value to **on**, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to **off**, you get a prompt that requests that you confirm the parameter input before the subcommand executes effectively.

Example

When you type the following subcommand using the **setuser** command in interactive mode:

```
>>>chuser jsmith xyztuv
```

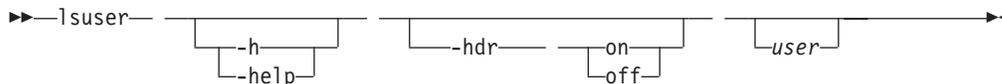
The following output displays on your screen:

```
The entry for user jsmith successfully changed
```

lsuser

Use the **lsuser** subcommand to list the users that currently exist in the password file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **lsuser** subcommand.

[-h | -help]

Displays a help message.

[-hdr on | off]

Use **-hdr** to specify whether or not the **lsuser** subcommand displays the header line.

If you set the value to **on**, the **lsuser** subcommand displays a header line before the lines containing information about the users.

If you set the value to **off**, the **lsuser** subcommand does not display the header line.

Example

When you type the following subcommand using the **setuser** command in interactive mode:

```
>>>lsuser -hdr on
```

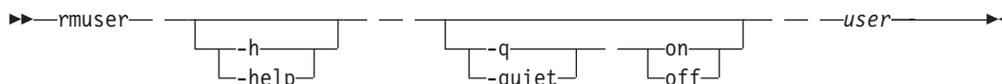
The following output displays on your screen:

```
USER      : ENCRYPTED PASSWORD
jsmith    : PyyvPJ11/VTa+1TD
ljohnson  : gKguQMSQjpnKEi3
bcollins  : Uj15YZ6uNg==
```

rmuser

Use the **rmuser** subcommand to remove the user from the password file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **rmuser** subcommand.


```
>>>setentry
```

The following output displays on your screen:

```
quiet=on
```

setoutput

Use the **setoutput** command to list or set the -hdr option globally

Syntax

```
► setoutput [ -h | -help ] [ -hdr [ on | off ] ]
```

Parameters

This section describes the syntax for the options and values you can use with the **setoutput** command.

[-h | -help]

Displays a help message.

[-hdr on | off]

Use -hdr in interactive mode to set the -hdr option to on or off for the subsequent commands in the interactive session. It applies as a default to the subsequent **lsuser** commands, except for the commands that explicitly specify the -hdr option.

Note:

1. When the **setuser** command starts, the -hdr option is set to the value specified as command option (if present in the command line) or to the following initial default value: -hdr on.
2. The **setentry** subcommand without any argument displays the current state of the option -hdr.

Example

When you type the following subcommand and parameters using the **setuser** command in interactive mode:

```
>>>setoutput
```

The following output displays on your screen:

```
hdr=on
```

setdevice

Description

Use the **setdevice** command to update the configuration of managed storage units. You can also use the **setdevice** command to define the storage unit that is managed by the CIM agent. You must have a username, password, and valid internet protocol address of a storage unit to access the CIM agent.

There are two ways to invoke the **setdevice** command:

- Single command line invocation
You can invoke a command by including all the relevant subcommands, parameters and values on one command line.
- Interactive mode
You can invoke a program which opens an interactive session and displays the following command prompt >>> at the beginning of each line.

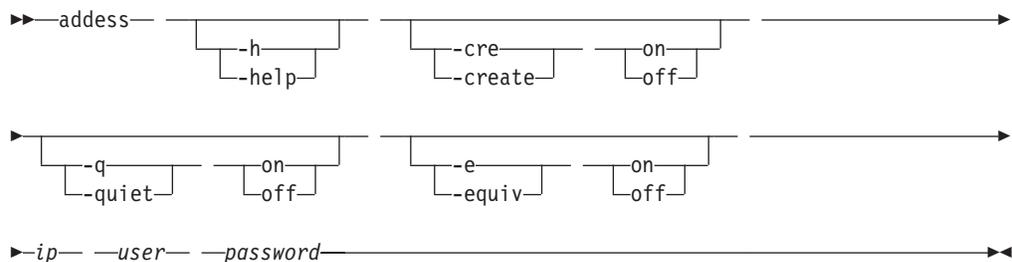
You can use the following commands with the **setdevice** command:

- **address**
- **addressserver**
- **chess**
- **chessserver**
- **lssess**
- **lssessserver**
- **rmess**
- **rmessserver**
- **setentry**
- **setoutput**
- **exit**
- **help** or ?

address

Use the **address** subcommand to add the specified provider entry to the configuration file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **address** subcommand.

[-h | -help]

Use **-h** or **-help** to display the help for the **address** subcommand.

[-cre[ate] on | off]

Use **-cre** or **-create** to create the configuration file if it does not already exist.

If you set the value to **on**, the command automatically creates the configuration file if it does not already exist.

If you set the value to off and the configuration file does not already exist, you get an error message and the operation stops.

[-e[quiv] on | off]

Use `-e` or `-equiv` to specify whether or not the **address** and **chess** subcommands are equivalent.

If you set the value to on, the **address** and **chess** subcommands are equivalent. The commands create an entry if an entry with the same key does not exist. Or, the command updates the existing entry if an entry with the same key already exists.

If you set the value to off, **address** and **chess** are not considered equivalent. You get an error message when you use **address** if an entry with the same key already exists. Or, you get an error message when you use **chess** if an entry with the same key does not exist.

[-q[uiet] on | off]

Use `-q` or `-quiet` to prevent the dialog for confirmation or parameter input.

If you set the value to on, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to off, you get a prompt that requests that you confirm the parameter input if it is to replace an existing entry (assuming `-equiv on`).

Example

When you type the following subcommand and parameters using the **setdevice** command in interactive mode,

```
>>>address 1.2.3.4 msmith abcdef
```

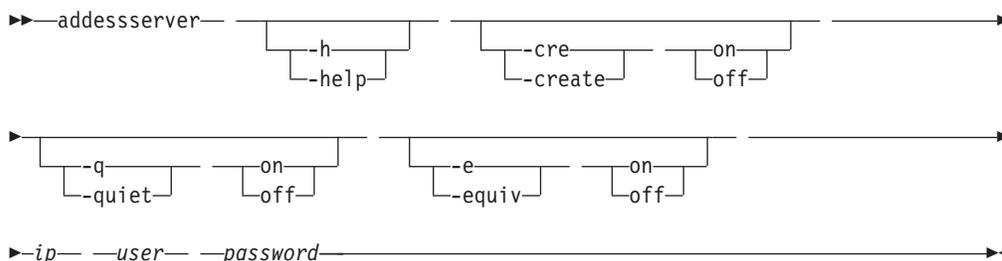
The following output displays on your screen:

```
A provider entry for IP 1.2.3.4 successfully added
```

addressserver

Use the **addressserver** subcommand to add the specified storage unit server entry to the configuration file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **addressserver** subcommand.

[-h | -help]

Use -h or -help to display the help for the adduserserver subcommand.

[-cre[ate] on | off]

Use -cre or -create to create the configuration file if it does not already exist.

If you set the value to on, the command automatically creates the configuration file if it does not already exist.

If you set the value to off and the configuration file does not already exist, you get an error message and the operation stops.

[-e[quiv] on | off]

Use -e or -equiv to specify whether or not the **addessserver** and **chess** subcommands are equivalent.

If you set the value to on, the **addessserver** and **chess** subcommands are equivalent. The commands create an entry if an entry with the same key does not exist. Or, the command updates the existing entry if an entry with the same key already exists.

If you set the value to off, **addessserver** and **chess** are not considered equivalent. You get an error message when you use **addessserver** if an entry with the same key already exists. Or, you get an error message when you use **chess** if an entry with the same key does not exist.

[-q[uiet] on | off]

Use -q or -quiet to prevent the dialog for confirmation or parameter input.

If you set the value to on, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to off, you get a prompt that requests that you confirm the parameter input if it is to replace an existing entry (assuming -equiv on).

Example

When you type the following subcommand and parameters using the **setdevice** command in interactive mode,

```
>>>addessserver 1.2.3.4 msmith abcdef
```

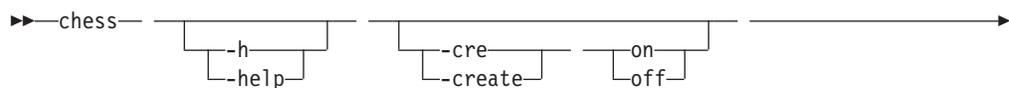
The following output displays on your screen:

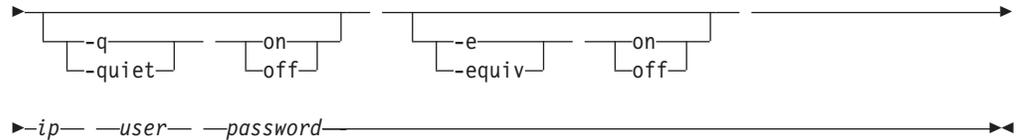
```
A copy services provider entry for IP 1.2.3.4 successfully added
```

chess

Use the **chess** subcommand to change the specified provider entry in the configuration file.

Syntax





Parameters

This section describes the syntax for the options and values you can use with the **chess** subcommand.

[-h | -help]

Use `-h` or `-help` to display the help for the **chess** subcommand.

[-cre[ate] on | off]

Use `-cre` or `-create` to create the configuration file if it does not already exist.

If you set the value to `on`, the command automatically creates the configuration file if it does not already exist.

If you set the value to `off` and the configuration file does not already exist, you get an error message and the operation stops.

[-q[uiet] on | off]

Use `-q` or `-quiet` to prevent the dialog for confirmation or parameter input.

If you set the value to `on`, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to `off`, you get a prompt that requests that you confirm the parameter input before the command executes successfully.

[-e[quiv] on | off]

Use `-e` or `-equiv` to specify whether or not the **address** and **chess** subcommands are equivalent.

If you set the value to `on`, the **address** and **chess** subcommands are equivalent. The commands create an entry if an entry with the same key does not exist. Or the command updates the existing entry if an entry with the same key already exists.

If you set the value to `off`, **address** and **chess** are not considered equivalent. You get an error message when you use **address** if an entry with the same key already exists. Or, you get an error message when you use **chess** if an entry with the same key does not exist.

Example

When you type the following subcommand and parameters using the **setdevice** command in interactive mode:

```
>>>chess 1.2.3.4 1johnson xyztuv
```

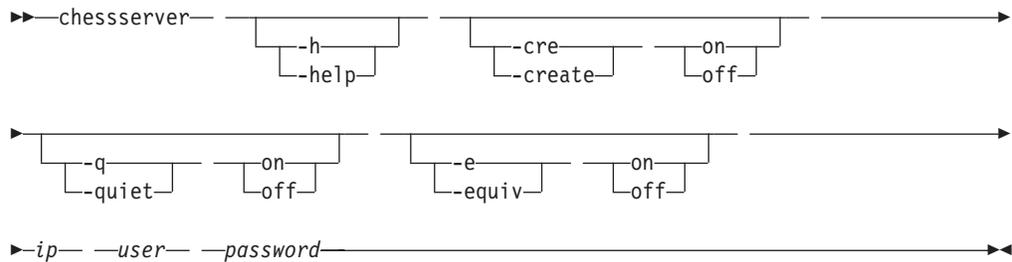
The following output displays on your screen:

```
The provider entry for IP 1.2.3.4 successfully changed
```

chessserver

Use the **chessserver** subcommand to change the specified Copy Services server entry in the configuration file.

Syntax



Parameters

This section describes the syntax for the options and values that you can use with the **chessserver** subcommand.

[-h | -help]

Use -h or -help to display the help for the **chessserver** subcommand.

[-cre[ate] on | off]

Use -cre or -create to create the configuration file if it does not already exist.

If you set the value to on, the command automatically creates the configuration file if it does not already exist.

If you set the value to off and the configuration file does not already exist, you get an error message and the operation stops.

[-e[quiv] on | off]

Use -e or -equiv to specify whether or not the **addressserver** and **chessserver** subcommands are equivalent.

If you set the value to on, the **addressserver** and **chessserver** subcommands are equivalent. The commands create an entry if an entry with the same key does not exist. Or, the command updates the existing entry if an entry with the same key already exists.

If you set the value to off, **addressserver** and **chessserver** are not considered equivalent. You get an error message when you use **addressserver** if an entry with the same key already exists. Or, you get an error message when you use **chessserver** if an entry with the same key does not exist.

[-q[uiet] on | off]

Use -q or -quiet to prevent the dialog for confirmation or parameter input.

If you set the value to on, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to off, you get a prompt that requests that you confirm the parameter input before the command executes successfully.

Example

When you type the following subcommand and parameters using the **chessserver** command in interactive mode:

```
>>>chessserver 1.2.3.4 1johnson xyztuv
```

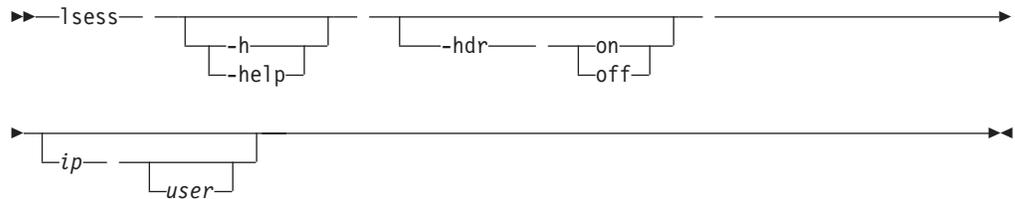
The following output displays on your screen:

The provider entry for IP 1.2.3.4 successfully changed

Isess

Use the **Isess** subcommand to list the provider entries that currently exist in the configuration file and meet the optional search criteria.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **Isess** subcommand.

[-h | -help]

Use **-h** or **-help** to display the help for the **Isess** subcommand.

[-hdr] on | off]

Use **-hdr** to control the display of the header line when using the **Isess** subcommand.

If you set the value to **on**, the **Isess** subcommand displays a header line before the lines containing information about the DS entries.

If you set the value to **off**, the **Isess** subcommand does not display the header line before the lines containing information about the storage unit entries.

Example

When you type the following subcommand and parameters using **setdevice** command in interactive mode:

```
>>>Isess -hdr off 1.2.3.4
```

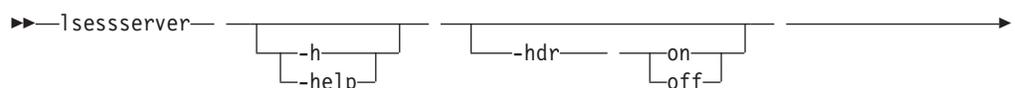
The following output displays on your screen:

```
1.2.3.4:1johnson:o18xP0gGhB0=
```

Isessserver

Use the **Isessserver** subcommand to list the server entries that currently exist in the configuration file and that meet the optional search criteria.

Syntax





Parameters

This section describes the syntax for the options and values you can use with the **lsess** subcommand.

[-h | -help]

Use -h or -help to display the help for the **lsessserver** subcommand.

[-hdr] on | off]

Use -hdr to control the display of the header line when using the **lsessserver** subcommand.

If you set the value to on, the **lsessserver** subcommand displays a header line before the lines that contain information about the Copy Services entries.

If you set the value to off, the **lsessserver** subcommand does not display the header line before the lines that contain information about the Copy Services entries.

Example

When you type the following subcommand and parameters using **setdevice** command in interactive mode:

```
>>>lsessserver -hdr off 1.2.3.4
```

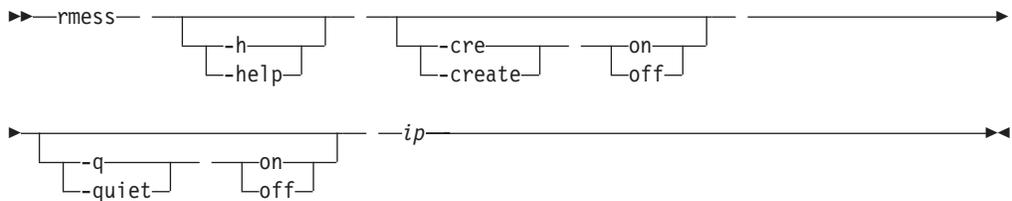
The following output displays on your screen:

```
1.2.3.4:1johnson:o18xP0gGhB0=
```

rmess

Use the **rmess** subcommand to remove the specified provider entry from the configuration file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **rmess** subcommand.

[-h | -help]

Use -h or -help to display the help for the **rmess** subcommand.

[-cre[ate] on | off]

Use `-cre` or `-create` to create the configuration file if it does not already exist.

If you set the value to `on`, the command automatically creates the configuration file if it does not already exist.

If you set the value to `off` and the configuration file does not already exist, you get an error message and the operation stops.

[-q[uiet] on | off]

Use `-q` or `-quiet` to prevent the dialog for confirmation or parameter input.

If you set the value to `on`, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to `off`, you get a prompt that requests that you confirm the parameter input before the command executes effectively.

Example

When you type the following subcommand and parameters using the **setdevice** command in interactive mode:

```
>>>rmess -q on 1.2.3.4
```

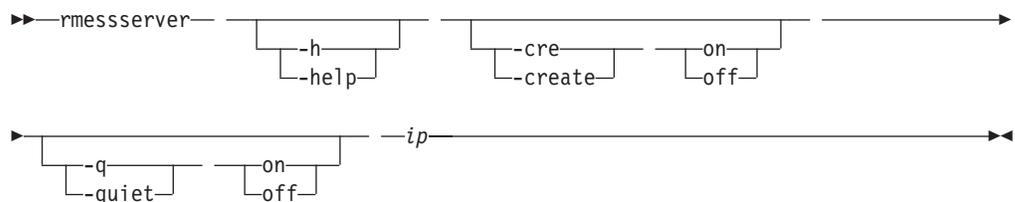
The following output displays on your screen:

```
The provider entry for IP 1.2.3.4 successfully removed
```

rmessserver

Use the **rmessserver** subcommand to remove the specified Copy Services server entry from the configuration file.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **rmessserver** subcommand.

[-h | -help]

Use `-h` or `-help` to display the help for the **rmessserver** subcommand.

[-cre[ate] on | off]

Use `-cre` or `-create` to create the configuration file if it does not already exist.

If you set the value to `on`, the command automatically creates the configuration file if it does not already exist.

If you set the value to `off` and the configuration file does not already exist, you get an error message and the operation stops.

[-q[uiet] on | off]

Use `-q` or `-quiet` to prevent the dialog for confirmation or parameter input.

If you set the value to `on`, you do not get a prompt that requests that you confirm the parameter input.

If you set the value to `off`, you get a prompt that requests that you confirm the parameter input before the command executes effectively.

Example

When you type the following subcommand and parameters using the **setdevice** command in interactive mode:

```
>>>rmessserver -q on 1.2.3.4
```

The following output displays on your screen:

```
The provider entry for IP 1.2.3.4 successfully removed
```

Operational commands

This section describes the following CIM agent operational commands:

- **startcimom**
- **stopcimom**

startcimom

Use the **startcimom** command to start the CIM agent.

Syntax

```
▶▶ startcimom ◀◀
```

Parameters

There are no options for the **startcimom** command.

Description

Use the **startcimom** command to run the CIM agent code. When you use the **startcimom** command, it registers itself with SLP and accepts requests on the port specified in the `cimom.properties` file (by default 5989).

This command starts the CIM agent when the CIM agent is installed. Generally it is installed as a service or part of the system **inittab**. In most cases, there is no reason to start the CIM agent manually; however, this command will start the CIM agent, if needed.

The certificate used by the CIM agent must also be made available to each client software product that intends to communicate with the CIM agent.

stopcimom

Use the **stopcimom** command to stop the CIM agent.

Syntax

▶▶—stopcimom—▶▶

Parameters

There are no options for the **stopcimom** command.

Description

Use the **stopcimom** command to stop the CIM agent.

Utility commands

The following sections describe the following CIM agent utility commands:

- **mkcertificate**
- **slpd**
- **verifyconfig**

mkcertificate

Use the **mkcertificate** command to check the level of security on your host.

Syntax

▶▶—mkcertificate—▶▶

Description

The **mkcertificate** runs at install time and can be rerun whenever the user feels that security might be compromised. The **mkcertificate** command creates an X.509 certificate and places it in a certificate store called truststore. The certificate is required by client code that communicates with the CIM agent using SSL secure communication. If you have installed a product that uses this type of communication with the CIM agent, you must be sure that the certificate that is created with the **mkcertificate** command is available to all clients and software products that communicate with the CIM agent.

Note: If you get error message CMMOMO116E when you try to connect to CIMOM, ensure that the following files are in the same directory where the client program resides:

- truststore
- cimom.properties
- niClientLogging.properties
- logger.properties

Parameters

There are no options for the **mkcertificate** command.

slpd

Use the **slpd** command to enable the client code to find the CIM agent service.

Syntax

▶▶—slpd—▶▶

Description

The SLP daemon starts automatically by the installation program or at the system reboot, but you can also start it manually if it is not already running. The CIM agent registers itself with the SLP daemon to enable client code to find the CIM agent service. You should always keep the SLP daemon running.

The Service Agents (SA) communicate with each other on one subnet of an IP network to find each other's services. If you install products that use the CIM agent but the products run on multiple subnets, consider designating one of your SLP daemons to act as a Directory Agent (DA). To do this, change the configuration that is used by each SLP daemon (slpd.conf) to point to the IP address of the SLP daemon that is to act as the DA. To do this, change the *isDA* configuration variable so that the slpd.conf is true. See the documentation for Open SLP at <http://www.openslp.org/Documentation>.

Parameters

There are no options for the slpd command.

verifyconfig

Use the **verifyconfig** command to locate all WBEM services (for example, CIMOMs) in the local network.

Syntax

▶▶—verifyconfig—▶▶
 -b
 -u
 -p

Parameters

This section describes the syntax for the options and values you can use with the **verifyconfig** command.

- b Gets basic authentication if authentication is disabled.
- u The username used to log into CIMOM.
- p The password for the username.

Description

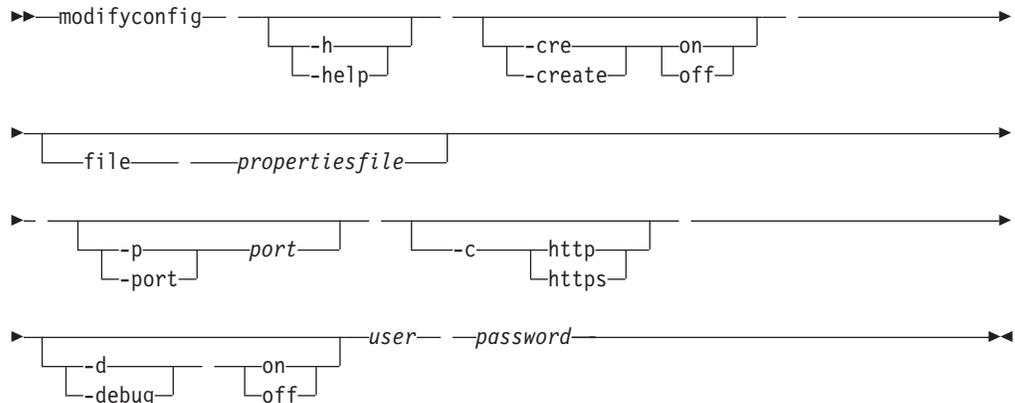
The **verifyconfig** command is used to locate all WBEM services (for example, CIMOMs) in the local network, display them and then call the CIMOMs on the local

machine only requesting information about whether the CIMOMs know of any storage unit. Locates all WBEM services in the network. These may include CIM agents of other hardware storage units. It then communicates with the WBEM service (that is, CIMOM) running on the local machine, if it is found, and attempts to retrieve some basic instance information from the CIMOM running there.

modifyconfig

Use the modifyconfig subcommand to modify cimom.properties file properties.

Syntax



Parameters

This section describes the syntax for the options and values you can use with the **modifyconfig** command.

[-h | -help]

Displays a help message.

[-cre[ate] on | off]

If you set the value to on, the command automatically creates the properties file if it does not already exist.

If you set the value to off and the properties file does not already exist, you get an error message and the operation stops.

[-file propertiesfile]

Use -file flag to specify the properties file, if you want to use a file other than the default (cimom.properties) file, that must be used by this command.

[-p[ort] port]

Use the -p flag to update the port property value. The port parameter specifies the value of the port property.

[-c http|https]

Use the -c flag to update the communication protocol value. The possible values are http or https.

[-d[ebug] on|off]

Use -d or -debug to specify the debug mode. If you set the value to on, the debug is enabled. If you set the value to off, the debug is disabled.

Example

When you type the following subcommand, using the **modifyconfig** command in interactive mode:

```
modifyconfig -p 5989 -d on
```

The following output displays on your screen:

```
Port (set to 5989) and Debug (set to 0n)
```

Chapter 7. DS Open API component definitions

This section describes the elements, the namespace, and the object name for the DS Open API.

Elements

The DS Open API consists of the following elements: schemas, classes, properties, methods, indications, associations, references and qualifiers. The following list describes each type of element:

Schema

A group of classes defined to a single namespace. Within the CIM agent, the schemas that are supported are the ones loaded through the managed object format (MOF) compiler.

Class The definition of an object within some hierarchy. Classes can have methods and properties and be the target of an association.

Property

A value used to characterize instances of a class.

Method

An implementation of a function on a class.

Indication

An object representation of an event.

Association

A class that contains two references which define a relationship between two objects.

Reference

The role that an object plays in an association.

Qualifier

Additional information about other elements, classes, associations, indications, methods, method parameters, instances, properties, or references.

Namespace

DS Open API operations always execute within the context of a namespace. A namespace defines the scope over which a DS Open API schema applies. The only namespace supported by the CIM agent is **root/cimv2**. A DS Open API schema or version is loaded into a namespace when that schema is compiled by the MOF compiler. The namespace must be specified within the message that the client sends to the CIM agent.

Clients cannot create new namespaces. Attempts to do so result in errors.

Object name

An object name consists of a namespace path and a model path. The namespace path provides access to the DS Open API implementation managed by the CIM agent. The model path provides navigation within the implementation. An example of an object name is:

```
http://cimom.storage.sanjose.ibm.com/root/cimv2:CIMDisk.key1=value1, key2=value2
```

where *http://cimom.storage.sanjose.ibm.com/root/CIMV2* is the namespace path and the rest is the model path.

Chapter 8. CIM agent communication with the DS Open API

This section describes communication between the CIM agent and the DS Open API. It includes the following information:

- CIM agent communication concepts
- CIM agent communication methods
- CIM agent functional groups
- Error codes returned by the CIMOM

CIM agent communication concepts

This section describes the concepts involved in communication between the CIM agent and the client application.

Client communication

A client application communicates with the CIM agent through operation request messages encoded within XML. The CIM agent returns responses with operation response messages. Requests and responses are subelements of the CIM <MESSAGE> element.

A <MESSAGE> sent to the CIM agent must contain an ID attribute. A response from the CIM agent returns this value and thereby enables the client to track requests and their responses.

The CIM agent supports simple requests and simple responses. Simple requests are operation request messages that contain the <SIMPLEREQ> XML tag. Simple responses are operation response messages that contain the <SIMPLERSP> tag. A client application determines that the CIM Agent only supports simple operation requests and responses by examining the results of running the OPTIONS method.

Intrinsic and Extrinsic Methods

All operations on the CIM agent are performed by running one or more methods. A method is either an intrinsic method or an extrinsic method. Intrinsic methods are supported by the CIM agent itself. These methods are included within XML <IMETHODCALL> tags sent in messages to the CIM agent. Extrinsic methods are defined by the schema supported by the CIM agent. These methods are included within XML <METHODCALL> tags sent in messages to the CIM agent.

Client applications can call on the CIM agent using the methods. These methods fall within certain functional groups that might or might not actually be supported by the CIM agent.

CIM agent communication methods

The following sections and tables list the CIM intrinsic and extrinsic communication methods along with their parameters.

Client application calls to these intrinsic methods result in CIM agent calls to the device provider, if the device provider surfaces the classes or instances that are referenced in those calls.

The CIM agent returns <IMETHODRESPONSE> or <METHODRESPONSE> elements to the client application when the intrinsic or extrinsic methods are executed. These elements are contained within a <MESSAGERESPONSE> tag.

GetClass

The GetClass method is used to return a single class from the target namespace. Table 5 describes the parameters of the GetClass method.

Table 5. GetClass method parameters

Parameter	Type	Description
ClassName	String	Defines the name of the class to retrieve.
LocalOnly	Boolean	TRUE returns all properties, methods, and qualifiers overridden within the definition of the class.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for the class, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN attribute of the class.

Return values: Either a single class or one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_FAILED

GetInstance

The GetInstance method is used to return a single instance from the target namespace. Table 6 describes the parameters of the GetInstance method.

Table 6. GetInstance method parameters

Parameter	Type	Description
InstanceName	String	Defines the name of the instance to retrieve.
LocalOnly	Boolean	TRUE returns all properties and qualifiers overridden within the definition of the class.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for the class, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN attribute of the class.

Return values: Either a single class or one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_FAILED

DeleteClass

The DeleteClass method is used to delete a single class from the target namespace.

Note: This operation is not supported. The CIM_ERR_NOT_SUPPORTED error code is returned to the client application if a request to execute this operation is received.

DeleteInstance

The DeleteInstance method is used to delete a single instance from the target namespace. Table 7 describes the parameters of the DeleteInstance method.

Table 7. DeleteInstance method parameters

Parameter	Type	Description
InstanceName	String	Defines the name of the instance to delete.

Return values: The named instance is deleted or one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_FAILED

CreateClass

The CreateClass method is used to create a new class from the target namespace.

Note: This operation is not supported. The CIM_ERR_NOT_SUPPORTED error code is returned to the client application if a request to execute this operation is received.

CreateInstance

The CreateInstance method is used to create an instance in the target namespace. The instance must not already exist. Table 8 describes the parameters of the CreateInstance method.

Table 8. CreateInstance method parameters

Parameter	Type	Description
Instance	Object	The instance to be created. The instance must be based on a class already defined in the target namespace.

Return values: If successful, the specified instance is created. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER

- CIM_ERR_INVALID_CLASS
- CIM_ERR_ALREADY_EXISTS
- CIM_ERR_FAILED

ModifyClass

The ModifyClass method is used to modify an existing class.

Note: This operation is not supported. The CIM_ERR_NOT_SUPPORTED error code is returned to the client application if a request to execute this operation is received.

ModifyInstance

The ModifyInstance method is used to modify an existing instance in the target namespace. The instance must already exist. Table 9 describes the parameters of the ModifyInstance method.

Table 9. ModifyInstance method parameters

Parameter	Type	Description
Instance	Object	Defines the modified instance.

Return values: If successful, the specified instance is updated. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_FAILED

EnumerateClasses

The EnumerateClasses method is used to return a single class from the target namespace. Table 10 describes the parameters of the EnumerateClasses method.

Table 10. EnumerateClasses method parameters

Parameter	Type	Description
ClassName	String	Defines the name of the class for which subclasses are to be returned. If this field is NULL, all base classes within the target namespace are returned.
DeepInheritance	Boolean	TRUE returns all subclasses of the specified class. FALSE returns only immediate child subclasses.
LocalOnly	Boolean	TRUE returns all properties, methods, and qualifiers, that are overridden within the definition of the class.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for the class, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN of the class.

Return values: If successful, zero or more classes (CIMClass) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

EnumerateClassNames

The EnumerateClassNames method is used to enumerate the names of subclasses of a class defined within the target namespace. Table 11 describes the parameters of the EnumerateClassNames method.

Table 11. EnumerateClassNames method parameters

Parameter	Type	Description
ClassName	String	Defines the name of the class for which subclass names are to be returned. If this field is NULL, all base class names within the target namespace are returned.
DeepInheritance	Boolean	TRUE returns all subclass names of the specified class. FALSE returns only immediate child subclass names.

Return values: If successful, zero or more class names are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

EnumerateInstances

The EnumerateInstances method is used to enumerate instances of a class defined in the target namespace. Table 12 describes the parameters of the EnumerateInstances method.

Table 12. EnumerateInstances method parameters

Parameter	Type	Description
ClassName	String	Defines the name of the class for which instances are to be returned.
LocalOnly	Boolean	TRUE returns all properties, methods, and qualifiers that are overridden within the definition of the class.
DeepInheritance	Boolean	TRUE returns all instances and all properties of the instance, including those added by subclassing. FALSE returns only properties defined for the specified class.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for each instance, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN attribute of the class within the instance.

Return values: If successful, zero or more instances (Objects) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

EnumerateInstanceNames

The EnumerateInstanceNames method is used to enumerate the names of the instances of a class within a target namespace. Table 13 describes the parameter of the EnumerateInstanceNames method.

Table 13. EnumerateInstanceNames method parameters

Parameter	Type	Description
ClassName	String	Defines the name of the class for which instance names are to be returned.

Return values: If successful, zero or more names of instances are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

ExecQuery

The ExecQuery method is used to execute a query against the target namespace. Table 14 describes the parameters of the ExecQuery method.

Table 14. ExecQuery method parameters

Parameter	Type	Description
QueryLanguage	String	Defines the query language in which the query parameter is expressed.
Query	String	Defines the query to be executed.

Return values: If successful, zero or more classes (CIMClass) or instances (Objects) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

Associators

The Associators method is used to enumerate classes or instances that are associated to a particular CIM Object. Table 15 on page 131 describes the

parameters of the Associators method.

Table 15. Associators method parameters

Parameter	Type	Description
ObjectName	String	Defines the class name or instance name that is the source of the association.
AssocClass	String	If not NULL, indicates that all objects must be associated to the source object through an instance of this class or one of its subclasses.
ResultClass	String	If not NULL, indicates that all returned objects must be instances of this class or one of its subclasses or be this class.
Role	String	If not NULL, indicates that each return object must be associated to the source object through an association in which the source object plays the specified role. The name of the property in the association class that refers to the source object must match the value of this parameter.
ResultRole	String	If not NULL, indicates that each returned object must be associated to the source object via an association in which the return object plays the specified role. That is, the name of the property in the association class that refers to the returned object must match the value of this parameter.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for the class, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN attribute of the class.

Return values: If successful, zero or more classes (CIMClass) or instances (Objects) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

AssociatorNames

The AssociatorNames method is used to enumerate the names of the classes or instances that are associated with a particular CIM Object. Table 16 describes the parameters of the AssociatorNames method.

Table 16. AssociatorNames method parameters

Parameter	Type	Description
ObjectName	String	Defines the class name or instances name that is the source of the association.
AssocClass	String	If not NULL, indicates that all object paths returned identify an object that is associated to the source object through an instance of this class or one of its subclasses.

Table 16. *AssociatorNames* method parameters (continued)

Parameter	Type	Description
ResultClass	String	If not NULL, indicates that all returned object paths must identify instances of this class or one of its subclasses or must be this class.
Role	String	If not NULL, the name of the property in the association class that refers to the source object must match the value of this parameter.
ResultRole	String	If not NULL, the name of the property in the association class that refers to the return object must match the value of this parameter.

Return values: If successful, zero or more class paths (CIMObjectPath) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_FAILED

References

The References method is used to enumerate the association objects that refer to a particular target class or instance. Table 17 describes the parameters of the References method.

Table 17. *References* method parameters

Parameter	Type	Description
ObjectName	String	Defines the class name or instance name whose referring objects are to be returned.
ResultClass	String	If not NULL, indicates that all returned objects must be instances of this class or one of its subclasses or must be this class.
Role	String	If not NULL, must be a valid property name. Each returned object must refer to the target object through a property whose name matches the value of this parameter.
IncludeQualifiers	Boolean	TRUE returns all qualifiers for the class, its properties, methods, or method parameters. FALSE returns no qualifiers.
IncludeClassOrigin	Boolean	TRUE returns the CLASSORIGIN attribute of the class.

Return values: If successful, zero or more classes (CIMClass) or instances (Objects) are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_FAILED

ReferenceNames

The ReferenceNames method is used to enumerate the association objects that refer to a particular target class or instance. Table 18 describes the parameters of the ReferenceNames method.

Table 18. ReferenceNames method parameters

Parameter	Type	Description
ObjectName	String	Defines the class name or instance name whose referring objects are to be returned.
ResultClass	String	If not NULL, indicates that all returned object paths must be object paths of instances of this class or one of its subclasses, or must be this class.
Role	String	If not NULL, must be a valid property name. Each returned object must refer to the target object through a property whose name matches the value of this parameter.

Return values: If successful, the return value specifies the value of the requested property. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_NO_SUCH_PROPERTY
- CIM_ERR_FAILED

GetProperty

The GetProperty method is used to retrieve a single property value from an instance in the target namespace. Table 19 describes the parameters of the GetProperty method.

Table 19. GetProperty method parameters

Parameter	Type	Description
InstanceName	String	Defines the name of the instance.
Property	String	The name of the property whose value is to be returned from the instance.

Return values: If successful, the return value specifies the value of the requested property. Otherwise, one of the following return codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_NO_SUCH_PROPERTY
- CIM_ERR_FAILED

SetProperty

The SetProperty method is used to set a single property value within an instance in the target namespace. Table 20 describes the parameters of the SetProperty method.

Table 20. SetProperty method parameters

Parameter	Type	Description
InstanceName	String	Defines the name of the instance.
PropertyName	String	The name of the property whose value is to be updated.

Return values: If successful, the instance is updated. Otherwise, one of the following return codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_INVALID_CLASS
- CIM_ERR_NOT_FOUND
- CIM_ERR_NO_SUCH_PROPERTY
- CIM_ERR_TYPE_MISMATCH
- CIM_ERR_FAILED

GetQualifier

The GetQualifier method is used to retrieve a single qualifier declaration from the target namespace. Table 21 describes the parameters of the GetQualifier method.

Table 21. GetQualifier method parameters

Parameter	Type	Description
QualifierName	String	Defines the qualifier whose declaration is to be returned.

Return values: If successful, the value of the qualifier is returned. Otherwise, one of the following return codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_NOT_FOUND
- CIM_ERR_FAILED

SetQualifier

The SetQualifier method is used to create or update a qualifier declaration in the target namespace. Table 22 describes the parameters of the SetQualifier method.

Table 22. SetQualifier method parameters

Parameter	Type	Description
QualifierDeclaration	Void	Defines the qualifier declaration to be added to the target namespace.

Return values: If successful, the qualifier is updated in the target namespace. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_NOT_FOUND
- CIM_ERR_FAILED

DeleteQualifier

The DeleteQualifier method is used to delete a single class from the target namespace.

Note: This operation is not supported. The CIM_ERR_NOT_SUPPORTED error message is returned to the client application if a request to execute this operation is received.

EnumerateQualifiers

The EnumerateQualifiers method is used to enumerate qualifier declarations from the target namespace.

There are no parameters for this method.

Return values: If successful, zero or more qualifier declarations are returned. Otherwise, one of the following error codes is returned:

- CIM_ERR_ACCESS_DENIED
- CIM_ERR_INVALID_NAMESPACE
- CIM_ERR_INVALID_PARAMETER
- CIM_ERR_FAILED

CIM agent functional groups

Table 23 describes the functional groups supported by the CIM agent. This information is also returned to a client which makes an OPTIONS request of the CIM agent.

Table 23. Functional groups for the CIM agent

Functional group	Parameters	Supported or Not Supported
Basic read	<ul style="list-style-type: none">• GetClass• EnumerateClasses• EnumerateClassNames• GetInstance• EnumerateInstances• EnumerateInstanceNames• GetProperty	Supported
Basic write	<ul style="list-style-type: none">• SetProperty	Supported

Table 23. Functional groups for the CIM agent (continued)

Functional group	Parameters	Supported or Not Supported
Schema manipulation	<ul style="list-style-type: none"> CreateClass ModifyClass DeleteClass 	Not Supported
Instance manipulation	<ul style="list-style-type: none"> CreateInstance ModifyInstance DeleteInstance 	Supported
Association traversal	<ul style="list-style-type: none"> Associators AssociatorNames References ReferenceNames 	Supported
Qualifier declaration	<ul style="list-style-type: none"> GetQualifier SetQualifier DeleteQualifier EnumerateQualifiers 	Supported
Query execution	<ul style="list-style-type: none"> ExecQuery 	Supported

Error codes returned by the CIMOM

This section identifies the possible error codes returned by CIMOM communication methods.

Return Error Codes

The CIMOM might return status to the client application in one of two ways:

- Through HTTP status messages or
- Through error codes contained within <METHODRESPONSE> or <IMETHODRESPONSE> XML tags

Table 24 describes the status codes that the CIMOM might return.

Table 24. Return error codes for the CIMOM

Symbolic Name	Code	Definition
CIM_ERR_FAILED	1	A general error occurred that is not covered by a more specific error code.
CIM_ERR_ACCESS_DENIED	2	Access to a CIM resource was not available to the client.
CIM_ERR_INVALID_NAMESPACE	3	The target namespace does not exist.
CIM_ERR_INVALID_PARAMETER	4	One or more parameter values passed to the method were invalid.

Table 24. Return error codes for the CIMOM (continued)

Symbolic Name	Code	Definition
CIM_ERR_INVALID_CLASS	5	The specified class does not exist.
CIM_ERR_NOT_FOUND	6	The requested object could not be found.
CIM_ERR_NOT_SUPPORTED	7	The requested operation is not supported.
CIM_ERR_CLASS_HAS_CHILDREN	8	The operation cannot be carried out on this class because it has instances.
CIM_ERR_CLASS_HAS_INSTANCES	9	The operation cannot be carried out on this class because it has instances.
CIM_ERR_INVALID_SUPERCLASS	10	The operation cannot be carried out since the specified superclass does not exist.
CIM_ERR_ALREADY_EXISTS	11	The operation cannot be carried out because an object already exists.
CIM_ERR_NO_SUCH_PROPERTY	12	The specified property does not exist.
CIM_ERR_TYPE_MISMATCH	13	The value supplied is incompatible with the type.
CIM_ERR_QUERY_LANGUAGE_NOT_SUPPORTED	14	The query language is not recognized or supported.
CIM_ERR_INVALID_QUERY	15	The query is not valid for the specified query language.
CIM_ERR_METHOD_NOT_AVAILABLE	16	The extrinsic method could not be executed.
CIM_ERR_METHOD_NOT_FOUND	17	The specified extrinsic method does not exist.
CIM_ERR_LOW_ON_MEMORY	20	There is not enough memory.
XMLERROR	21	An XML error has occurred.
CIM_ERR_LISTNER_ALREADY_DEFINED	22	The listener is already defined.
CIM_ERR_INDICATION_NOT_COLLECTED	23	The indications are not collected.
CIM_ERR_NO_METHOD_NAME	24	The method name is null.

Table 24. Return error codes for the CIMOM (continued)

Symbolic Name	Code	Definition
CIM_ERR_INVALID_QUALIFIER_DATATYPE	25	The datatype qualifier is invalid.
CIM_ERR_NAMESPACE_NOT_IN_MANAGER	26	The namespace value is not found.
CIM_ERR_INSTANTIATE_FAILED	27	The instantiation failed.
CIM_ERR_FAILED_TO_LOCATE_INDICATION_HANDLER	28	The indication handler is not found.
CIM_ERR_IO_EXCEPTION	29	An IO exception has occurred.
CIM_ERR_COULD_NOT_DELETE_FILE	30	The file could not be deleted.
INVALID_QUALIFIER_NAME	31	The qualifier name is null.
NO_QUALIFIER_VALUE	32	The qualifier value is null.
NO_SUCH_QUALIFIER1	33	There is no such qualifier.
NO_SUCH_QUALIFIER2	34	There is no such qualifier.
QUALIFIER_UNOVERRIDABLE	35	The qualifier is unoverridable.
SCOPE_ERROR	36	A scope error has occurred.
TYPE_ERROR	37	A type error has occurred.
CIM_ERR_MISSING_KEY	38	The key is missing.
CIM_ERR_KEY_CANNOT_MODIFY	39	The key cannot be modified.
CIM_ERR_NO_KEYS	40	There are no keys found.
CIM_ERR_KEYS_NOT_UNIQUE	41	The keys are not unique.
CIM_ERR_SET_CLASS_NOT_SUPPORTED	100	The set class operation is not supported.
CIM_ERR_SET_INSTANCE_NOT_SUPPORTED	101	The set instance operation is not supported.
CIM_ERR_QUALIFIER_NOT_FOUND	102	The qualifier value is not found.
CIM_ERR_QUALIFIERTYPE_NOT_FOUND	103	The qualifier type is not found.
CIM_ERR_CONNECTION_FAILURE	104	The connection failed.
CIM_ERR_FAIL_TO_WRITE_TO_SERVER	105	There is a fail to write to the server.

Table 24. Return error codes for the CIMOM (continued)

Symbolic Name	Code	Definition
CIM_ERR_SERVER_NOT_SPECIFIED	106	The server not specified.
CIM_ERR_INDICATION_ERROR	107	There is an indication processing error.
CIM_ERR_FAIL_TO_WRITE_TO_CIMOM	108	There is a fail to write to the CIMOM.
CIM_ERR_SUBSCRIPTION_EXISTS	109	A subscription already exists.
CIM_ERR_INVALID_SUBSCRIPTION_DEST	110	The subscription destination is invalid.
CIM_ERR_INVALID_FILTER_PATH	111	The filter path is invalid.
CIM_ERR_INVALID_HANDLER_PATH	112	The handler path is invalid.
CIM_ERR_NO_FILTER_INSTANCE	113	The filter instance is not found.
CIM_ERR_NO_HANDLER_INSTANCE	114	The handler instance is not found.
CIM_ERR_UNSUPPORTED_FILTER	115	There is an unsupported filter referenced in the subscription.
CIM_ERR_INVALID_TRUSTSTORE	116	The CIMOM cannot be connected to because there is a bad or missing truststore or an incorrect truststore password.
CIM_ERR_ALREADY_CONNECTED	117	The CIMOM cannot be connected to because it is already connected.
CIM_ERR_UNKNOWN_SERVER	118	The server is unknown. The CIMOM cannot be connected to.
CIM_ERR_INVALID_CERTIFICATE	119	The correct certificate cannot be found in truststore. The CIMOM cannot be connected to.

Chapter 9. CIM agent class information for the DS Open API

The CIM agent uses the classes that are described in this section to manage the implementation of the DS Open API. This information assists you in writing your DS Open API-based applications.

CIM agent class definitions quick reference

This section provides a quick reference for the CIM agent class definitions.

Table 25 describes the CIM agent classes and provides the class names from which they are derived.

Note: You can obtain a file with comprehensive DS Open API class definition tables from the CIM agent for IBM TotalStorage DS Open API installation CD. These tables list the properties, types, qualifiers, and descriptions for each CIM agent class definition.

Table 25. CIM agent class definitions (quick reference)

IBMTSESS class name	Description
IBMTSESS_AllocatedFromStoragePool	An association between a volume and the volumespace from which it is allocated. This class is derived from CIM_AllocatedFromStoragePool.
IBMTSESS_AsyncPPRCService	Contains methods that allow the manipulation of Asynchronous PPRC volumes. This class is derived from StorageConfigurationService.
IBMTSESS_AuthorizedSubject	An association that ties specific privileges to specific subjects (for example, identities or roles). This class is derived from CIM_AuthorizedSubject.
IBMTSESS_AuthorizedTarget	An association that ties the identity or role privileges to specific target resources. This class is derived from CIM_AuthorizedTarget.
IBMTSESS_BasedOn	An association describing how StorageExtents can be assembled from lower level Extents. For example, ProtectedSpaceExtents are parts of PhysicalExtents. This class is derived from CIM_BasedOn.
IBMTSESS_Chassis	A representation of a chassis that contains one physical storage unit. This class is derived from CIM_Chassis.
IBMTSESS_Cluster	Represents the cluster on the storage unit. This class is derived from CIM_Cluster.
IBMTSESS_Component	An association between storage extent and VolumeSpace. This class is derived from CIM_ConcreteComponent.
IBMTSESS_ComponentCS	An association of storage unit and its component systems. This class is derived from CIM_ComponentCS.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_ComputerSystemPackage	An association between a physical package and the computer system. This class is derived from CIM_ComputerSystemPackage.
IBMTSESS_ComputerSystemPackageCard	An association between a physical package and the computer system. This class is derived from CIM_ComputerSystemPackage.
IBMTSESS_ConcreteDependencyController	A generic association that establishes dependency relationships between managed elements. This class is derived from CIM_ConcreteDependency.
IBMTSESS_ConcreteDependencyPrivilege	A generic association that establishes dependency relationships between managed elements. This class is derived from CIM_ConcreteDependency.
IBMTSESS_ConcreteDependencyStorageHardwareID	A generic association that establishes dependency relationships between managed elements. This class is derived from CIM_ConcreteDependency.
IBMTSESS_ConcretelIdentityCapSet	An association that associates two elements representing different aspects of the same underlying entity. This class is derived from CIM_ConcretelIdentity.
IBMTSESS_ConcretelIdentityInitiator	IBMTSESS_ConcretelIdentityInitiator is derived from CIM_ConcretelIdentity.
IBMTSESS_ControllerConfigurationService	Includes methods that allow a client to manipulate LUN Masking in a storage system. This class is derived from CIM_ControllerConfigurationService.
IBMTSESS_DeviceMaskingCapabilities	A subclass of capabilities that defines the masking-related capabilities of a storage system. This class is derived from CIM_ProtocolControllerMaskingCapabilities.
IBMTSESS_DeviceSoftwareIdentity	This class is derived from CIM_DeviceSoftwareIdentity.
IBMTSESS_DiskDrive	A description of the physical disk on the storage unit. This class is derived from CIM_DiskDrive.
IBMTSESS_ElementCapabilities	An association between managed elements and their capabilities. This class is derived from CIM_ElementCapabilities.
IBMTSESS_ElementCapabilitiesMasking	An association between managed elements and their capabilities. This class is derived from CIM_ElementCapabilities.
IBMTSESS_ElementConformsToProfile	The registered profile that a managed element is conformant to. This class is derived from CIM_ElementConformsToProfile.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_ElementSettingData	An association between managed elements and applicable setting data. This association also describes whether this is a default or current setting. This class is derived from CIM_ElementSettingData.
IBMTSESS_EltCapabilitiesStgPool	An association between managed elements and their capabilities. This class is derived from CIM_ElementCapabilities.
IBMTSESS_ExtraCapacitySet	A description of the type of redundancy available in the storage system. This class is derived from CIM_ExtraCapacitySet.
IBMTSESS_FCPort	A description of a single fibre-channel adapter I/O port on the storage unit. This class is derived from CIM_FCPort.
IBMTSESS_FCPortStatisticalData	An association that relates a IBMTSESS_FCPort to its IBMTSESS_FCPortStatistics. This class is derived from CIM_ElementStatisticalData.
IBMTSESS_FCPortStatistics	The FC Port specific statistics for a storage unit. This class is derived from CIM_StatisticalData.
IBMTSESS_Host	Describes a host system attached to a storage unit. This class is derived from CIM_ComputerSystem.
IBMTSESS_HostedAccessPoint	An association between a service access point and the system on which it is provided. This class is derived from CIM_HostedAccessPoint.
IBMTSESS_HostedDependency	This class is derived from CIM_HostedDependency.
IBMTSESS_HostedPrimordialStoragePool	An association that establishes that the storagepool is defined in the context of the primordialstoragepool. This class is derived from CIM_HostedStoragePool.
IBMTSESS_HostedService	An association between a system and the storage configuration service. This class is derived from CIM_HostedService.
IBMTSESS_HostedService2	An association between a system and the privilege management service; derived from CIM_HostedService.
IBMTSESS_HostedService3	An association between a system and the storage hardware ID management service. This class is derived from CIM_HostedService.
IBMTSESS_HostedService4	An association between a system and the controller configuration service. This class is derived from CIM_HostedService.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_HostedService6	An association between a service and the system on which the functionality resides. This class is derived from CIM_HostedService.
IBMTSESS_HostedStoragePool	An association that establishes that the storage pool is defined in the context of the System. This class is derived from CIM_HostedStoragePool.
IBMTSESS_HostToInitiator	This class is derived from CIM_SystemDevice.
IBMTSESS_IndicationFiltersConformsToProfile	Connects IndicationFilters and Array profile. This class is derived from CIM_ElementConformsToProfile.
IBMTSESS_IndicationFiltersConformsToSubProfile	Connects IndicationFilters and Array-Sub profile. This class is derived from CIM_ElementConformsToProfile.
IBMTSESS_Initiator	IBMTSESS_Initiator is derived from CIM_LogicalDevice.
IBMTSESS_InitiatorElementSettingData	Represents the association between ManagedElements and applicable setting data. This association also describes whether this is a default or current setting. This class is derived from CIM_ElementSettingData.
IBMTSESS_InstalledSoftwareIdentity	An association that identifies the System on which a SoftwareIdentity is installed. This class is a corollary to InstalledSoftwareElement, but deals with the asset aspects of software (as indicated by SoftwareIdentity), versus the deployment aspects (as indicated by SoftwareElement). This class is derived from CIM_InstalledSoftwareIdentity.
IBMTSESS_Location	The position and address of a physical element. This class is derived from CIM_Location.
IBMTSESS_LunMaskPrivilegeService	Manages privilege instances. This class is derived from CIM_PrivilegeManagementService.
IBMTSESS_MediaPresent	IBMTSESS_MediaPresent is derived from CIM_MediaPresent.
IBMTSESS_MediaPresentExtent	The association between a media access device and the StorageExtent. This class is derived from CIM_MediaPresent.
IBMTSESS_MemberOfCollection	An aggregation used to establish membership of ManagedElements in a Collection. This class is derived from CIM_MemberOfCollection.
IBMTSESS_ObjectManagerIsProvider	This class is derived from CIM_ObjectManagerIsProvider.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_PackagedComponent	Makes the relationship explicit between a component and PhysicalPackage container (such as a chassis or card). However, a Component may not always be associated with a container: a Component may be removed from, or not yet inserted into, its containing Package. This class is derived from CIM_PackagedComponent.
IBMTSESS_PCMEltCapabilities	Association of a storage unit and the masking capabilities of its protocol Controller. This class is derived from CIM_ElementCapabilities.
IBMTSESS_PerformanceStatisticsService	Includes methods that enable and disable the collection of performance statistics. In addition, it supports a method to retrieve the statistics file for storage unit volumes and volume spaces. This class is derived from CIM_Service.
IBMTSESS_PhysicalElementLocation	A description of the association between a physical element with a location object for inventory or replacement purposes. This class is derived from CIM_PhysicalElementLocation.
IBMTSESS_PhysicalPackage	A representation of physical elements that contain or host other components. This class is derived from CIM_PhysicalPackage.
IBMTSESS_Pool2PrimordialPool	An association describing how VolumeSpaces are allocated from PrimordialStoragePool. This class is derived from CIM_AllocatedFromStoragePool.
IBMTSESS_PPRCPath	Defines the type of PPRC path as either ESCON or FCP. This class is derived from CIM_LogicalDevice.
IBMTSESS_PrimordialStoragePool	A pool of Storage that is managed by a particular storage unit, representing a pool of disk groups which are available to create VolumeSpaces. This class is derived from CIM_StoragePool.
IBMTSESS_Privilege	An association of subjects and access rights. This class is derived from CIM_AuthorizedPrivilege.
IBMTSESS_Product	A representation of the top-level description of physical components that make up a product, in this case, the entire storage unit. This class is derived from CIM_Product.
IBMTSESS_ProductPhysicalComponent	An association that indicates that the referenced physical element is acquired as part of a product. This class is derived from CIM_ProductPhysicalComponent.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_ProtocolControllerForPort	An association that defines a relationship between a protocol controllers and a port. This class is derived from CIM_ProtocolControllerForPort.
IBMTSESS_ProtocolControllerForUnit	An association that defines a relationship between a protocol controllers and an exposed logical unit (for example, a storage volume). This class is derived from CIM_ProtocolControllerForUnit.
IBMTSESS_ProtocolControllerMaskingCapabilities	A subclass of Capabilities that defines the Masking-related capabilities of a ProtocolController. This class is derived from CIM_ProtocolControllerMaskingCapabilities.
IBMTSESS_Provider	A CIM_Provider operates at the request of the CIM_ObjectManager to perform operations on CIM objects, for example, providing version information for the current CIM provider. This class is derived from CIM_Provider.
IBMTSESS_RDiskDrive	A subclass of the logical device classes that define a RAID drive. This class is derived from CIM_LogicalDevice.
IBMTSESS_Realizes	An association that associates a logical device and the physical elements that implement them. This class is derived from CIM_Realizes.
IBMTSESS_RealizesExtent	The relationship of Extents to PhysicalComponents is made explicit by the RealizesExtent association. This class is derived from CIM_RealizesExtent.
IBMTSESS_RegisteredProfile	IBMTSESS_RegisteredProfile is derived from CIM_RegisteredProfile.
IBMTSESS_RegisteredSubProfile	A RegisteredSubProfile subclasses RegisteredProfile to indicate that a scoping profile is required to provide context. The latter is specified by the mandatory association, SubProfileRequiresProfile.
IBMTSESS_RemoteServiceAccessPoint	A description of access and addressing information for a remote connection that is known to a local network element. This class is derived from CIM_RemoteServiceAccessPoint.
IBMTSESS_RemoteSourceStorageSynchronized	A representation of the relationship involving a remote domain volume. For this association the remote volume is the source and the local volume the target. This class is derived from CIM_ManagedElement.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_RemoteTargetStorageSynchronized	A representation of the relationship involving a remote domain volume. For this association the remote volume is the target and the local volume is the source of the relationship. This class is derived from CIM_ManagedElement.
IBMTSESS_RemoteVolume	A representation of a volume that is contained within a domain that is unaccessible. IBMTSESS_RemoteVolume has PPRC copy relationship with IBMTSESS_Volume, which is contained within a domain that is accessible. This class derived from CIM_ManagedElement.
IBMTSESS_SAPAvailableForElement	Conveys the semantics of a Service Access Point being available for a ManagedElement. When CIM_SAPAvailableForElement is not instantiated then the SAP is assumed to be generally available. If instantiated, the SAP is only available for the associated ManagedElements. For example, a storage unit might provide management access through a URL. This association allows the URL to be advertised for the storage unit. This class is derived from CIM_SAPAvailableForElement.
IBMTSESS_SCSIProtocolController	A type of ProtocolController, managing a SCSI interface. This class is derived from CIM_SCSIProtocolController.
IBMTSESS_SoftwareIdentity	SoftwareIdentity represents software, viewed as an asset and/or individually identifiable entity (similar to Physical Element). A SoftwareIdentity may correspond to a Product, or to one or more SoftwareFeatures or SoftwareElements - depending on the granularity of these classes and the deployment model. This class is derived from CIM_SoftwareIdentity.
IBMTSESS_StgConfigSrvEltCapabilities	Represents the association between ManagedElements and their Capabilities. This class is derived from CIM_ElementCapabilities.
IBMTSESS_StorageCapabilities	Describes the capabilities of VolumeSpace. There is one instance for all the storage units. This class is derived from CIM_StorageCapabilities.
IBMTSESS_StorageClientSettingData	This class is derived from CIM_StorageClientSettingData.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_StorageConfigurationCapabilities	A subclass of Capabilities that defines the Capabilities of a StorageConfigurationService. An instance of this class is associated with a StorageConfigurationService using ElementCapabilities. This class is derived from CIM_StorageConfigurationCapabilities.
IBMTSESS_StorageConfigurationService	A service provided by the CIM agent to enable volume creation, volumespace creation, volumespace deletion and copy services functions. This class is derived from CIM_StorageConfigurationService.
IBMTSESS_StorageExtent	Describes the capabilities and management of the various media that exist to store data and allow data retrieval. This class is derived from CIM_StorageExtent.
IBMTSESS_StorageExtentStatisticalData	An association that relates a IBMTSESS_StorageExtent to its IBMTSESS_StorageExtentStatistics. This class is derived from CIM_ElementStatisticalData.
IBMTSESS_StorageExtentStatistics	Provides storage extent specific statistics for a storage unit. This class is derived from CIM_StatisticalData.
IBMTSESS_StorageHardwareID	This class is derived from CIM_StorageHardwareID.
IBMTSESS_StorageHardwareIDManagementService	Includes methods for creating and deleting storage hardware IDs. This class is derived from CIM_StorageHardwareIDManagementService.
IBMTSESS_StorageSetting	StorageSetting is roughly equivalent to a Service Level Agreement (SLA). It defines the characteristics, qualities of service and goals when used in a CreateOrModifyElement FromStoragePool or CreateOrModifyStoragePool method in the StorageConfigurationService. It specifies a series of properties with Maximum and Minimum values that define the (inclusive) bounds that the object should maintain. Note that the setting is associated to a StorageVolume, using ElementSetting. This class is derived from CIM_StorageSetting.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_StorageProcessorCard	A representation of a type of physical container that can be plugged into another card or hosting board, or is itself a hosting board or mother board in a chassis. Each storage unit has two instances of IBMTSESS_StorageProcessorCard. This class derived from CIM_Card.
IBMTSESS_StorageSynchronized	An association that indicates that two storage objects were replicated at the specified point in time. This class is derived from CIM_StorageSynchronized.
IBMTSESS_StorageSystem	A representation of the entire storage unit in the configuration. This class is derived from CIM_ComputerSystem.
IBMTSESS_StorageSystemToController	An association that associates a controller with a storage subsystem. This class is derived from CIM_SystemDevice.
IBMTSESS_StorageSystemToPort	An association that associates a port with a storage subsystem. This class is derived from CIM_SystemDevice.
IBMTSESS_StorageSystemToVolume	An association that associates a volume with a storage subsystem. This class is derived from CIM_SystemDevice.
IBMTSESS_SubProfileExtendsProfile	This class is derived from CIM_ReferencedProfile.
IBMTSESS_SubProfileRequiresProfile	This class is derived from CIM_SubProfileRequiresProfile.
IBMTSESS_SystemDevice	An association that describes the aggregation of logical devices by a system. This class is derived from CIM_SystemDevice.
IBMTSESS_SystemElementSettingData	This class is derived from CIM_ElementSettingData.
IBMTSESS_V8Pack	Locates and manages Removable Media - to define a specific media. This class is derived from CIM_PhysicalMedia.
IBMTSESS_Volume	A representation one storage volume for the storage unit. This class is derived from CIM_StorageVolume.
IBMTSESS_VolumeSpace	A representation of a storage unit volume group from which storage volumes can be created. This class is derived from CIM_StoragePool.
IBMTSESS_VolumeSpaceStatisticalData	A connection is made between IBMTSESS_VolumeSpace with its corresponding statistics instance. This class is derived from CIM_ElementStatisticalData.

Table 25. CIM agent class definitions (quick reference) (continued)

IBMTSESS class name	Description
IBMTSESS_VolumeStatisticalData	A connection is made from IBMTSESS_Volume with its corresponding statistics instance. This class is derived from CIM_ElementStatisticalData.
IBMTSESS_VolumeSpaceStatistics	Provides volume space specific statistics for an ESS. This class is derived from CIM_StatisticalData.
IBMTSESS_VolumeStatistics	Provides volume specific statistic for an ESS. This class is derived from CIM_StatisticalData.

Chapter 10. DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services for Windows

This chapter includes an overview of DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services along with an overview of the installation process and instructions for installing and reconfiguring Microsoft Volume Shadow Copy and Virtual Disk Services on a Windows Server 2003 operating system. Instructions for uninstalling Microsoft Volume Shadow Copy and Virtual Disk Services are also provided.

DS Open API Support for Microsoft's Virtual Disk Service Overview

DS Open API Support for Microsoft's Virtual Disk Service provides a single, vendor and technology neutral interface for managing block storage virtualization, whether done by OS software, RAID storage hardware, or other storage virtualization engines. Microsoft's Virtual Disk Service enables the management of heterogeneous storage systems, while leveraging both client and provider APIs. Microsoft's Virtual Disk Service also supports automatic LUN configuration, which facilitates dynamic reconfiguration by hardware in response to load or fault handling.

Microsoft's Virtual Disk Service is implemented using a CIM client query and control the DS through

DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Service installation overview

This section provides an overview of the installation and configuration of Microsoft Volume Shadow Copy and Virtual Disk Services on a Windows Server 2003 operating system. You should have some knowledge of how to administer a Windows Server 2003 operating system before you install Microsoft Volume Shadow Copy Service or Volume Shadow Copy Service. You should also become familiar with the installation tasks and gather all of the information you will need for installation ahead of time.

Steps:

The following installation tasks are presented in the order in that they must be performed:

1. Before you install Microsoft Volume Shadow Copy or Virtual Disk Services, check the hardware and software requirements.
2. Install the prerequisite CIM agent software.
3. Run the InstallShield Wizard for Microsoft Volume Shadow Copy and Virtual Disk Services to install the CIM agent.
4. Verify the installation.
5. Create free and reserved volume pools.
6. Reconfigure the services. Perform this optional task if you would like to change the configuration that you established during installation.

DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services installation requirements

Ensure that your system satisfies the following prerequisite for installing Microsoft Volume Shadow Copy and Virtual Disk Services on a Windows Server 2003 operating system before you start the installation.

You must install the CIM agent *before* you install Microsoft Volume Shadow Copy and Virtual Disk Services. You can locate the CIM agent on the same machine as Microsoft Volume Shadow Copy and Virtual Disk Services or on a different machine.

Hardware

The following minimum hardware is required:

- For Volume Shadow Copy Services: a DS8000, DS6000, or ESS storage unit (with FlashCopy Version 1 or 2)
- For Virtual Disk Services: a DS8000 storage unit

Note: If you are using ESS Fxx models, at least one ESS in the environment must be a model 800.

- A system capable of running Windows Server 2003
- 133 - 733 megahertz CPU
- 128 - 256 megabytes of random access memory
- 1.5 gigabyte disk space
- Supported QLogic or Emulex fibre-channel host bus adapter (HBA)

Software

The following software is required:

- Windows Server 2003 operating system. The following editions of Windows Server 2003 are supported:
 - Enterprise Edition, 32-bit version
 - Datacenter Edition, 32-bit version
- Common Information Model (CIM) agent. The CIM agent can be located on the same machine as Microsoft Volume Shadow Copy Service or on a different machine. You can find this software on the *CIM agent for IBM TotalStorage DS Open Application Programming Interface CD*.
- Microsoft Volume Shadow Copy Service compliant backup software

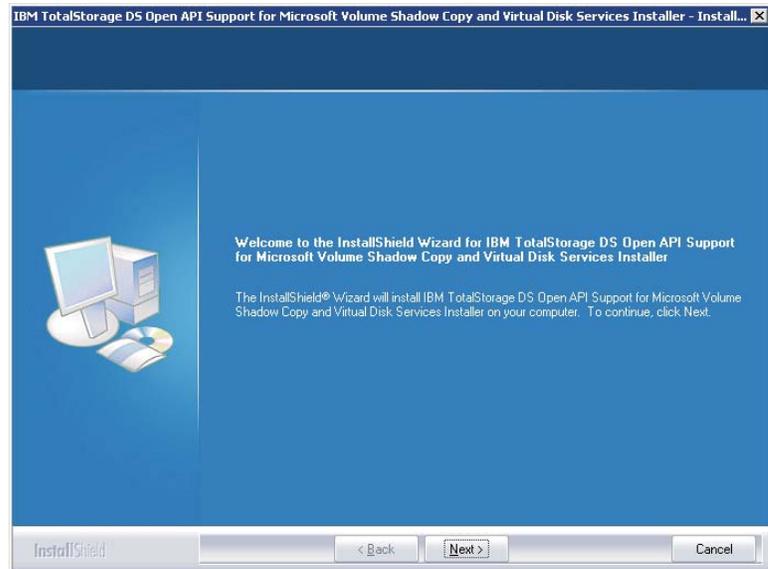
Installing the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services on Windows

This section includes the steps to install the DS Open API support for both Microsoft Volume Shadow Copy and Virtual Disk Services on your Windows system.

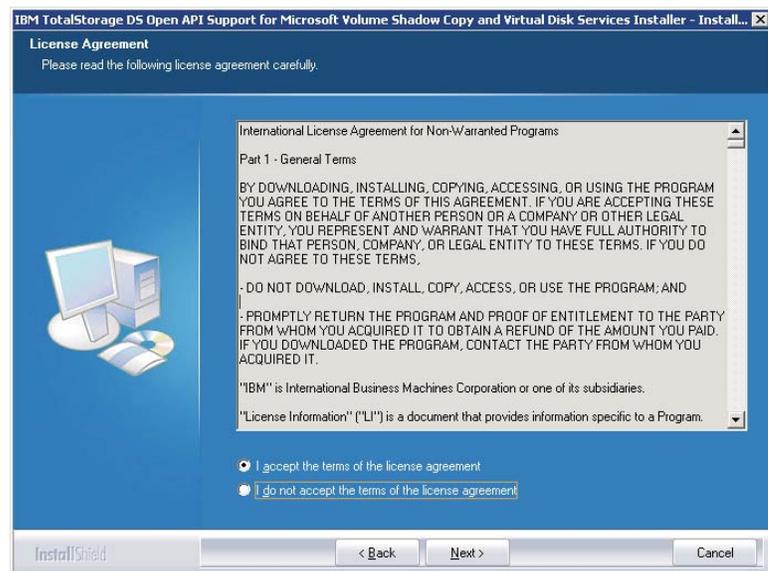
You must satisfy all prerequisites that are listed in installation requirements section before you start the installation.

1. Log on to your system as the local administrator.
2. Run the InstallShield Wizard by inserting the *IBM TotalStorage DS Open Application Programming Interface support for Microsoft Volume Shadow Copy and Disk Services CD* into the CD-ROM drive.

3. The Welcome window opens. Click **Next** to continue with the InstallShield Wizard. You can click **Cancel** at any time while using the wizard to exit the installation. To move back to previous screens while using the wizard, click **Back**.



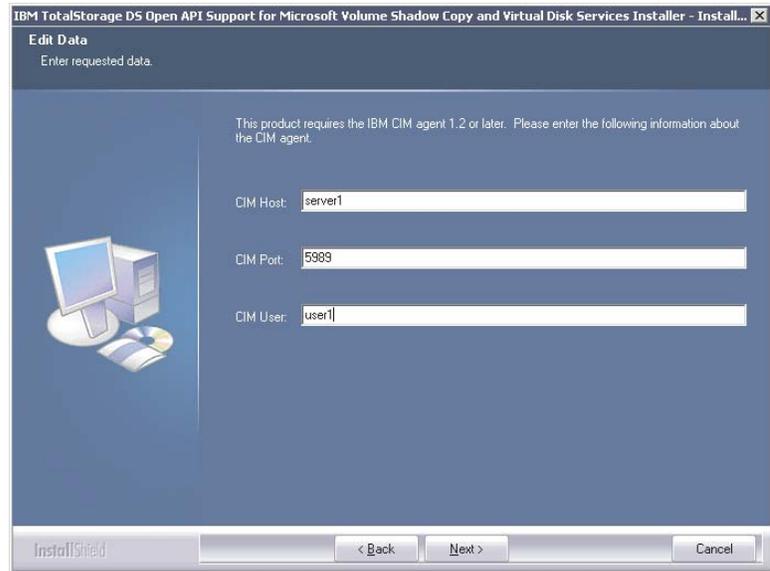
4. The License Agreement window opens. Read the license agreement information. Select whether you accept the terms of the license agreement and click **Next**. If you do not accept, you cannot continue with the installation.



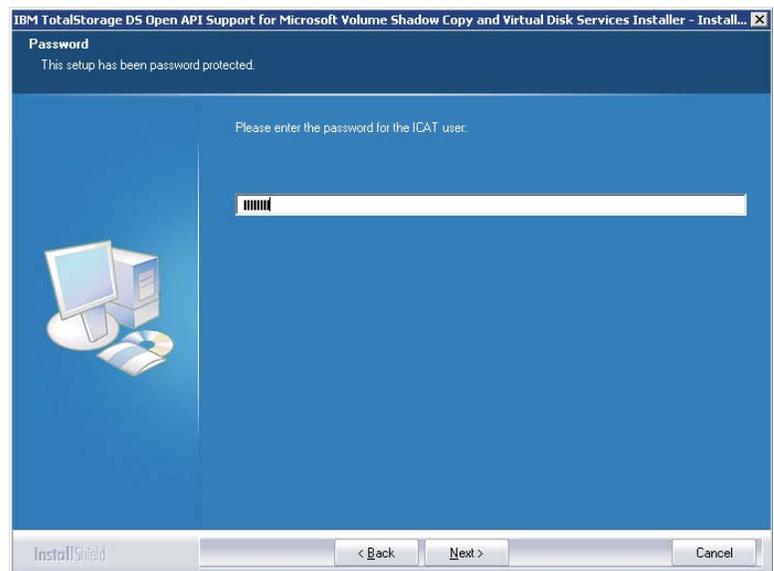
5. The Edit Data window opens. In order to connect to the CIM agent, Microsoft Volume Shadow Copy and Disk Services must obtain some information about the server that the CIM agent is installed on. Type the required CIM agent port, host, and user information and click **Next**.

Note:

- a. If these settings change after installation, you can use the *ibmvcfg.exe* tool to update Microsoft Volume Shadow Copy and Virtual Disk Services with the new settings.
- b. If you do not have the CIM agent port, host, or user information, contact your CIM agent administrator.



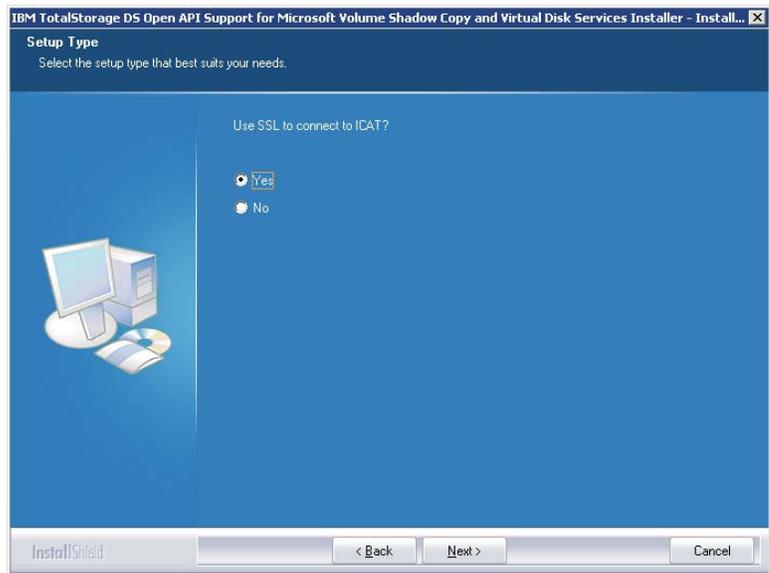
6. The Password window opens. Enter your CIM agent password and click **Next**.



7. The Setup Type window opens. Select whether you want to use Secure Sockets Layer (SSL) to connect to the CIM agent and click **Next**.

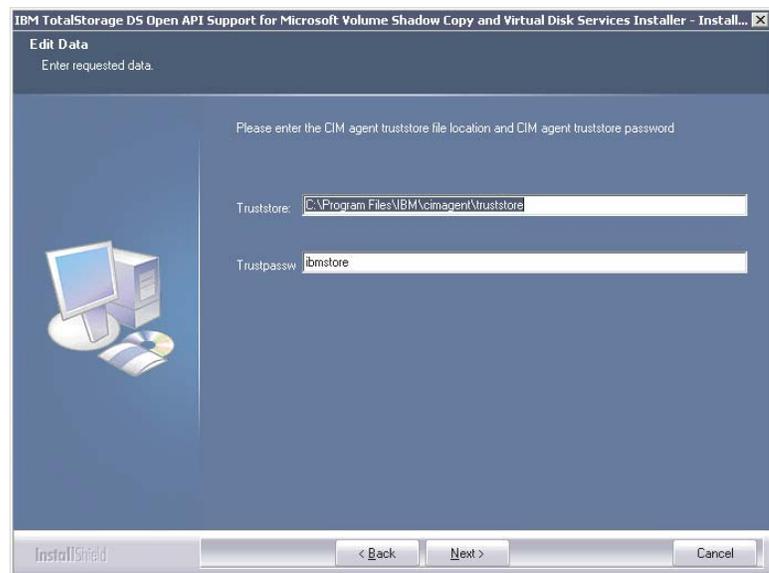
Note:

- a. You can set the SSL using the *ibmvcfg.exe* configuration tool.
- b. If you are not sure whether to use SSL to connect to the CIM agent, contact your CIM agent administrator.

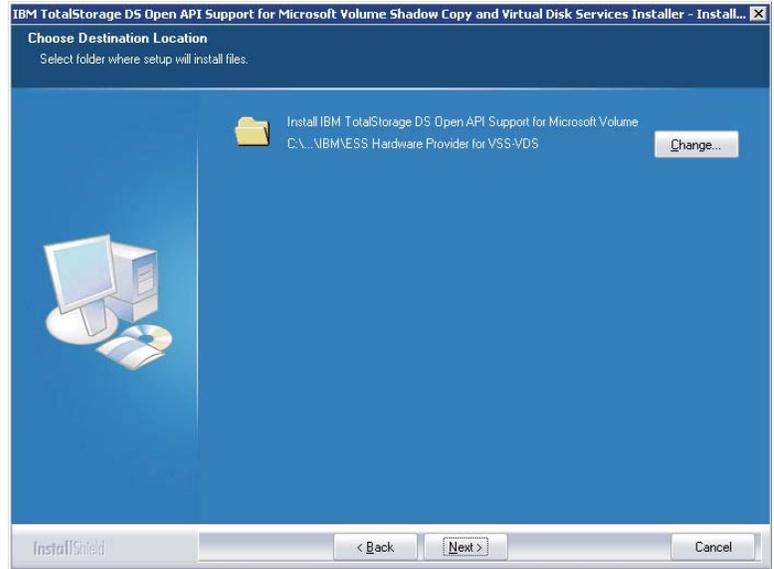


8. The Edit Data window opens. Type the location of the CIM agent truststore file. This truststore file is generated during CIM agent installation. You must copy this file to a location accessible by Microsoft Volume Shadow Copy and Virtual Disk Services. Then type the truststore password and click **Next**.

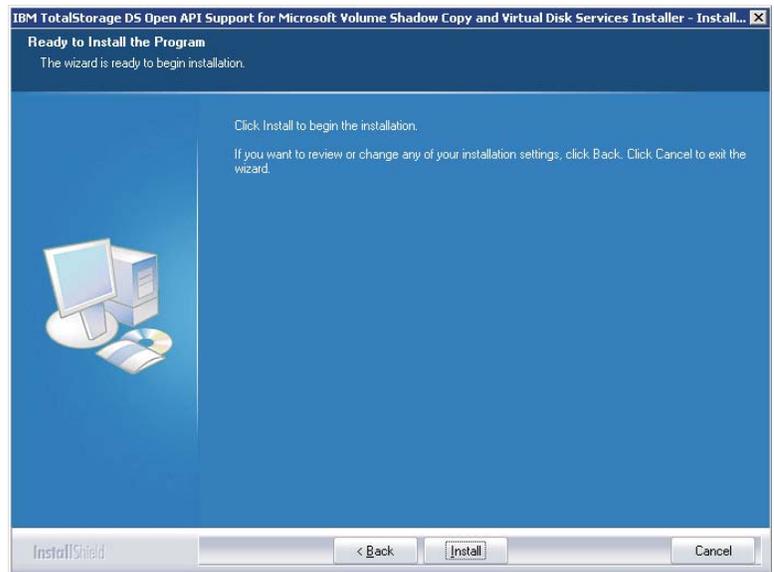
Note: The default CIM agent truststore password is “ibmstore”. If the CIM agent truststore password has been changed from the default and you do not have this information, contact your CIM agent administrator. You can change the CIM agent truststore password using the *ibmvcfg.exe* configuration tool.



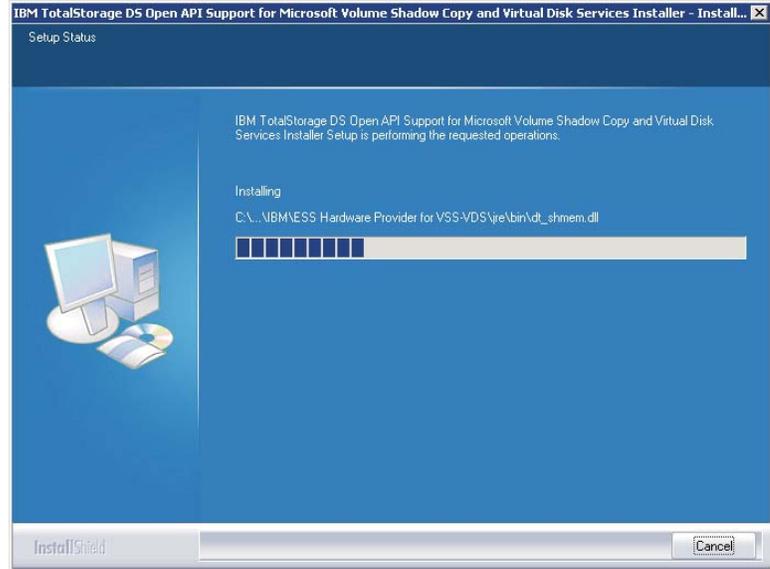
9. The Choose Destination Location Window opens. Click **Next** to accept the default directory where the setup will install the files, or click **Change** to select a different directory and then click **Next**.



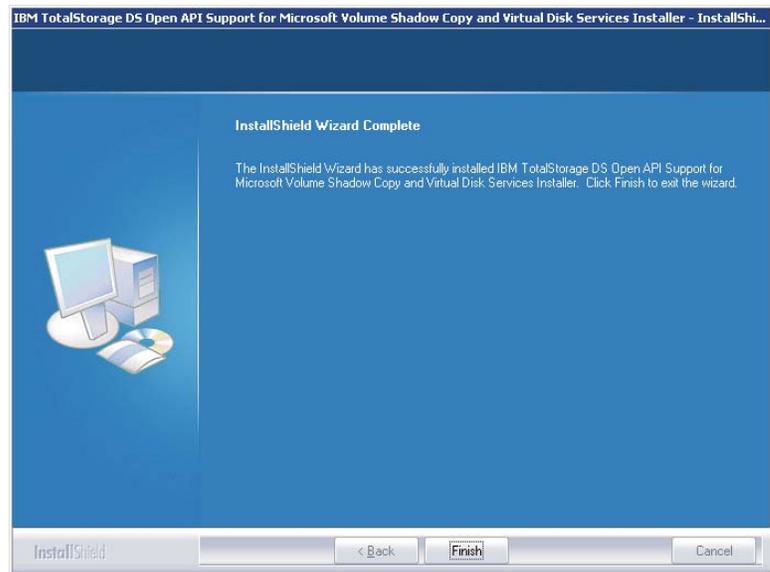
10. The Ready to Install the Program window opens. Click **Install** to begin the installation. To exit the wizard and end the installation, click **Cancel**.



The Setup Status window opens. Wait for the setup to complete, or click **Cancel** if you want to stop the setup.



11. The InstallShield Wizard Complete window opens. The installation is complete. Click **Finish** to exit the wizard.



12. The installation program might prompt you to reboot your system.

If you are able to perform all of the installation tasks successfully, Microsoft Volume Shadow Copy Service has been successfully installed on your Windows system.

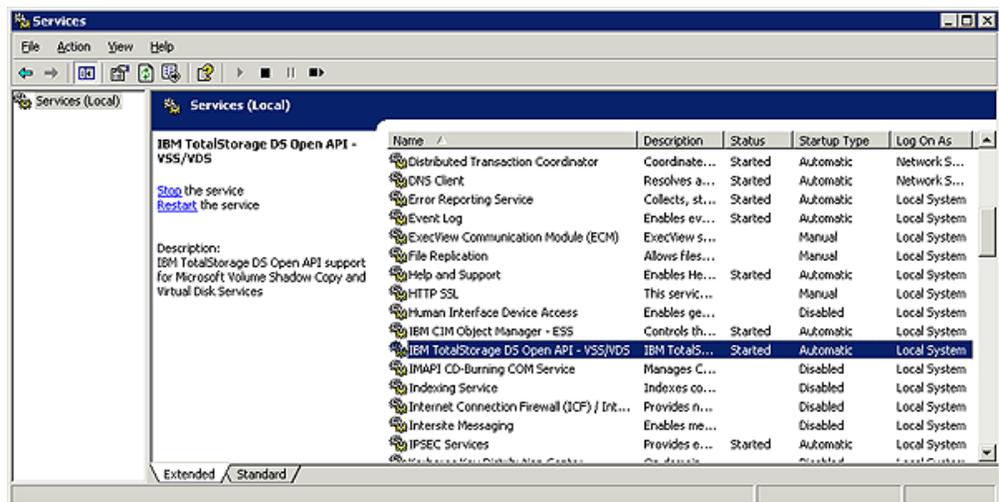
Verifying the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services Windows installation

This task verifies that the services that you selected to install are correctly installed on your system. During installation, you had the option to install Microsoft Volume Shadow Copy Service, Microsoft Virtual Disk Services, or both.

Steps:

Perform the following steps to verify the installation of the services that you selected to install:

1. If verifying Microsoft Volume Shadow Copy Service installation, select **Start -> All Programs -> Administrative Tools -> Services**
2. Ensure that there is a service named IBM TotalStorage DS Open API Support for Microsoft Volume Shadow Copy that is listed, and that the Status is Started and the Startup Type is Automatic.



3. Open a command prompt window and type the following command to verify that DS Open API Support for Microsoft Volume Shadow Copy and Virtual Disk Services is installed:

```
vssadmin list providers
```

Ensure each service that you installed is listed as a provider.

If you are able to perform all of these verification tasks successfully, either Microsoft Volume Shadow Copy, Virtual Disk Services, or both, have been successfully installed on your Windows system.

Creating the VSS_FREE and VSS_RESERVED pools for Microsoft Volume Shadow Copy Service

This task allows you to create the VSS_FREE and VSS_RESERVED pools.

Before using the IBM TotalStorage DS Open API support for Microsoft Volume Shadow Copy for the first time, you must designate which volumes that the services can use as FlashCopy target volumes. This designation is done by creating a

VSS_FREE pool and a VSS_RESERVED pool, represented by virtual hosts that are created on the storage unit. Once the virtual hosts are created, volumes can be added to the free pool by simply assigning a volume to the virtual host.

Perform the following steps using the IBM TotalStorage DS Storage Manager or DSCLI to create the VSS_FREE and VSS_RESERVED pools:

Note: If you are using the DSCLI you must perform these steps in order.

Steps:

1. Create a volume group with the name "VSS_FREE" or another name, of the same type as your Windows Server 2003 host, for example: SCSI Map 256.
2. Create a virtual hostconnect on the storage unit named "VSS_FREE" or another name, with the following parameters:
 - a. -profile "Intel - Windows 2003"
 - b. -addrdiscovery LUNPolling
 - c. -volgrp Where *volgrp* is volume group created in step 1.
 - d. -wwname 5000000000000000
3. Create a volume group with the name "VSS_RESERVED" or another name, of the same type as your Windows Server 2003 host, e.g. SCSI Map 256.
4. Create a virtual hostconnect on the storage unit named "VSS_RESERVED" or another name, with the following parameters:
 - a. -profile "Intel - Windows 2003"
 - b. -addrdiscovery LUNPolling
 - c. -volgrp Where *volgrp* is volume group created in step 3.
 - d. -wwname 5000000000000000
5. Create and assign free volumes to the VSS_FREE volume group.

Note: If you already have volumes that are created for the VSS_FREE virtual host, you must assign those volumes to VSS_FREE.

Verifying DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services Windows configuration

This task verifies that Microsoft Volume Shadow Copy and Virtual Disk Services are configured correctly on your Windows system.

Steps:

After you have created the VSS_FREE and VSS_RESERVED pools for Microsoft Volume Shadow Copy Service, perform the following steps to verify your configuration:

1. Issue the following command:

```
ibmvcfg listvols
```

All of the volumes on your storage unit are listed with the WWPNs that they are assigned to.

2. If the volumes are not listed, check the connectivity of your CIM agent. Then, check your DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services configuration. You can reconfigure using the commands

that are listed in the next section. The IBMVSS.log provides more detailed information on which of the settings is incorrect. DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services do not work if this command does not complete successfully.

Result:

If you are able to perform all of the verification tasks successfully, Microsoft Volume Shadow Copy and Virtual Disk Services has been successfully configured on your Windows system.

DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands

After installation, you can use several commands on the `ibmvcfg.exe` tool to change or correct parameters that you used to install the Microsoft Volume Shadow Copy and Virtual Disk Services. To do this, you must use the utility `ibmvcfg.exe`. You do not have to set many of the settings because there are defaults that are provided for them in Microsoft Volume Shadow Copy and Virtual Disk Services. Table 26 shows the commands that you can use for reconfiguration.

Note: If you do not know which settings to provide (for example, passwords or user names) for the following commands, contact your system administrator.

Table 26. Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands

Command	Description	Example
<code>ibmvcfg showcfg</code>	Provides the current settings.	
<i>CIMOM settings</i>		
<code>ibmvcfg set username <CIMOM username></code>	Sets the CIMOM user name.	<code>ibmvcfg set username johnny</code>
<code>ibmvcfg set password <CIMOM password></code>	Sets the CIMOM user password.	<code>ibmvcfg set password mypassword</code>
<code>ibmvcfg set trustpassword <trustpassword></code>	Sets the CIMOM trust password.	<code>ibmvcfg set trustpassword trustme</code>
<code>ibmvcfg set truststore <truststore location></code>	Specifies the truststore file location.	<code>ibmvcfg set truststore c:\truststore</code>
<code>ibmvcfg set usingSSL</code>	Specifies whether to use Secure Socket Layers to connect to the CIMOM.	<code>ibmvcfg set usingSSL yes</code>
<code>ibmvcfg set cimomPort <portnum></code>	Specifies the CIMOM port number. The default value is 5989.	<code>ibmvcfg set cimomPort 5989</code>
<code>ibmvcfg set cimomHost <server name></code>	Sets the name of the CIMOM server.	<code>ibmvcfg set cimomHost cimomserver</code>

Table 26. Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands (continued)

Command	Description	Example
ibmvcfg set namespace <namespace>	Specifies the namespace value that CIMOM is using. The default value is \root\ibm.	ibmvcfg set namespace \root\ibm
<i>Volume Shadow Copy Service settings</i>		
ibmvcfg listvols	Lists the volumes that are currently in the freepool, unassigned, or all volumes. By default, without any additional parameters, this command lists all of the volumes.	ibmvcfg listvols ibmvcfg listvols free ibmvcfg listvols unassigned ibmvcfg listvols all
ibmvcfg listvols free	Lists the volumes that are currently in the freepool, unassigned, or both.	ibmvcfg listvols free
ibmvcfg listvols unassigned	Lists the volumes that are currently in the freepool, unassigned, or both.	ibmvcfg listvols unassigned
ibmvcfg add	Adds a volume or volumes to the freepool.	ibmvcfg add 12312345 32112345
ibmvcfg rem	Removes a volume or volumes from the freepool.	ibmvcfg rem 512 ibmvcfg rem 51212345
ibmvcfg set vssFreeInitiator <WWPN>	Specifies the WWPN that designates the freepool. The default value is 5000000000000000. Modify this value only if there is a host already in your environment with a WWPN of 5000000000000000.	ibmvcfg set vssFreeInitiator 5000000000000000
ibmvcfg set vssReservedInitiator <WWPN>	Specifies the WWPN that designates the reservedpool. The default value is 5000000000000001. Modify this value only if there is a host already in your environment with a WWPN of 5000000000000001.	ibmvcfg set vssReservedInitiator 5000000000000001

Table 26. Microsoft Volume Shadow Copy and Virtual Disk Services reconfiguration commands (continued)

Command	Description	Example
ibmvcfg set FlashCopyVer <1 2>	Sets the FlashCopy version that is available on the storage unit. The default value is 1.	ibmvcfg set FlashCopyVer 1
<i>Virtual Disk Service settings</i>		
None		

Error codes returned by Microsoft Volume Shadow Copy and Virtual Disk Services

Return Error Codes

Table 27 lists Microsoft Volume Shadow Copy and Virtual Disk Services error codes.

Note: These errors are logged in the Windows Event Monitor and in the Microsoft Volume Shadow Copy and Virtual Disk Services log file that located in the directory chosen during installatin.

Table 27. Return error codes for Microsoft Volume Shadow Copy and Virtual Disk Services

Symbolic Name	Code	Definition
ERR_JVM	1000	JVM Creation failed.
ERR_CLASS_NOT_FOUND	1001	Class not found: %1.
ERR_MISSING_PARAMS	1002	Some required parameters are missing.
ERR_METHOD_NOT_FOUND	1003	Method not found: %1.
ERR_REQUIRED_PARAM	1004	A missing parameter is required. Use the configuration utility to set this parameter: %1.
ERR_RECOVERY_FILE_CREATION_FAILED	1600	The recovery file was not created.
ERR_ARELUNSSUPPORTED_IBMGETLUNINFO	1700	ibmGetLunInfo failed in AreLunsSupported.
ERR_FILLLUNINFO_IBMGETLUNINFO	1800	ibmGetLunInfo failed in FillLunInfo.
ERR_GET_TGT_CLEANUP	1900	Failed to delete the following temp files: %1
ERR_LOG_SETUP	2500	Error initializing log.
ERR_CLEANUP_LOCATE	2501	Unable to search for incomplete Shadow Copies. Windows Error: %1.

Table 27. Return error codes for Microsoft Volume Shadow Copy and Virtual Disk Services (continued)

Symbolic Name	Code	Definition
ERR_CLEANUP_READ	2502	Unable to read incomplete Shadow Copy Set information from file: %1.
ERR_CLEANUP_SNAPSHOT	2503	Unable to cleanup snapshot stored in file: %1.
ERR_CLEANUP_FAILED	2504	Cleanup call failed with error: %1.
ERR_CLEANUP_OPEN	2505	Unable to open file: %1.
ERR_CLEANUP_CREATE	2506	Unable to create file: %1.
ERR_HBAAPI_LOAD	2507	HBA: Error loading hba library: %1.
ERR_ESSSERVICE_EXCEPTION	3000	ESSService: An exception occurred. Check the ESSService log.
ERR_ESSSERVICE_LOGGING	3001	ESSService: Unable to initialize logging.
ERR_ESSSERVICE_CONNECT	3002	ESSService: Unable to connect to the CIM agent. Check your configuration.
ERR_ESSSERVICE_SCS	3003	ESSService: Unable to get the Storage Configuration Service. Check your configuration.
ERR_ESSSERVICE_INTERNAL	3004	ESSService: An internal error occurred with the following information: %1.
ERR_ESSSERVICE_FREE_CONTROLLER	3005	ESSService: Unable to find the VSS_FREE controller.
ERR_ESSSERVICE_RESERVED_CONTROLLER	3006	ESSService: Unable to find the VSS_RESERVED controller. Check your configuration.
ERR_ESSSERVICE_INSUFFICIENT_TARGETS	3007	Unable to find suitable targets for all volumes.
ERR_ESSSERVICE_ASSIGN_FAILED	3008	ESSService: The assign operation failed. Check the CIM agent log for details.

Table 27. Return error codes for Microsoft Volume Shadow Copy and Virtual Disk Services (continued)

Symbolic Name	Code	Definition
ERR_ESSSERVICE_WITHDRAW_FAILED	3009	ESSService: The withdraw FlashCopy operation failed. Check the CIM agent log for details.

Uninstalling the DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services on Windows

Use the steps below to uninstall VSS or VDS services.

1. Log on to your system as the local administrator.
2. Click **Start -> Control Panel**.
3. The Control Panel window opens. Double-click on **Add or Remove Programs** and then select **IBM TotalStorage DS Open API support for Microsoft Volume Shadow Copy and Virtual Disk Services**. Click **Remove** to remove the program.
4. Select **Yes** when you are asked if you want to completely remove the selected application and all of its components, or click **No** to go back to the Add or Remove Programs window.
5. The progress window quickly opens and closes.
6. The Finish window opens. Click **Finish**. The removal is now complete.

If you are able to perform all of the uninstallation tasks successfully, Microsoft Volume Shadow Copy and Virtual Disk Services have been successfully uninstalled on your Windows system.

Accessibility

Accessibility features provide users who have disabilities with the ability to successfully access information and use technology.

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

Features

These are the major accessibility features in the IBM TotalStorage DS8000 information:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. IBM Home Page Reader version 3.0 has been tested.
- You can operate features using the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate menu actions that can also be done through mouse actions. You can navigate the IBM TotalStorage DS8000 information from the keyboard by using the shortcut keys for your browser or Home Page Reader. See your browser Help for a list of shortcut keys that it supports. See the following Web site for a list of shortcut keys supported by Home Page Reader: http://www-306.ibm.com/able/solution_offerings/keyshort.html

Accessing the publications

You can find HTML versions of the IBM TotalStorage DS8000 information at the following Web site:
<http://www.ehone.ibm.com/public/applications/publications/cgibin/pbi.cgi>

You can access the information using IBM Home Page Reader 3.0.

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.*

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 PUBLICATIONS "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.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Terms and conditions for downloading and printing publications

Permissions for the use of the information you have selected for download are granted subject to the following terms and conditions and your indication of acceptance thereof.

Personal Use: You may reproduce this information for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative works of this information, or any portion thereof, without the express consent of the manufacturer.

Commercial Use: You may reproduce, distribute and display this information solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of this information, or reproduce, distribute or display this information or any portion thereof outside your enterprise, without the express consent of the manufacturer.

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the information or any data, software or other intellectual property contained therein.

The manufacturer reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the information is detrimental to its interest or, as determined by the manufacturer, the above instructions are not properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations. THE MANUFACTURER MAKES NO GUARANTEE ABOUT THE CONTENT OF THIS INFORMATION. THE INFORMATION IS PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.

All material copyrighted by IBM Corporation.

By downloading or printing information from this site, you have indicated your agreement with these terms and conditions.

Trademarks

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

- AIX
- DB2
- DFSMS/MVS
- DFSMS/VM
- e (logo)
- Enterprise Storage Server
- ES/9000
- ESCON
- FICON
- FlashCopy
- HACMP
- IBM
- Intellistation
- MVS/ESA
- Netfinity
- NetVista
- Operating System/400
- OS/400
- RS/6000
- S/390
- Seascape
- SNAP/SHOT
- SP
- System/390
- TotalStorage
- Versatile Storage Server
- Virtualization Engine
- VSE/ESA
- z/Architecture
- z/OS
- z/VM
- zSeries

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

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

Electronic emission notices

This section contains the electronic emission notices or statements for the United States and other countries.

Federal Communications Commission (FCC) statement

This equipment has been tested and complies with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors, or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the users authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Industry Canada compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conform à la norme NMB-003 du Canada.

European community compliance statement

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

Germany only

Zulassungsbescheinigung laut Gesetz ueber die elektromagnetische Vertraeglichkeit von Geraeten (EMVG) vom 30. August 1995.

Dieses Geraet ist berechtigt, in Uebereinstimmung mit dem deutschen EMVG das EG-Konformitaetszeichen - CE - zu fuehren.

Der Aussteller der Konformitaetserklaeung ist die IBM Deutschland.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2) 2:

Das Geraet erfuehlt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse A.

EN 55022 Klasse A Geraete beduerfen folgender Hinweise:

Nach dem EMVG:

"Geraete duerfen an Orten, fuer die sie nicht ausreichend entstoert sind, nur mit besonderer Genehmigung des Bundesministeriums fuer Post und Telekommunikation oder des Bundesamtes fuer Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Stoerungen zu erwarten sind." (Auszug aus dem EMVG, Paragraph 3, Abs.4)

Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Nach der EN 55022:

"Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstoerungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Massnahmen durchzufuehren und dafuer aufzukommen."

Anmerkung:

Um die Einhaltung des EMVG sicherzustellen, sind die Geraete wie in den Handbuechern angegeben zu installieren und zu betreiben.

Japanese Voluntary Control Council for Interference (VCCI) class A statement

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Korean Ministry of Information and Communication (MIC) statement

Please note that this device has been certified for business use with regard to electromagnetic interference. If you find this is not suitable for your use, you may exchange it for one of residential use.

Taiwan class A compliance statement

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

VS07171L

Java Compatibility logo

The Java Compatibility logo identifies products that incorporate a Java application environment (JDK or JRE). These products pass the applicable, JavaSoft defined, Java Compatibility test suite in order to enable execution of Java or Personal Java (pJava) applications.



Glossary

This glossary includes terms for the IBM TotalStorage and other Resiliency Family products.

This glossary includes selected terms and definitions from:

- The *American National Standard Dictionary for Information Systems*, ANSI X3.172–1990, copyright 1990 by the American National Standards Institute (ANSI), 11 West 42nd Street, New York, New York 10036. Definitions derived from this book have the symbol (A) after the definition.
- *IBM Terminology*, which is available online at the following Web site: <http://www-306.ibm.com/ibm/terminology/index.html>. Definitions derived from this source have the symbol (GC) after the definition.
- The *Information Technology Vocabulary* developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions derived from this book have the symbol (I) after the definition. Definitions taken from draft international standards, committee drafts, and working papers that the ISO/IEC JTC1/SC1 is developing have the symbol (T) after the definition, indicating that final agreement has not been reached among the participating National Bodies of SC1.

This glossary uses the following cross-reference forms:

- See** Refers the reader to one of two kinds of related information:
- A term that is the expanded form of an abbreviation or acronym. This expanded form of the term contains the full definition.
 - A synonym or more preferred term

See also Refers the reader to one or more related terms.

Contrast with

Refers the reader to a term that has an opposite or substantively different meaning.

Numerics

- 750** A model of the Enterprise Storage Server featuring a 2-way processor with limited physical storage capacity. This model can be updated to the model 800.
- 800** A model of the Enterprise Storage Server featuring a standard processor or an optional Turbo processor. The Model 800 supports RAID 5, RAID 10, and 15000 rpm drives. Model 800 supersedes Model F20.
- 1750** The machine type for the IBM TotalStorage DS6000 series. Models for the DS6000 include the 511 and EX1.
- 2105** The machine number for the IBM TotalStorage Enterprise Storage Server. Models of the Enterprise Storage Server are expressed as the number 2105 followed by "Model <xxx>", such as 2105 Model 800. The 2105 Model 100 is an Enterprise Storage Server expansion enclosure that is typically referred to simply as the Model 100.
- 2107** The machine type for the IBM TotalStorage DS8000 series. Models for the DS8000 series include the base units 921, 922 and 9A2 and expansion units 92E and 9AE.
- 3390** The machine number of an IBM disk storage system. The Enterprise Storage Server, when interfaced to IBM zSeries hosts, is set up to appear as one or more 3390 devices, with a choice of 3390-2, 3390-3, or 3390-9 track formats.
- 3990** The machine number of an IBM control unit.
- 7133** The machine number of an IBM disk storage system. The Model D40 and 020 drawers of the 7133 can be installed in the 2105-100 expansion enclosure of the ESS.

A

access

- 1) To obtain the use of a computer resource.
- 2) In computer security, a specific type of interaction between a subject and an object that results in flow of information from one to the other.

access-any mode

One of the two access modes that can be set for the storage unit during initial configuration. It enables all fibre-channel-attached host systems with no defined access profile to access all logical volumes on the storage unit. With a profile defined in DS Storage Manager for a particular host, that host has access only to volumes that are assigned to the WWPN for that host. See also *pseudo host* and *worldwide port name*.

ACK See *request for acknowledgment and acknowledgment*.

agent A program that automatically performs some service without user intervention or on a regular schedule. See also *subagent*.

alert A message or log that a storage unit generates as the result of error event collection and analysis. An alert indicates that a service action is required.

allegiance

For zSeries, a relationship that is created between a device and one or more channel paths during the processing of certain conditions. See also *implicit allegiance*, *contingent allegiance*, and *reserved allegiance*.

allocated storage

The space that is allocated to volumes but not yet assigned. Contrast with *assigned storage*.

American National Standards Institute (ANSI)

An organization of producers, consumers, and general interest groups that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. (A)

Anonymous

In the DS Storage Manager, the label on an icon that represents all connections that are using fibre-channel adapters

between the storage unit and hosts but are not completely defined to the storage unit. See also *anonymous host*, *pseudo host*, and *access-any mode*.

anonymous host

Synonym for *pseudo host*. Contrast with *Anonymous* and *pseudo host*.

ANSI See *American National Standards Institute*.

APAR See *authorized program analysis report*. (GC)

API See *application programming interface*.

application programming interface

An interface that allows an application program that is written in a high-level language to use specific data or functions of the operating system or another program.

arbitrated loop

A fibre-channel topology that enables the interconnection of a set of nodes. See also *point-to-point connection* and *switched fabric*.

array An ordered collection, or group, of physical devices (disk drive modules) that is used to define logical volumes or devices. In the storage unit, an array is a group of disks that the user designates to be managed by the RAID technique. See also *redundant array of independent disks*.

ASCII (American National Standard Code for Information Interchange) The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), that is used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters. (A) Some organizations, including IBM, have used the parity bit to expand the basic code set.

assigned storage

The space that is allocated to a volume and that is assigned to a port.

authorized program analysis report (APAR)

A request for correction of a defect in a current release of an IBM-supplied program. (GC)

availability

The degree to which a system or resource is capable of performing its normal function. See *data availability*.

B

bay The physical space that is used for installing SCSI, ESCON, and fibre-channel host adapter cards. The DS8000 has four bays, two in each cluster. See also *service boundary*.

bit 1) Either of the digits 0 or 1 when used in the binary numeration system. (T)
2) The storage medium required to store a single binary digit. See also *byte*.

block A string of data elements recorded or transmitted as a unit. The elements may be characters, words, or physical records. (T)

A group of consecutive bytes used as the basic storage unit in fixed-block architecture (FBA). All blocks on the storage device are the same size (fixed size). See also *fixed-block architecture* and *data record*.

byte 1) A group of eight adjacent binary digits that represent one EBCDIC character.
2) The storage medium required to store eight bits. See also *bit*.

C

cache A special-purpose buffer storage, smaller and faster than main storage, used to hold a copy of instructions and data obtained from main storage and likely to be needed next by the processor. (T)

cache fast write

A form of the fast-write operation in which the storage server writes the data directly to cache, where it is available for later destaging.

cache hit

An event that occurs when a read operation is sent to the cluster, and the requested data is found in cache. Contrast with *cache miss*.

cache memory

Memory, typically volatile memory, that a storage server uses to improve access times to instructions or data. The cache

memory is typically smaller and faster than the primary memory or storage medium. In addition to residing in cache memory, the same data also resides on the storage devices in the storage unit.

cache miss

An event that occurs when a read operation is sent to the cluster, but the data is not found in cache. Contrast with *cache hit*.

call home

A communication link established between the DS8000 and a service provider. The DS8000 can use this link to place a call to IBM or to another service provider when it requires service. With access to the machine, service personnel can perform service tasks, such as viewing error logs and problem logs or initiating trace and dump retrievals. See also *heartbeat* and *remote technical assistance information network*.

cascading

1) Connecting network controllers to each other in a succession of levels to concentrate many more lines than a single level permits.

2) In high-availability cluster multiprocessing (HACMP), cascading pertains to a cluster configuration in which the cluster node with the highest priority for a particular resource acquires the resource if the primary node fails. The cluster node relinquishes the resource to the primary node upon reintegration of the primary node into the cluster.

catcher

A server that service personnel use to collect and retain status data that an DS8000 sends to it.

CCR See *channel command retry*.

CCW See *channel command word*.

CD See *compact disc*.

CEC See *computer-electronic complex*.

channel

For zSeries, the part of a channel subsystem that manages a single I/O interface between a channel subsystem and a set of control units.

channel command retry (CCR)

For zSeries, the protocol used between a channel and a control unit that enables the control unit to request that the channel reissue the current command.

channel command word (CCW)

For zSeries, a data structure that specifies an I/O operation to the channel subsystem.

channel path

For zSeries, the interconnection between a channel and its associated control units.

channel subsystem

For zSeries, the part of a host computer that manages I/O communication between the program and any attached control units.

channel-subsystem image

For zSeries, the logical functions that a system requires to perform the function of a channel subsystem. With ESCON multiple image facility (EMIF), one channel subsystem image exists in the channel subsystem for each logical partition (LPAR). Each image appears to be an independent channel subsystem program, but all images share a common set of hardware facilities.

CKD See *count key data*.

CLI See *command-line interface*. See also *Copy Services command-line interface*.

cluster

1) A partition capable of performing all DS8000 functions. With two clusters in the DS8000, any operational cluster can take over the processing of a failing cluster.

2) In the AIX operating system, a group of nodes within a complex.

cluster processor complex (CPC)

The unit within a cluster that provides the management function for the DS8000. It consists of cluster processors, cluster memory, and related logic.

command-line interface (CLI)

An interface provided by an operating system that defines a set of commands and enables a user (or a script-like language) to issue these commands by typing text in response to the command prompt (for example, DOS commands or

UNIX shell commands). See also *Copy Services command-line interface*.

compact disc

An optically read disc, typically storing approximately 660 MB. CD-ROM (compact disc read-only memory) refers to the read-only format used to distribute DS8000 code and documentation.

compression

1) The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

2) Any encoding that reduces the number of bits used to represent a given message or record. (GC)

computer-electronic complex (CEC)

The set of hardware facilities associated with a host computer.

concurrent copy

A facility on a storage server that enables a program to make a backup of a data set while the logical volume remains available for subsequent processing. The data in the backup copy is frozen at the point in time that the server responds to the request.

concurrent installation of licensed internal code Process of installing licensed internal code on a DS8000 while applications continue to run.

concurrent maintenance

Service that is performed on a unit while it is operational.

concurrent media maintenance

Service performed on a disk drive module (DDM) without losing access to the data.

configure

In storage, to define the logical and physical configuration of the input/output (I/O) subsystem through the user interface that the storage unit provides for this function.

consistency group

A group of volumes participating in FlashCopy relationships in a logical subsystem, across logical subsystems, or across multiple storage units that must be kept in a consistent state to ensure data integrity.

consistency group interval time

The value in seconds that indicates the length of time between the formation of consistency groups.

consistent copy

A copy of a data entity (a logical volume, for example) that contains the contents of the entire data entity at a single instant in time.

console

A user interface to a server, for example, the interface provided on a personal computer. See also *IBM TotalStorage Management Console*.

contingent allegiance

For zSeries, a relationship that is created in a control unit between a device and a channel when the channel accepts unit-check status. The allegiance causes the control unit to guarantee access; the control unit does not present the busy status to the device. The allegiance enables the channel to retrieve sense data that is associated with the unit-check status on the channel path associated with the allegiance.

control path

The route that is established from the master storage unit to the subordinate storage unit when more than one storage unit participates in a Global Mirror session. If there is only one storage unit (the master) in the Global Mirror session, no control path is required.

control unit (CU)

- 1) A device that coordinates and controls the operation of one or more input/output devices, and synchronizes the operation of such devices with the operation of the system as a whole.
- 2) For zSeries, a storage server with ESCON or OEMI interfaces. The control unit adapts a native device interface to an I/O interface that a zSeries host system supports.
- 3) The portion of the storage unit that supports the attachment of emulated count key data devices over ESCON, FICON, or OEMI interfaces. See also *cluster*.

control-unit image

For zSeries, a logical subsystem that is

accessed through an ESCON I/O interface. One or more control-unit images exist in each control unit. Each image appears as an independent control unit, but all control-unit images share a common set of hardware facilities. The DS8000 can emulate 3990-3, TPF, 3990-6, or 2105 control units.

control-unit-initiated reconfiguration (CUIR)

A software mechanism that the DS8000 uses to request that an operating system of a zSeries host verify that one or more subsystem resources can be taken offline for service. The DS8000 can use this process to automatically vary channel paths offline and online to facilitate bay service or concurrent code installation. Depending on the operating system, support for this process might be model dependent, might depend on the IBM TotalStorage Enterprise Storage Server Subsystem Device Driver, or might not exist.

Coordinated Universal Time (UTC)

The international standard of time that is kept by atomic clocks around the world.

Copy Services

A collection of optional software features, with a Web-browser interface, used for configuring, managing, and monitoring data-copy functions.

Copy Services CLI

See *Copy Services command-line interface*.

Copy Services client

Software that runs on each DS8000 cluster in the Copy Services server group and that performs the following functions:

- Communicates configuration, status and connectivity information to the Copy Services server
- Performs data-copy functions on behalf of the Copy Services server

Copy Services command-line interface (Copy Services CLI)

The command-line interface software that is provided with DS8000 Copy Services and used for invoking Copy Services functions from host systems attached to the DS8000. See also *command-line interface*.

Copy Services server

A cluster that the Copy Services administrator designates to perform the DS8000 Copy Services functions.

Copy Services server group

A collection of user-designated DS8000 clusters participating in Copy Services functions that a designated, active, Copy Services server manages. A Copy Services server group is also called a Copy Services domain.

count field

The first field of a count key data (CKD) record. This eight-byte field contains a four-byte track address (CCHH). It defines the cylinder and head that are associated with the track, and a one-byte record number (R) that identifies the record on the track. It defines a one-byte key length that specifies the length of the record's key field (0 means no key field). It defines a two-byte data length that specifies the length of the record's data field (0 means no data field). Only the end-of-file record has a data length of zero.

count key data (CKD)

For zSeries, a data-record format employing self-defining record formats in which each record is represented by up to three fields: a *count* field that identifies the record and specifies its format, an optional *key* field that identifies the data area contents, and an optional *data* field that typically contains the user data. For CKD records on the storage unit, the logical volume size is defined in terms of the device emulation mode (3390 or 3380 track format). The count field is always 8 bytes long and contains the lengths of the key and data fields, the key field has a length of 0 to 255 bytes, and the data field has a length of 0 to 65 535 or the maximum that will fit on the track. See also *data record*.

CPC See *cluster processor complex*.

CRC See *cyclic redundancy check*.

CU See *control unit*.

CUIR See *control-unit initiated reconfiguration*.

custom volume

A volume in count-key-data (CKD) format that is not a standard volume, which means that it does not necessarily present

the same number of cylinders and capacity to its assigned logical control unit as provided by one of the following standard zSeries volume types: 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode). See also *count-key-data*, *interleave*, *standard volume*, and *volume*.

CUT See *Coordinated Universal Time*.

cyclic redundancy check (CRC)

A redundancy check in which the check key is generated by a cyclic algorithm. (T)

cylinder

A unit of storage on a CKD device with a fixed number of tracks.

D

DA See *device adapter*. See also *IBM Serial Storage adapter*.

daisy chain

See *serial connection*.

DASD See *direct access storage device*.

DASD fast write (DFW)

A function of a storage server in which active write data is stored in nonvolatile cache, thus avoiding exposure to data loss.

data availability

The degree to which data is available when needed, typically measured as a percentage of time that the system would be capable of responding to any data request (for example, 99.999% available).

data compression

A technique or algorithm used to encode data such that the encoded result can be stored in less space than the original data. The original data can be recovered from the encoded result through a reverse technique or reverse algorithm. See also *compression*.

Data Facility Storage Management Subsystem (DFSMS)

An operating environment that helps automate and centralize the management of storage. To manage storage, DFSMS provides the storage administrator with control over data class, storage class, management class, storage group, and automatic class selection routine definitions.

data field

The optional third field of a count key data (CKD) record. The count field specifies the length of the data field. The data field contains data that the program writes.

data record

The basic unit of zSeries storage on a DS8000, also known as a count-key-data (CKD) record. Data records are stored on a track. The records are sequentially numbered starting with 0. The first record, R0, is typically called the track descriptor record and contains data that the operating system normally uses to manage the track. See also *count-key-data* and *fixed-block architecture*.

data set FlashCopy

For zSeries hosts, a feature of FlashCopy that indicates how many partial volume FlashCopy relationships are active on a volume.

data sharing

The ability of multiple host systems to concurrently utilize data that they store on one or more storage devices. The storage unit enables configured storage to be accessible to any, or all, attached host systems. To use this capability, the host program must be designed to support data that it is sharing.

DDM See *disk drive module*.

DDM group

See *disk pack*.

dedicated storage

Storage within a storage unit that is configured such that a single host system has exclusive access to the storage.

demote

To remove a logical data unit from cache memory. A storage server demotes a data unit to make room for other logical data units in the cache or because the logical data unit is not valid. The storage unit must destage logical data units with active write units before they can be demoted. See also *destage*.

destage

To move data from an online or higher priority to an offline or lower priority

device. The storage unit stages incoming data into cache and then destages it to disk.

device

For zSeries, a disk drive.

device adapter (DA)

A physical component of the DS8000 that provides communication between the clusters and the storage devices. The DS8000 has eight device adapters that it deploys in pairs, one from each cluster. Device adapter pairing enables the DS8000 to access any disk drive from either of two paths, providing fault tolerance and enhanced availability.

device address

For zSeries, the field of an ESCON device-level frame that selects a specific device on a control-unit image.

device ID

The unique two-digit hexadecimal number that identifies the logical device.

device interface card

A physical subunit of a storage cluster that provides the communication with the attached device drive modules.

device number

For zSeries, a four-hexadecimal-character identifier, for example 13A0, that the systems administrator associates with a device to facilitate communication between the program and the host operator. The device number is associated with a subchannel.

device sparing

A subsystem function that automatically copies data from a failing device drive module to a spare device drive module. The subsystem maintains data access during the process.

DFS See *distributed file service*.

DFSMS

See *Data Facility Storage Management Subsystem*.

direct access storage device (DASD)

1) A mass storage medium on which a computer stores data.

2) A disk device.

disk cage

A container for disk drives. Each disk cage supports eight disk packs (64 disks).

disk drive

Standard term for a disk-based nonvolatile storage medium. The DS8000 uses hard disk drives as the primary nonvolatile storage media to store host data.

disk drive module (DDM)

A field replaceable unit that consists of a single disk drive and its associated packaging.

disk drive module group

See *disk pack*.

disk pack

A group of disk drive modules (DDMs) installed as a unit in a DDM bay.

disk group

A collection of 4 disk drives that are connected to the same pair of IBM Serial Storage adapters and can be used to create a RAID array. A disk group can be formatted as count key data or fixed block, and as RAID or non-RAID, or it can be left unformatted. A disk group is a logical assemblage of disk drives. Contrast with *disk pack*.

distributed file service (DFS)

A service that provides data access over IP networks.

DNS See *domain name system*.

domain

1) That part of a computer network in which the data processing resources are under common control.

2) In TCP/IP, the naming system used in hierarchical networks.

3) A Copy Services server group, in other words, the set of clusters the user designates to be managed by a particular Copy Services server.

domain name system (DNS)

In TCP/IP, the server program that supplies name-to-address translation by mapping domain names to internet addresses. The address of a DNS server is the internet address of the server that hosts the DNS software for the network.

dotted decimal notation

A convention used to identify IP

addresses. The notation consists of four 8-bit numbers written in base 10. For example, 9.113.76.250 is an IP address that contains the octets 9, 113, 76, and 250.

drawer

A unit that contains multiple device drive modules and provides power, cooling, and related interconnection logic to make the device drive modules accessible to attached host systems.

drive 1) A peripheral device, especially one that has addressed storage media. See also *disk drive module*.

2) The mechanism used to seek, read, and write information on a storage medium.

DS8000

See *IBM TotalStorage DS8000*.

DS8000 Batch Configuration tool

A program that automatically configures a DS8000. The configuration is based on data that IBM service personnel enter into the program.

DS Storage Manager

See *IBM TotalStorage DS Storage Manager*.

duplex

1) Regarding Copy Services, the state of a volume pair after Remote Mirror and Copy has completed the copy operation and the volume pair is synchronized.

2) In general, pertaining to a communication mode in which data can be sent and received at the same time.

dynamic sparing

The ability of a storage server to move data from a failing disk drive module (DDM) to a spare DDM while maintaining storage functions.

E

E10 The predecessor of the F10 model of the Enterprise Storage Server. See also *F10*.

E20 The predecessor of the F20 model of the Enterprise Storage Server. See also *F20*.

EBCDIC

See *extended binary-coded decimal interchange code*.

EC See *engineering change*.

ECKD See *extended count key data*.

eight pack
See *disk pack*.

electrostatic discharge (ESD)
An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

emergency power off (EPO)
A means of turning off power during an emergency, usually a switch.

EMIF See *ESCON multiple image facility*.

enclosure
A unit that houses the components of a storage subsystem, such as a control unit, disk drives, and power source.

end of file
A coded character recorded on a data medium to indicate the end of the medium. On a count-key-data direct access storage device, the subsystem indicates the end of a file by including a record with a data length of zero.

engineering change (EC)
An update to a machine, part, or program.

Enterprise Systems Architecture/390 (ESA/390)
An IBM architecture for mainframe computers and peripherals. Processor systems that follow the ESA/390 architecture include the ES/9000® family. See also *z/Architecture*.

Enterprise Systems Connection (ESCON)
1) A zSeries computer peripheral interface. The I/O interface uses zSeries logical protocols over a serial interface that configures attached units to a communication fabric.
2) A set of IBM products and services that provide a dynamically connected environment within an enterprise.

EPO See *emergency power off*.

ERDS See *error-recording data set*.

ERP See *error recovery procedure*.

error-recording data set (ERDS)
On zSeries hosts, a data set that records data-storage and data-retrieval errors. A

service information message (SIM) provides the error information for the ERDS.

error recovery procedure (ERP)
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record information on machine malfunctions.

ESA/390
See *Enterprise Systems Architecture/390*.

ESCD See *ESCON director*.

ESCON
See *Enterprise System Connection*.

ESCON channel
A zSeries channel that supports ESCON protocols.

ESCON director (ESCD)
An I/O interface switch that allows the interconnection of multiple ESCON interfaces in a distributed-star topology.

ESCON host systems
zSeries hosts that attach to the DS8000 with an ESCON adapter. Such host systems run on operating systems that include MVS, VSE, TPF, or versions of VM.

ESCON multiple image facility (EMIF)
For zSeries, a function that enables LPARs to share an ESCON channel path by providing each LPAR with its own channel-subsystem image.

EsconNet
In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the ESCON protocol and that is not completely defined on the DS8000. See also *pseudo host* and *access-any mode*.

ESD See *electrostatic discharge*.

eserver
See *IBM e(logo)server*.

ESSNet
See *IBM TotalStorage Enterprise Storage Server Network*.

extended binary-coded decimal interchange code (EBCDIC)
An IBM-developed coding scheme used to represent various alphabetic, numeric, and

special symbols with a coded character set of 256 eight-bit codes.

extended count key data (ECKD)

An extension of the count key data (CKD) architecture.

extent A continuous space on a disk that is occupied by or reserved for a particular data set, data space, or file. The unit of increment is a track. See also *multiple allegiance* and *parallel access volumes*.

extent pool

A groups of extents. See also *extent*.

F

fabric In fibre-channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are said to be *cascaded*.

failback

Pertaining to a cluster recovery from failover following repair. See also *failover*.

failover

Pertaining to the process of transferring all control to a single cluster when the other cluster in the storage unit fails. See also *cluster* and *failback*.

fast write

A write operation at cache speed that does not require immediate transfer of data to a disk drive. The subsystem writes the data directly to cache, to nonvolatile storage, or to both. The data is then available for destaging. A fast-write operation reduces the time an application must wait for the I/O operation to complete.

FBA See *fixed-block architecture*.

FC See *feature code*. **Note:** *FC* is a common abbreviation for fibre channel in the industry, but the DS8000 customer documentation library reserves *FC* for feature code.

FC-AL See *Fibre Channel-Arbitrated Loop*.

FCP See *fibre-channel protocol*.

FCS See *fibre-channel standard*.

feature code (FC)

A code that identifies a particular orderable option and that is used by service personnel to process hardware and software orders. Individual optional features are each identified by a unique feature code.

fibre channel

A data-transmission architecture based on the ANSI Fibre Channel standard, which supports full-duplex communication. The DS8000 supports data transmission over fiber-optic cable through its fibre-channel adapters. See also *fibre-channel protocol* and *fibre-channel standard*.

Fibre Channel-Arbitrated Loop (FC-AL)

An implementation of the Fibre Channel standard that uses a ring topology for the communication fabric. Refer to American National Standards Institute (ANSI) X3T11/93-275. In this topology, two or more fibre-channel end points are interconnected through a looped interface.

fibre-channel connection (FICON)

A fibre-channel communications protocol designed for IBM mainframe computers and peripherals.

fibre-channel protocol (FCP)

A protocol used in fibre-channel communications with five layers that define how fibre-channel ports interact through their physical links to communicate with other ports.

Fibre-Channel standard (FCS)

An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. The protocol has two layers. The IP layer defines basic interconnection protocols. The upper layer supports one or more logical protocols (for example, FCP for SCSI command protocols and SBICON for zSeries command protocols). Refer to American National Standards Institute (ANSI) X3.230-199x. See also *fibre-channel protocol*.

fibre-channel topology

An interconnection topology supported on fibre-channel adapters. See also *point-to-point connection*, *switched fabric*, and *arbitrated loop*.

FICON

See *fibre-channel connection*.

FiconNet

In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the FICON protocol and that is not completely defined on the DS8000. See also *pseudo host* and *access-any mode*.

field replaceable unit (FRU)

An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit might contain other field replaceable units. (GC)

FIFO See *first-in-first-out*.

File Transfer Protocol (FTP)

In TCP/IP, an application protocol used to transfer files to and from host computers. See also *Transmission Control Protocol/Internet Protocol*.

firewall

A protection against unauthorized connection to a computer or a data storage system. The protection is usually in the form of software on a gateway server that grants access to users who meet authorization criteria.

first-in-first-out (FIFO)

A queuing technique in which the next item to be retrieved is the item that has been in the queue for the longest time. (A)

fixed-block architecture (FBA)

An architecture for logical devices that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size). The subsystem can access them independently.

fixed-block device

An architecture for logical devices that specifies the format of the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size); the subsystem can access them independently. This is the required format of the logical data units for host systems that attach with a SCSI or fibre-channel interface. See also *fibre channel* and *small computer systems interface*.

FlashCopy

An optional feature of the DS8000 that can make an instant copy of data, that is, a point-in-time copy of a volume.

FlashCopy relationship

A mapping of a FlashCopy source volume and a FlashCopy target volume that allows a point-in-time copy of the source volume to be copied to the target volume. FlashCopy relationships exist from the time that you initiate a FlashCopy operation until the storage unit copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is persistent.

FRU See *field replaceable unit*.

FTP See *File Transfer Protocol*.

full duplex

See *duplex*.

fuzzy copy

A function of the Global Copy feature wherein modifications to the primary logical volume are performed on the secondary logical volume at a later time. The original order of update is not strictly maintained. See also *Global Copy*.

G

GB See *gigabyte*.

GDPS See *Geographically Dispersed Parallel Sysplex*.

Geographically Dispersed Parallel Sysplex (GDPS)

A zSeries multisite application-availability solution.

gigabyte (GB)

A gigabyte of storage is 10^9 bytes. A gigabyte of memory is 2^{30} bytes.

Global Copy

An optional capability of the DS8000 remote mirror and copy feature that maintains a fuzzy copy of a logical volume on the same DS8000 or on another DS8000. In other words, all modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume at a later point in time. The original order of update is not strictly maintained. See also *Remote Mirror and Copy* and *Metro Mirror*.

Global Mirror

An optional capability of the DS8000 remote mirror and copy feature that provides a 2-site extended distance remote copy. Data that is written by the host to the storage unit at the local site is automatically maintained at the remote site. See also *Metro Mirror* and *Remote Mirror and Copy*.

group In DS8000 documentation, a nickname for two different kinds of groups, depending on the context. See *disk pack* or *Copy Services server group*.

H

HA See *host adapter*.

HACMP

See *High-Availability Cluster Multi-Processing*.

hard disk drive (HDD)

1) A storage medium within a storage server used to maintain information that the storage server requires.

2) A mass storage medium for computers that is typically available as a fixed disk (such as the disks used in system units of personal computers or in drives that are external to a personal computer) or a removable cartridge.

hardware service manager (HSM)

An option on an AS/400 or iSeries host that enables the user to display and work with system hardware resources and to debug input-output processors (IOP), input-output adapters (IOA), and devices.

HCD See *Hardware Configuration Data*.

HDA See *head and disk assembly*.

HDD See *hard disk drive*.

hdisk An AIX term for storage space.

head and disk assembly (HDA)

The portion of an HDD associated with the medium and the read/write head.

heartbeat

A status report sent at regular intervals from the DS8000. The service provider uses this report to monitor the health of the call home process. See also *call home*, *heartbeat call home record*, and *remote technical assistance information network*.

heartbeat call home record

Machine operating and service information sent to a service machine. These records might include such information as feature code information and product logical configuration information.

hierarchical storage management

1) A function in storage management software, such as Tivoli Storage Management or Data Facility Storage Management Subsystem/MVS (DFSMS/MVS), that automatically manages free space based on the policy that the storage administrator sets.

2) In AS/400 storage management, an automatic method to manage and distribute data between the different storage layers, such as disk units and tape library devices.

High-Availability Cluster Multi-Processing (HACMP)

Software that provides host clustering, so that a failure of one host is recovered by moving jobs to other hosts within the cluster.

high-speed link (HSL)

A hardware connectivity architecture that links system processors to system input/output buses and other system units.

home address

A nine-byte field at the beginning of a track that contains information that identifies the physical track and its association with a cylinder.

hop Interswitch connection. A hop count is the number of connections that a particular block of data traverses between source and destination. For example, data traveling from one hub over a wire to another hub traverses one hop.

host See *host system*.

host adapter

A physical subunit of a storage server that provides the ability to attach to one or more host I/O interfaces.

host name

The Internet address of a machine in the network. The host name can be entered in the host definition as the fully qualified domain name of the attached host system, such as *mycomputer.city.company.com*, or

as the subname of the fully qualified domain name, for example, mycomputer. See also *host system*.

host processor

A processor that controls all or part of a user application network. In a network, the processing unit in which the data communication access method resides. See also *host system*.

host system

A computer, either of the mainframe (for example, zSeries) or of the open-systems type, that is connected to the DS8000. zSeries hosts are connected to the DS8000 through ESCON interfaces. Open-systems hosts are connected to the DS8000 by SCSI or fibre-channel interfaces.

hot plug

Pertaining to the ability to add or remove a hardware facility or resource to a unit while power is on.

HSL See *high-speed link*.

HSM See *hierarchical storage management or Hardware Service Manager*.

I

i5/OS The IBM operating system that runs the IBM i5/OS and e(logo)Server i5 server families of servers.

IBM e(logo)server

The IBM brand name for a series of server products that are optimized for e-commerce. The products include the iSeries, pSeries, xSeries, and zSeries.

IBM product engineering (PE)

The third-level of IBM service support. Product engineering is composed of IBM engineers who have experience in supporting a product or who are knowledgeable about the product.

IBM Serial Storage adapter

A physical adapter based on the IBM Serial Storage architecture. IBM Serial Storage adapters connect disk drive modules to DS8000 clusters.

IBM TotalStorage

The brand name used to identify storage products from IBM, including the IBM TotalStorage DS8000. See also *IBM*

TotalStorage DS8000 and IBM TotalStorage DS Storage Manager.

IBM TotalStorage DS8000

A member of the IBM TotalStorage Resiliency Family of storage servers and attached storage devices (disk drive modules). The DS8000 delivers high-performance, fault-tolerant storage and management of enterprise data, affording access through multiple concurrent operating systems and communication protocols. High performance is provided by multiple symmetrical multiprocessors, integrated caching, RAID support for the disk drive modules, and disk access through a high-speed serial storage architecture interface.

IBM TotalStorage DS CLI

The command-line interface (CLI) that is specific to the DS8000.

IBM TotalStorage DS Storage Manager (DS Storage Manager)

Software with a Web-browser interface for configuring the DS8000.

IBM TotalStorage Enterprise Storage Server Network (ESSNet)

A private network providing Web browser access to the Enterprise Storage Server. IBM installs the ESSNet software on an IBM workstation called the IBM TotalStorage ESS Master Console, supplied with the first ESS delivery.

IBM TotalStorage Management Console (MC)

An IBM workstation that acts as the focal point for configuration, Copy Services management, and maintenance for the DS8000. It includes a Web browser that provides links to the user interface, including the DS Storage Manager and the DS8000 Copy Services.

IBM TotalStorage Multipath Subsystem Device Driver (SDD)

Software that is designed to support the multipath configuration environments of the DS8000. The SDD resides in a host system with the native disk device driver.

IBM TotalStorage Resiliency Family

A set of hardware and software features and products, as well as integrated software and services that are available on the IBM TotalStorage DS8000 and the

IBM TotalStorage Enterprise Storage Server, Models 750 and 800.

image See *storage image*.

IML See *initial microcode load*.

implicit allegiance

In Enterprise Systems Architecture/390, a relationship that a control unit creates between a device and a channel path when the device accepts a read or write operation. The control unit guarantees access to the channel program over the set of channel paths that it associates with the allegiance.

initial microcode load (IML)

The action of loading microcode for a computer into that computer's storage.

initial program load (IPL)

The action of loading software into a computer, typically an operating system that controls the computer.

initiator

A SCSI device that communicates with and controls one or more targets. Contrast with *target*.

i-node The internal structure in an AIX operating system that describes the individual files in the operating system. It contains the code, type, location, and owner of a file.

input/output (I/O)

Pertaining to (a) input, output, or both or (b) a device, process, or channel involved in data input, data output, or both.

input/output configuration data set

A configuration definition built by the I/O configuration program (IOCP) and stored on disk files associated with the processor controller.

interleave

To automatically create two striped partitions across the drives in a RAID-5 array, both of which use the count-key-data (CKD) record format.

Internet Protocol (IP)

In the Internet suite of protocols, a protocol without connections that routes data through a network or interconnecting networks and acts as an intermediary between the higher protocol layers and the physical network. The upper layer supports one or more logical protocols (for

example, a SCSI-command protocol and a zSeries command protocol). Refer to ANSI X3.230-199x. The IP acronym is the IP in TCP/IP. See also *Transmission Control Protocol/Internet Protocol*.

invalidate

To remove a logical data unit from cache memory because it cannot support continued access to the logical data unit on the device. This removal might be the result of a failure within the storage server or a storage device that is associated with the device.

I/O See *input/output*.

I/O adapter (IOA)

An input-output adapter on the PCI bus.

IOCDS

See *input/output configuration data set*.

IOCP See *I/O Configuration Program*.

I/O Configuration Program (IOCP)

A program that defines to a system all the available I/O devices and channel paths.

I/O device

An addressable read and write unit, such as a disk drive device, magnetic tape device, or printer.

I/O interface

An interface that enables a host to perform read and write operations with its associated peripheral devices.

I/O Priority Queuing

A facility in the Workload Manager of zSeries that enables the system administrator to set priorities for queueing I/Os from different system images. See also *multiple allegiance* and *parallel access volume*.

I/O processor (IOP)

Controls input-output adapters and other devices.

I/O sequential response time

The time an I/O request is queued in processor memory waiting for previous I/Os to the same volume to complete.

IOSQ See *I/O sequential response time*.

IP See *Internet Protocol*.

IPL See *initial program load*.

iSeries

An IBM e(logo)server product that emphasizes integration. It is the successor to the AS/400 family of servers.

J

Java Virtual Machine (JVM)

A software implementation of a central processing unit (CPU) that runs compiled Java code (applets and applications). (GC)

JVM See *Java Virtual Machine*.

K

KB See *kilobyte*.

key field

The second (optional) field of a count key data record. The key length is specified in the count field. The key length determines the field length. The program writes the data in the key field and uses the key field to identify or locate a given record. The subsystem does not use the key field.

kilobyte (KB)

1) For processor storage, real, and virtual storage, and channel volume, 2^{10} or 1024 bytes.

2) For disk storage capacity and communications volume, 1000 bytes.

Korn shell

Interactive command interpreter and a command programming language.

KPOH See *thousands of power-on hours*.

L

LAN See *local area network*.

last-in first-out (LIFO)

A queuing technique in which the next item to be retrieved is the item most recently placed in the queue. (A)

LBA See *logical block address*.

LCU See *logical control unit*.

least recently used (LRU)

1) The algorithm used to identify and make available the cache space that contains the least-recently used data.

2) A policy for a caching algorithm that chooses to remove from cache the item that has the longest elapsed time since its last access.

LED See *light-emitting diode*.

LMC See *licensed machine code*.

licensed machine code (LMC)

Microcode that IBM does not sell as part of a machine, but licenses to the customer. LMC is implemented in a part of storage that is not addressable by user programs. Some IBM products use it to implement functions as an alternate to hard-wired circuitry.

LIFO See *last-in first-out*.

light-emitting diode (LED)

A semiconductor chip that gives off visible or infrared light when activated.

link address

On an ESCON interface, the portion of a source or destination address in a frame that ESCON uses to route a frame through an ESCON director. ESCON associates the link address with a specific switch port that is on the ESCON director. Equivalently, it associates the link address with the channel subsystem or control unit link-level functions that are attached to the switch port.

link-level facility

The ESCON hardware and logical functions of a control unit or channel subsystem that allow communication over an ESCON write interface and an ESCON read interface.

local area network (LAN)

A computer network located on a user's premises within a limited geographic area.

local e-mail

An e-mail configuration option for storage servers that are connected to a host-system network that does not have a domain name system (DNS) server.

logical address

On an ESCON interface, the portion of a source or destination address in a frame used to select a specific channel-subsystem or control-unit image.

logical block address (LBA)

The address assigned by the DS8000 to a sector of a disk.

logical control unit (LCU)

See *control-unit image*.

logical data unit

A unit of storage that is accessible on a given device.

logical device

The facilities of a storage server (such as the DS8000) associated with the processing of I/O operations directed to a single host-accessible emulated I/O device. The associated storage is referred to as a logical volume. The logical device is mapped to one or more host-addressable units, such as a device on a zSeries I/O interface or a logical unit on a SCSI I/O interface, such that the host initiating I/O operations to the I/O-addressable unit interacts with the storage on the associated logical device.

logical partition (LPAR)

For zSeries, a set of functions that create the programming environment in which more than one logical partition (LPAR) is established on a processor. An LPAR is conceptually similar to a virtual machine environment except that the LPAR is a function of the processor. Also, the LPAR does not depend on an operating system to create the virtual machine environment.

logical path

1) The relationship between a channel image and a control-unit image that designates the physical path to be used for device-level communications between these images. The logical path is established as part of the channel and control-unit initialization procedures by the exchange of link-level frames.

2) With the Remote Mirror and Copy feature, the relationship between a source logical subsystem (LSS) and a target LSS that is created over a physical path through the interconnection fabric that is used for Remote Mirror and Copy functions. An LSS is a primary control unit, which performs the functions of a channel image.

logical subsystem (LSS)

A topological construct that consists of a

group of up to 256 logical devices. A DS8000 can have up to 16 CKD-formatted logical subsystems (4096 CKD logical devices) and also up to 16 fixed-block logical subsystems (4096 fixed-block logical devices). The logical subsystem facilitates configuration of the DS8000 and might have other implications relative to the operation of certain functions. There is a one-to-one mapping between a CKD logical subsystem and a zSeries control-unit image.

For zSeries hosts, a logical subsystem represents a logical control unit (LCU). Each control-unit image is associated with only one logical subsystem. See also *control-unit image*.

logical unit

In open systems, a logical disk drive.

logical unit number (LUN)

In the SCSI protocol, a unique number that is used on a SCSI bus to enable it to differentiate between separate devices, each of which is a logical unit.

logical volume

The storage medium that is associated with a logical disk drive. A logical volume typically resides on one or more storage devices. The DS8000 administrator defines this unit of storage. The logical volume, when residing on a RAID-formatted array, is spread over the drives in the array.

logical volume manager (LVM)

A set of system commands, library routines, and other tools that allow the user to establish and control logical volume storage. The LVM maps data between the logical view of storage space and the physical disk drive module.

longitudinal redundancy check (LRC)

1) A method of error checking during data transfer that involves checking parity on a row of binary digits that are members of a set that forms a matrix. Longitudinal redundancy check is also called a longitudinal parity check.

2) A mechanism that the DS8000 uses for locating errors. The LRC checks the data as it progresses from the host, through the DS8000 controller, into the device adapter, and to the array.

longwave laser adapter

A connector that is used between a host and the DS8000 to support longwave fibre-channel communication.

loop The physical connection between a pair of device adapters in the DS8000. See also *device adapter*.

LPAR See *logical partition*.

LRC See *longitudinal redundancy check*.

LRU See *least recently used*.

LSS See *logical subsystem*.

LUN See *logical unit number*.

LVM See *logical volume manager*.

M**machine level control (MLC)**

A database that contains the EC level and configuration of products in the field.

machine reported product data (MRPD)

Product data gathered by a machine and sent to a destination such as an IBM support server or RETAIN. These records might include such information as feature code information and product logical configuration information.

mainframe

A computer, usually in a computer center, with extensive capabilities and resources to which other computers may be connected so that they can share facilities. (T)

maintenance analysis procedure (MAP)

A hardware maintenance document that gives an IBM service representative a step-by-step procedure for tracing a symptom to the cause of a failure.

management console

See *IBM TotalStorage Management Console*.

Management Information Base (MIB)

1) A collection of objects that can be accessed by means of a network management protocol. (GC)

2) The MIB record conforms to the Open Systems Interconnection (OSI) standard defined by the International Organization for Standardization (ISO) for the exchange of information. See also *simple network management protocol*.

MAP See *maintenance analysis procedure*.

master storage unit

The physical unit that controls the creation of consistency groups in a Global Mirror session. The master storage unit sends commands to subordinate storage units. A storage unit can be a master for only one Global Mirror session. Contrast with *subordinate storage unit*.

maximum consistency group drain time

The value in seconds that indicates the maximum time that writes from the local site are delayed to the remote site while the current consistency group is being formed at the remote site. When this time is exceeded, the current attempt to form a consistency group is ended and another attempt is started. If this time is exceeded five times, this maximum time is ignored on the next attempt to form a consistency group. The default value is the larger of four minutes or two times the consistency group interval time if this value is set to zero.

maximum coordination time

The value in milliseconds that indicates the maximum time that is allowed for host I/O to be delayed during the coordination of the primary volumes of an Global Mirror session. The default is 50 milliseconds if this value is set to zero.

MB See *megabyte*.

MC See *IBM TotalStorage Management Console*.

MCA See *Micro Channel architecture*.

MDM See *Multiple Device Manager*.

mean time between failures (MTBF)

1) A projection of the time that an individual unit remains functional. The time is based on averaging the performance, or projected performance, of a population of statistically independent units. The units operate under a set of conditions or assumptions.

2) For a stated period in the life of a functional unit, the mean value of the lengths of time between consecutive failures under stated conditions. (I) (A)

medium

For a storage unit, the disk surface on which data is stored.

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.

Metro Mirror

A function of a storage server that maintains a consistent copy of a logical volume on the same storage server or on another storage server. All modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume. See also *Remote Mirror and Copy* and *Global Copy*.

MES See *miscellaneous equipment specification*.

MIB See *management information base*.

Micro Channel architecture (MCA)

The rules that define how subsystems and adapters use the Micro Channel bus in a computer. The architecture defines the services that each subsystem can or must provide.

Microsoft Internet Explorer (MSIE)

Web browser software manufactured by Microsoft.

migration

The replacement of a system or subsystem with a different type of system or subsystem, such as replacing a SCSI host adapter with a fibre-channel host adapter. In the context of data migration regarding the DS8000, the transfer of data from one storage unit to another, such as from a 3390 to the DS8000.

MIH See *missing-interrupt handler*.

mirrored pair

Two units that contain the same data. The system refers to them as one entity.

mirroring

In host systems, the process of writing the same data to two disk units within the same auxiliary storage pool at the same time.

miscellaneous equipment specification (MES)

IBM field-installed change to a machine.

missing-interrupt handler (MIH)

An MVS and MVS/XA facility that tracks

I/O interrupts. MIH informs the operator and creates a record whenever an expected interrupt fails to occur before a specified elapsed time is exceeded.

MLC See *machine level control*.

mobile solutions terminal (MoST)

The mobile terminal used by service personnel.

mode conditioning patch cable

A cable that converts a single-mode signal from a longwave adapter into a light signal that is appropriate for multimode fibre. Another mode conditioning patch cable is required at the terminating end of the multimode fibre to convert the signal back to a single-mode signal for a longwave adapter.

Model 100

A 2105 Model 100, often simply referred to as a Mod 100, is an expansion enclosure for the Enterprise Storage Server. See also *2105*.

MoST See *mobile solutions terminal*.

MRPD See *machine reported product data*.

MSA See *multiport serial adapter*.

MSIE See *Microsoft Internet Explorer*.

MTBF See *mean time between failures*.

Multipath Subsystem Device Driver

See *IBM TotalStorage DS8000 Multipath Subsystem Device Driver*.

multiple allegiance

A DS8000 hardware function that is independent of software support. This function enables multiple system images to concurrently access the same logical volume on the DS8000 as long as the system images are accessing different extents. See also *extent* and *parallel access volumes*.

Multiple Device Manager (MDM)

A component of the IBM TotalStorage Productivity Center that allows administrators to configure, manage, and monitor the performance of SAN storage devices from a single console.

multiple relationship FlashCopy

An option of the DS8000 that creates backup copies from one source to multiple

targets by simultaneously establishing multiple FlashCopy relationships.

multiple virtual storage (MVS)

Implies MVS/390, MVS/XA, MVS/ESA, and the MVS element of the zSeries operating system.

multiplex

The action of transmitting simultaneously.

multiport serial adapter (MSA)

An adapter on the IBM TotalStorage Management Console that has multiple ports to which aDS8000 can be attached.

multiprocessor

A computer that includes two or more processors that have common access to a main storage. For the DS8000, the multiprocessors operate in parallel.

MVS See *multiple virtual storage*.

N

name server

A server that stores names of the participating DS8000 clusters.

Netfinity

IBM Intel-processor-based server; predecessor to the IBM xSeries server.

Netscape Navigator

Web browser software manufactured by Netscape.

network manager

A program or group of programs that is used to monitor, manage, and diagnose the problems of a network. (GC)

node The unit that is connected in a fibre-channel network. A DS8000 is a node in a fibre-channel network.

non-RAID

A disk drive set up independently of other disk drives and not set up as part of a disk pack to store data using the redundant array of disks (RAID) data-stripping methodology.

nonremovable medium

A recording medium that cannot be added to or removed from a storage device.

nonvolatile storage (NVS)

Memory that stores active write data to avoid data loss in the event of a power loss.

NVS See *nonvolatile storage*.

O

octet In Internet Protocol addressing, one of the four parts of a 32-bit integer presented in dotted decimal notation. See also *dotted decimal notation*.

OEMI See *original equipment manufacturer's information*.

open system

A system whose characteristics comply with standards made available throughout the industry and that therefore can be connected to other systems complying with the same standards. Applied to the DS8000, such systems are those hosts that connect to the DS8000 through SCSI or FCP protocols. See also *small computer system interface* and *fibre-channel protocol*.

organizationally unique identifier (OUI)

An IEEE-standards number that identifies an organization with a 24-bit globally unique assigned number referenced by various standards. OUI is used in the family of 802 LAN standards, such as Ethernet and Token Ring.

original equipment manufacturer's information (OEMI)

A reference to an IBM guideline for a computer peripheral interface. The interface uses ESA/390 logical protocols over an I/O interface that configures attached units in a multidrop bus topology.

OS/390

The IBM operating system that includes and integrates functions that many IBM software products (including the MVS operating system) previously provided for the IBM S/390 family of enterprise servers.

OUI See *organizationally unique identifier*.

P

panel The formatted display of information that appears on a display screen.

parallel access volume (PAV)

An advanced function of the DS8000 that enables OS/390 and z/OS systems to issue concurrent I/O requests against a count key data logical volume by

associating multiple devices of a single control-unit image with a single logical device. Up to eight device addresses can be assigned to a PAV. The PAV function enables two or more concurrent write operations to the same logical volume, as long as the write operations are not to the same extents. See also *extent*, *I/O Priority Queueing*, and *multiple allegiance*.

parity A data checking scheme used in a computer system to ensure the integrity of the data. The RAID implementation uses parity to re-create data if a disk drive fails.

path group

In zSeries architecture, a set of channel paths that are defined to a control unit as being associated with a single logical partition (LPAR). The channel paths are in a group state and are online to the host. See also *logical partition*.

path group identifier

In zSeries architecture, the identifier that uniquely identifies a given logical partition (LPAR). The path group identifier is used in communication between the LPAR program and a device. The identifier associates the path group with one or more channel paths, thereby defining these paths to the control unit as being associated with the same LPAR. See also *logical partition*.

PAV See *parallel access volume*.

PCI See *peripheral component interconnect*.

PDU See *protocol data unit*.

PE See *IBM product engineering*.

peripheral component interconnect (PCI)

An architecture for a system bus and associated protocols that supports attachments of adapter cards to a system backplane.

persistent FlashCopy

A state where a FlashCopy relationship remains indefinitely until the user deletes it. The relationship between the source and target volumes is maintained after a background copy completes.

physical path

A single path through the I/O interconnection fabric that attaches two units. For Copy Services, this is the path from a host adapter on one DS8000

(through cabling and switches) to a host adapter on another DS8000.

pinned data

Data that is held in cache until either an error condition is corrected and it can be moved to disk storage or until the data is discarded by a host command. Pinned data conditions can only occur on an ESS Model 800 during fast-write or dual-copy functions.

point-in-time copy

A FlashCopy option that creates an instantaneous view of original source data at a specific moment in time.

point-to-point connection

A fibre-channel topology that enables the direct interconnection of ports. See also *arbitrated loop* and *switched fabric*.

port

A physical connection on a host adapter to the cable that connects the DS8000 to hosts, switches, or another DS8000. The DS8000 uses SCSI and ESCON host adapters that have two ports per adapter, and fibre-channel host adapters that have one port. See also *ESCON*, *fibre channel*, *host adapter*, and *small computer system interface*.

POST See *power-on self test*.

power-on self test (POST)

A diagnostic test that servers or computers run when they are turned on.

predictable write

A write operation that can cache without knowledge of the existing format on the medium. All write operations on FBA DASD devices are predictable. On CKD DASD devices, a write operation is predictable if it does a format write operation for the first data record on the track.

primary control unit

The DS8000 to which a Remote Mirror and Copy primary device is physically attached.

processor complex

A partition of a storage server that is capable of performing all defined functions of the storage server. Multiple processor complexes provide redundancy.

product engineering

See *IBM product engineering*.

program

On a computer, a generic term for software that controls the operation of the computer. Typically, the program is a logical assemblage of software modules that perform multiple related tasks.

program-controlled interruption

An interruption that occurs when an I/O channel fetches a channel command word with the program-controlled interruption flag on.

program temporary fix (PTF)

A temporary solution to, or bypass of, a problem diagnosed by IBM as the result of a defect in a current unaltered release of a licensed program. (GC)

promote

To add a logical data unit to cache memory.

protected volume

In AS/400, a disk storage device that is protected from data loss by RAID techniques. An AS/400 host does not mirror a volume configured as a protected volume, while it does mirror all volumes configured as unprotected volumes. The DS8000, however, can be configured to indicate that an AS/400 volume is protected or unprotected and give it RAID protection in either case.

protocol data unit (PDU)

A unit of data specified in the protocol of a given layer and consisting of protocol control information for the layer and, possibly, user data for the layer.

pSeries

The product name of an IBM e(logo)server product that emphasizes performance. It is the successor to the RS/6000 family of servers.

pseudo host

A host connection that is not explicitly defined to the DS8000 and that has access to at least one volume that is configured on the DS8000. The FiconNet pseudo host icon represents the FICON protocol. The EsconNet pseudo host icon represents the ESCON protocol. The pseudo host icon labelled Anonymous represents hosts connected through the FCP protocol. *Anonymous host* is a commonly used synonym for *pseudo host*.

The DS8000 adds a pseudo host icon only when it is set to access-any mode. See also *access-any mode*.

PTF See *program temporary fix*.

PV Links

Short for Physical Volume Links, an alternate pathing solution from Hewlett-Packard that provides for multiple paths to a volume, as well as static load balancing.

R

R0 See *track-descriptor record*.

rack See *enclosure*.

RAID See *redundant array of independent disks*. RAID is also commonly expanded to redundant array of *inexpensive* disks. See also *array*.

RAID 5

A type of RAID that optimizes cost-effective performance while emphasizing use of available capacity through data striping. RAID 5 provides fault tolerance for up to two failed disk drives by distributing parity across all the drives in the array plus one parity disk drive. The DS8000 automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 10*, and *redundant array of independent disks*.

RAID 10

A type of RAID that optimizes high performance while maintaining fault tolerance for up to two failed disk drives by striping volume data across several disk drives and mirroring the first set of disk drives on an identical set. The DS8000 automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 5*, and *redundant array of independent disks*.

random access

A mode of accessing data on a medium in a manner that requires the storage device to access nonconsecutive storage locations on the medium.

rank See *array*.

redundant array of independent disks (RAID)

A methodology of grouping disk drives for

managing disk storage to insulate data from a failing disk drive.

refresh FlashCopy target volume

An option (previously called *incremental FlashCopy*) of the DS8000 that creates a point-in-time data copy without copying an entire volume for each point-in-time copy.

Remote Mirror and Copy

A feature of a storage server that constantly updates a secondary copy of a logical volume to match changes made to a primary logical volume. The primary and secondary volumes can be on the same storage server or on separate storage servers. See also *Global Mirror*, *Metro Mirror* and *Global Copy*.

remote technical assistance information network (RETAIN)

The initial service tracking system for IBM service support, which captures heartbeat and call-home records. See also *support catcher* and *support catcher telephone number*.

REQ/ACK

See *request for acknowledgment and acknowledgment*.

request for acknowledgment and acknowledgment (REQ/ACK)

A cycle of communication between two data transport devices for the purpose of verifying the connection, which starts with a request for acknowledgment from one of the devices and ends with an acknowledgment from the second device. The REQ and ACK signals help to provide uniform timing to support synchronous data transfer between an initiator and a target. The objective of a synchronous data transfer method is to minimize the effect of device and cable delays.

reserved allegiance

For zSeries, a relationship that is created in a control unit between a device and a channel path, or path group, when the device completes a Sense Reserve command. The allegiance causes the control unit to guarantee access (that is, busy status is not presented) to the device. Access is over the set of channel paths that are associated with the allegiance; access is for one or more channel programs until the allegiance ends.

RETAIN

See *remote technical assistance information network*.

S

S/390 IBM enterprise servers based on Enterprise Systems Architecture/390 (ESA/390). *S/390* is the currently accepted shortened form of the original name *System/390*.

S/390 storage

Storage arrays and logical volumes that are defined as connected to S/390 servers. This term is synonymous with count-key-data storage.

SAID See *system adapter identification number*.

SAM See *sequential access method*.

SAN See *storage area network*.

SBCON

See *Single-Byte Command Code Sets Connection*.

screen

The physical surface of a display device upon which information is shown to users.

SCSI See *small computer system interface*.

SCSI device

A disk drive connected to a host through an I/O interface using the SCSI protocol. A SCSI device is either an initiator or a target. See also *initiator* and *small computer system interface*.

SCSI-FCP

Synonym for fibre-channel protocol, a protocol used to transport data between an open-systems host and a fibre-channel adapter on an DS8000. See also *fibre-channel protocol* and *small computer system interface*.

SCSI host systems

Host systems that are attached to the DS8000 with a SCSI interface. Such host systems run on UNIX, i5/OS, Windows NT, Windows 2000, or Novell NetWare operating systems.

SCSI ID

A unique identifier assigned to a SCSI device that is used in protocols on the SCSI interface to identify or select the device. The number of data bits on the SCSI bus determines the number of

available SCSI IDs. A wide interface has 16 bits, with 16 possible IDs.

SDD See *IBM Subsystem Multipathing Device Driver*.

secondary control unit

The DS8000 to which a Remote Mirror and Copy secondary device is physically attached.

self-timed interface (STI)

An interface that has one or more conductors that transmit information serially between two interconnected units without requiring any clock signals to recover the data. The interface performs clock recovery independently on each serial data stream and uses information in the data stream to determine character boundaries and inter-conductor synchronization.

sequential access

A mode of accessing data on a medium in a manner that requires the storage device to access consecutive storage locations on the medium.

sequential access method (SAM)

An access method for storing, deleting, or retrieving data in a continuous sequence based on the logical order of the records in the file.

serial connection

A method of device interconnection for determining interrupt priority by connecting the interrupt sources serially.

server A host that provides certain services to other hosts that are referred to as clients.

A functional unit that provides services to one or more clients over a network. (GC)

service boundary

A category that identifies a group of components that are unavailable for use when one of the components of the group is being serviced. Service boundaries are provided on the DS8000, for example, in each host bay and in each cluster.

service clearance

The area that is required to open the service covers and to pull out components for servicing.

service information message (SIM)

A message sent by a storage server to service personnel through an zSeries operating system.

service personnel

A generalization referring to individuals or companies authorized to service the DS8000. The terms *service provider*, *service representative*, and *IBM service support representative (SSR)* refer to types of service personnel. See also *service support representative*.

service processor

A dedicated processing unit that is used to service a storage unit.

service support representative (SSR)

Individuals or a company authorized to service the DS8000. This term also refers to a service provider, a service representative, or an IBM service support representative (SSR). An IBM SSR installs the DS8000.

SES SCSI Enclosure Services.

session

A collection of volumes within a logical subsystem that are managed together during the creation of consistent copies of data. All volumes in a session must transfer their data successfully to the remote site before the increment can be called complete.

SFP Small form factor pluggables.

shared storage

Storage that is configured so that multiple hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must have a common model for the information on a storage device. The programs must be designed to handle the effects of concurrent access.

shortwave laser adapter

A connector that is used between host and DS8000 to support shortwave fibre-channel communication.

SIM See *service information message*.

Simple Network Management Protocol (SNMP)

In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks.

SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB). (GC) See also *management information base*.

simplex volume

A volume that is not part of a FlashCopy, XRC, or PPRC volume pair.

Single-Byte Command Code Sets Connection (SBCON)

The ANSI standard for the ESCON I/O interface.

small computer system interface (SCSI)

A standard hardware interface that enables a variety of peripheral devices to communicate with one another. (GC)

smart relay host

A mail relay or mail gateway that has the capability to correct e-mail addressing problems.

SMIT See *System Management Interface Tool*.

SMP See *symmetrical multiprocessor*.

SNMP See *Simple Network Management Protocol*.

SNMP agent

A server process that resides on a network node and is responsible for communicating with managers regarding that node. The node is represented as a managed object, which has various fields or variables that are defined in the appropriate MIB.

SNMP manager

A managing system that runs a managing application or suite of applications. These applications depend on Management Information Base (MIB) objects for information that resides on the managed system. Managers generate requests for this MIB information, and an SNMP agent on the managed system responds to these requests. A request can either be the retrieval or modification of MIB information.

software transparency

Criteria applied to a processing environment that states that changes do not require modifications to the host software in order to continue to provide an existing function.

source device

One of the devices in a dual-copy or remote-copy volume pair. All channel commands to the logical volume are directed to the source device. The data on the source device is duplicated on the target device. See also *target device*.

spare

A disk drive on the DS8000 that can replace a failed disk drive. A spare can be predesignated to allow automatic dynamic sparing. Any data preexisting on a disk drive that is invoked as a spare is destroyed by the dynamic sparing copy process.

spatial reuse

A feature of serial storage architecture that enables a device adapter loop to support many simultaneous read/write operations. See also *serial storage architecture*.

SSID See *subsystem identifier*.

SSR See *service support representative*.

stacked status

For zSeries, the condition when the control unit is in a holding status for the channel, and the last time the control unit attempted to present the status, the channel responded with the stack-status control.

stage operation

The operation of reading data from the physical disk drive into the cache.

staging

To move data from an offline or low-priority device back to an online or higher priority device, usually on demand of the system or on request of the user.

standard volume

A volume that emulates one of several zSeries volume types, including 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode), by presenting the same number of cylinders and capacity to the host as provided by the native zSeries volume type of the same name.

STI See *self-timed interface*.

storage area network

A network that connects a company's heterogeneous storage resources.

storage capacity

The amount of data that a storage medium can hold; usually expressed in kilobytes, megabytes, or gigabytes.

storage complex

A configuration of one or more storage units that is managed by a management console.

storage device

A physical unit that provides a mechanism to store data on a given medium such that it can be subsequently retrieved. See also *disk drive module*.

storage extent

The minimum contiguous range of storage on a physical storage device, array, or rank that can be allocated to a local volume

storage image

A partitioning of a storage unit that provides emulation of a storage server with one or most storage devices that provides storage capability to a host computer. You can configure more than one storage image on a storage unit.

storage server

A physical unit that manages attached storage devices and provides an interface between them and a host computer by providing the function of one or more logical subsystems. The storage server can provide functions that the storage device does not provide. The storage server has one or more clusters.

storage unit

A physical unit that consists of a storage server that is integrated with one or more storage devices that provide storage capability to a host computer.

storage unit identifier

A unique identifier for a storage unit that consists of a manufacturer, a model number, a type number, a plant of manufacture, and a sequence number.

striping

A technique that distributes data in bit, byte, multibyte, record, or block increments across multiple disk drives.

subagent

An extension to an SNMP agent that permits a user to dynamically add, or in

some cases replace, additional management variables in the local MIB, thereby providing a means of extending the range of information that network managers can access. See also *agent*.

subchannel

A logical function of a channel subsystem associated with the management of a single device.

subordinate storage unit

The physical unit that receives commands from the master storage unit and is specified when a Global Mirror session is started. The subordinate storage unit forms consistency groups and performs other Global Mirror processing. A subordinate storage unit can be controlled by only one master storage unit. Contrast with *master storage unit*.

subsystem identifier (SSID)

A number that uniquely identifies a logical subsystem within a computer installation.

support catcher

See *catcher*.

support catcher telephone number

The telephone number that connects the support catcher server to the DS8000 to receive a trace or dump package. See also *support catcher* and *remote technical assistance information network*.

switched fabric

A fibre-channel topology in which ports are interconnected through a switch. Fabric switches can also be interconnected to support numerous ports on a single network. See also *arbitrated loop* and *point-to-point connection*.

symmetrical multiprocessor (SMP)

An implementation of a multiprocessor computer consisting of several identical processors configured in a way that any subset of the set of processors is capable of continuing the operation of the computer. The DS8000 contains four processors set up in SMP mode.

synchronous write

A write operation whose completion is indicated after the data has been stored on a storage device.

System/390

See *S/390*.

system adapter identification number (SAID)

The unique identification number that is automatically assigned to each DS8000 host adapter for use by Copy Services.

System Management Interface Tool (SMIT)

An interface tool of the AIX operating system for installing, maintaining, configuring, and diagnosing tasks.

System Modification Program

A program used to install software and software changes on MVS systems.

T

TAP See *Telocator Alphanumeric Protocol*.

target A SCSI device that acts as a subordinate to an initiator and consists of a set of one or more logical units, each with an assigned logical unit number (LUN). The logical units on the target are typically I/O devices. A SCSI target is analogous to a zSeries control unit. See also *small computer system interface*.

target device

One of the devices in a dual-copy or remote-copy volume pair that contains a duplicate of the data that is on the source device. Unlike the source device, the target device might only accept a limited subset of data. See also *source device*.

TB See *terabyte*.

TCP/IP

See *Transmission Control Protocol/Internet Protocol*.

Telocator Alphanumeric Protocol (TAP)

An industry standard protocol for the input of paging requests.

terabyte (TB)

- 1) Nominally, 1 000 000 000 000 bytes, which is accurate when speaking of bandwidth and disk storage capacity.
- 2) For DS8000 cache memory, processor storage, real and virtual storage, a terabyte refers to 2^{40} or 1 099 511 627 776 bytes.

terminal emulator

A function of the management console that allows it to emulate a terminal.

thousands of power-on hours (KPOH)

A unit of time used to measure the mean time between failures (MTBF).

time sharing option (TSO)

An operating system option that provides interactive time sharing from remote terminals.

TotalStorage

See *IBM TotalStorage*.

TPF See *transaction processing facility*.

track A unit of storage on a CKD device that can be formatted to contain a number of data records. See also *home address*, *track-descriptor record*, and *data record*.

track-descriptor record (R0)

A special record on a track that follows the home address. The control program uses it to maintain certain information about the track. The record has a count field with a key length of zero, a data length of 8, and a record number of 0. This record is sometimes referred to as R0.

transaction processing facility (TPF)

A high-availability, high-performance IBM operating system, designed to support real-time, transaction-driven applications. The specialized architecture of TPF is intended to optimize system efficiency, reliability, and responsiveness for data communication and database processing. TPF provides real-time inquiry and updates to a large, centralized database, where message length is relatively short in both directions, and response time is generally less than three seconds. Formerly known as the Airline Control Program/Transaction Processing Facility (ACP/TPF).

Transmission Control Protocol (TCP)

A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP)

- 1) A combination of data-transmission protocols that provide end-to-end connections between applications over interconnected networks of different types.

2) A suite of transport and application protocols that run over the Internet Protocol. (GC) See also *Internet Protocol* and *Transmission Control Protocol*.

transparency

See *software transparency*.

TSO See *time sharing option*.

turbo processor

A faster multiprocessor that has six processors with common access to the main storage.

U

UFS UNIX filing system.

Ultra-SCSI

An enhanced small computer system interface.

unconfigure

To delete the configuration.

unit address

For zSeries, the address associated with a device on a given control unit. On ESCON interfaces, the unit address is the same as the device address. On OEMI interfaces, the unit address specifies a control unit and device pair on the interface.

unprotected volume

An AS/400 term that indicates that the AS/400 host recognizes the volume as an unprotected device, even though the storage resides on a RAID-formatted array and is, therefore, fault tolerant by definition. The data in an unprotected volume can be mirrored. Also referred to as an *unprotected device*.

upper-layer protocol

The layer of the Internet Protocol (IP) that supports one or more logical protocols (for example, a SCSI-command protocol and an ESA/390 command protocol). Refer to ANSI X3.230-199x.

UTC See *Coordinated Universal Time*.

V

virtual machine facility

A virtual data processing machine that appears to the user to be for the exclusive use of that user, but whose functions are accomplished by sharing the resources of

a shared data processing system. An alternate name for the VM/370 IBM operating system.

vital product data (VPD)

Information that uniquely defines the system, hardware, software, and microcode elements of a processing system.

VM

The root name of several IBM operating systems, such as VM/XA, VM/ESA, VM/CMS, and z/VM. See also *virtual machine facility*.

volume

For zSeries, the information recorded on a single unit of recording medium. Indirectly, it can refer to the unit of recording medium itself. On a nonremovable-medium storage device, the term can also indirectly refer to the storage device associated with the volume. When multiple volumes are stored on a single storage medium transparently to the program, the volumes can be referred to as logical volumes.

volume group

A collection of either physical or logical volumes.

volume label

A unique identifier that a user assigns to a logical volume.

VPD See *vital product data*.

VSE/ESA

An IBM operating system, the letters of which represent virtual storage extended/enterprise systems architecture.

W

weight distribution area

The area that is required to distribute the weight of the storage unit.

worldwide node name (WWNN)

A unique 64-bit identifier for a host that contains a fibre-channel port. See also *worldwide port name*.

worldwide port name (WWPN)

A unique 64-bit identifier associated with a fibre-channel adapter port. It is assigned in an implementation- and protocol-independent manner. See also *worldwide node name*

write hit

A write operation in which the requested data is in the cache.

write penalty

The performance impact of a classical RAID-5 write operation.

WWNN

See *worldwide node name*.

WWPN

See *worldwide port name*.

X**xSeries**

The product name of an IBM e(logo)server product that emphasizes industry-standard server scalability and self-managing server technologies. It is the successor to the Netfinity family of servers.

Z**z/Architecture**

An IBM architecture for mainframe computers and peripherals. The IBM e(logo)server zSeries family of servers uses the z/Architecture architecture. It is the successor to the S/390 and 9672 family of servers. See also *iSeries*.

z/OS An operating system for the IBM e(logo)server product line that supports 64-bit real storage.

z/OS Global Mirror

A function of a storage server that assists a control program to maintain a consistent copy of a logical volume on another storage unit. All modifications of the primary logical volume by any attached host are presented in order to a single host. The host then makes these modifications on the secondary logical volume. This function was formerly called extended remote copy or XRC.

zSeries

An IBM e(logo)server family of servers that emphasizes near-zero downtime.

IBM enterprise servers based on z/Architecture.

zSeries storage

Storage arrays and logical volumes that are defined in the DS8000 as connected to zSeries servers.

Index

A

- about this guide
 - notational conventions 99
- accessibility features 165
 - keyboard 165
 - shortcut keys 165
- adapters
 - attaching to open-systems host 12
- address subcommand 110, 111
- adduser subcommand 105
- AIX
 - configuring CIM agent 43
 - configuring for unsecure mode 46
 - installation
 - graphical mode 32
 - unattended mode 40
 - installation overview 31
 - installing the CIM agent in graphical mode 32
 - installing the CIM agent in unattended mode 40
 - mounting the CD 31
 - removing the CIM agent 48, 49, 51, 70, 73
 - running the CIM agent 46
 - verifying installation 42
- anatomy of a command line 101
- API, DS Open 9
- arrays
 - across loops 15
 - across loops overview 15
- arrays across loops 15
- association, DS Open API 123
- AssociatorNames method parameters 131
- Associators method parameters 130
- availability features 10

C

- CD, mounting 31
- chess subcommand 112
- chessserver subcommand 114
- chuser subcommand 106
- CIM agent
 - class information 141
 - communication concepts 125
 - components 27
 - configuration on AIX 43
 - configuration on Linux 64
 - configuration on Windows 85
 - configuration programs 102, 103
 - configuring for unsecure mode on AIX 46
 - configuring for unsecure mode on Linux 67
 - configuring for unsecure mode on Windows 88
 - functional groups 135
 - installation overview 29
 - installation overview for AIX 31
 - installation overview for Linux 53
 - installation overview for Windows 75
 - installation requirements 28

- CIM agent (*continued*)
 - installing on AIX in graphical mode 32
 - installing on AIX in unattended mode 40
 - installing on Linux in graphical mode 53
 - installing on Linux in unattended mode 61
 - installing on Windows in graphical mode 75
 - installing on Windows in silent mode 82
 - installing on Windows in unattended mode 82
 - intrinsic and extrinsic communication methods 125
 - invoking 99
 - mounting the CD on AIX 31
 - overview 25
 - product overview 25
 - quick reference for class definitions 141
 - removing from AIX 48, 49, 51, 73
 - removing from Linux 69, 70
 - removing from Windows 92
 - running on AIX 46
 - running on Linux 67
 - security 30
 - verifying connection to the ESS 88
 - verifying installation on AIX 42
 - verifying installation on Linux 63
 - verifying installation on Windows 84
- CIM Agent
 - communication with the DS Open API 125
- CIM agent communication methods 125
- CIM API communication methods
 - AssociatorNames 131
 - Associators 130
 - CreateInstance 127
 - DeleteInstance 127
 - DeleteQualifier 135
 - Enumerate 128
 - EnumerateClass 129
 - EnumerateInstanceNames 130
 - EnumerateInstances 129
 - EnumerateQualifiers 135
 - error codes 136
 - ExecQuery 130
 - GetClass 126
 - GetInstance 126
 - GetProperty 133
 - GetQualifierGet 134
 - ModifyInstance 128
 - ReferenceNames 133
 - References 132
 - SetProperty 134
 - SetQualifier 134
- CIM component definitions
 - namespace 123
 - object name 123
- CIM component definitions core classes 123
- CIM overview 27
- CIMOM operations
 - client communication 125
 - intrinsic and extrinsic methods 125
- class information, CIM agent 141

- class, DS Open API 123
- command line string 101
- command-line interface 9
- commands
 - example of a typical command line string 101
 - interactive mode 99
 - mkcertificate 119
 - operational 102, 118
 - setdevice 109
 - setentry 108
 - setoutput 109
 - setuser 104
 - shell mode 99
 - slpd 120
 - startcimom 118
 - stopcimom 118
 - utility 119
 - verifyconfig 120
- comparing
 - Copy Services
 - features 20
- configuration
 - AIX 43
 - Linux 64
 - unsecure mode on AIX 46
 - unsecure mode on Linux 67
 - unsecure mode on Windows 88
 - Windows 85
- Copy Services
 - disaster recovery 19
 - feature comparison 20
 - functions of 16
 - monitoring 16
 - overview 16
- core classes, CIM 123
- CreateInstance method parameters 127

D

- data migration
 - selecting method 23
- DeleteInstance method parameters 127
- disaster recovery
 - using Copy Services 19
- DS command-line interface 9
- DS Open API 9
 - overview 25
- DS Open API class definitions
 - quick reference 141
- DS Open API component definitions
 - elements 123
- DS Storage Manager 9
- DS8000 series
 - Model 921 1
 - Model 922 1
 - Model 92E 1
 - Model 9A2 1
 - Model 9AE 1
- DS8100 1
- DS8300 1

E

- elements, DS Open API 123
- emphasis 101
- EnumerateClasses method parameters 128
- EnumerateInstanceNames method parameters 130
- EnumerateInstances method parameters 129
- EnumerateQualifiers method 135
- error codes returned by the CIMOM 136
- error codes returned by the Volume Shadow Copy and Virtual Disk Services 162
- ESCON
 - host systems 13
- ExecQuery method parameters 130

F

- fibre channel
 - adapters 12
- fibre-channel
 - host systems 12
- FICON
 - host systems 14
- FlashCopy
 - overview 18
- functional groups 135

G

- GetClassGetClass method parameters 126
- GetInstance method parameters 126
- GetProperty method parameters 133
- guidelines for invoking the CIM agent 99

H

- host systems
 - fibre channel 12
 - S/390 and zSeries 13
 - supported by the storage unit 11

I

- indication, DS Open API 123
- installation
 - AIX
 - graphical mode 32
 - unattended mode 40
 - graphical mode on AIX 32
 - graphical mode on Windows 75
 - Linux
 - graphical mode 53
 - mounting the CD on AIX 31
 - overview for AIX 31
 - overview for Linux 53
 - overview for Windows 75
 - silent mode on Windows 82
 - unattended mode on AIX 40
 - unattended mode on Linux 61
 - unattended mode on Windows 82
 - verifying on AIX 42

- installation (*continued*)
 - verifying on Linux 63
 - verifying on Windows 84
 - Volume Shadow Copy and Virtual Disk Services prerequisites 152
 - Windows prerequisites 29
- installation overview 29
- installation prerequisites 28
- invoking the CIM agent 99

L

- Linux
 - configuring CIM agent 64
 - configuring for unsecure mode 67
 - installation
 - graphical mode 53
 - installation overview 53
 - installing the CIM agent in graphical mode 53
 - installing the CIM agent in unattended mode 61
 - removing the CIM agent 69
 - running the CIM agent 67
 - verifying installation 63
- logs
 - uninstall 52, 74
- lsess subcommand 115
- lsessserver subcommand 115
- lsuser subcommand 107

M

- management console
 - multiple units 11
 - overview 11
- method, DS Open API 123
- migrating data
 - selecting method 23
- MIH (missing-interrupt handler) setting 13
- missing-interrupt handler (MIH) setting 13
- mkcertificate command 119
- modifyconfig subcommand 121
- ModifyInstance method parameters 128
- mounting the CD on AIX 31
- Multiple Device Manager (MDM), Copy Services 16

N

- NamesEnumerateClassNames method
 - parameters 129
- namespace, CIM 123
- notational conventions
 - emphasis 101
 - special characters 101

O

- object name, CIM 123

- open-systems
 - hosts
 - fibre-channel 12
- operational commands 102, 118
- overview
 - Copy Services
 - monitor 16
 - Multiple Device Manager (MDM) 16
 - FlashCopy 18

P

- physical configuration
 - I/O enclosures 1
- physical configuration
 - battery assemblies 1
 - device adapters 1
 - disk enclosures 1
 - host adapters 1
 - management consoles 1
 - power line disturbance (PLD) 1
- prerequisites 28
 - Volume Shadow Copy and Virtual Disk Services 152
 - Windows 29
- processors 1
- property, DS Open API 123

Q

- Qualifier method parameters 134
- qualifier, DS Open API 123
- quick reference table, class definitions 141

R

- RAID
 - RAID 10 overview 15
 - RAID 5 overview 15
 - RAID overview 15
- reference, DS Open API 123
- ReferenceNames method parameters 133
- References method parameters 132
- removing the CIM agent
 - AIX 48, 49, 51, 73
 - Linux 69, 70
 - Windows 92
- rmess subcommand 116
- rmessserver subcommand 117
- rmuser subcommand 107
- running the CIM agent
 - on AIX 46
 - on Linux 67

S

- S/390
 - host systems 14
- S/390 and zSeries
 - host systems 13

- S/390 and zSeries *(continued)*
 - operating system 13
- schema, DS Open API 123
- setdevice command 109
- setentry command 108
- setoutput command 109
- SetProperty method parameters 134
- SetQualifier method parameters 134
- setuser command 104
- setuser subcommand 105
- silent installation on Windows 82
- slpd command 120
- software
 - S/390 and zSeries 13
- special characters 101
- startcimom command 118
- stopcimom command 118
- storage unit
 - host systems supported by 11
- subcommands
 - address 110, 111
 - adduser 105
 - chess 112
 - chessserver 114
 - chuser 106
 - lssess 115
 - lssessserver 115
 - lsuser 107
 - modifyconfig 121
 - rmess 116
 - rmessserver 117
 - rmuser 107
 - setuser 105
- systems
 - S/390 and zSeries host 13

T

- Trademarks 169

U

- unattended installation on Windows 82
- utility commands 119

V

- verifyconfig command 120
- verifying connection to the ESS
 - on Windows 88
- verifying installation
 - AIX 42
 - Linux 63
 - Windows 84
- Virtual Disk Services
 - prerequisites 152
- Volume Shadow Copy
 - prerequisites 152
- Volume Shadow Copy and Virtual Disk Services
 - error codes 162

- Volume Shadow Copy Services
 - installation requirements 152

W

- Windows
 - configuring CIM agent 85
 - configuring for unsecure mode 88
 - installation overview 75
 - installing the CIM agent in graphical mode 75
 - installing the CIM agent in silent mode 82
 - installing the CIM agent in unattended mode 82
 - prerequisites 29
 - removing the CIM agent 92
 - verifying connection to the ESS 88
 - verifying installation 84

Z

- zSeries
 - host systems 14
 - See S/390 and zSeries 13

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

IBM TotalStorage
DS Open Application Programming Interface Reference

Publication No. GC35-0493-03

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

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	<input type="checkbox"/>				

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

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Accurate	<input type="checkbox"/>				
Complete	<input type="checkbox"/>				
Easy to find	<input type="checkbox"/>				
Easy to understand	<input type="checkbox"/>				
Well organized	<input type="checkbox"/>				
Applicable to your tasks	<input type="checkbox"/>				

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.



Fold and Tape

Please do not staple

Fold and Tape



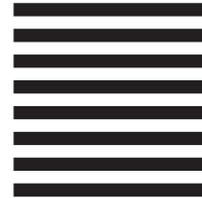
NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

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

POSTAGE WILL BE PAID BY ADDRESSEE

International Business Machines Corporation
Information Development
Department 61C
9032 South Rita Road
Tucson, AZ 85775-4401



Fold and Tape

Please do not staple

Fold and Tape



Printed in USA

GC35-0493-03



Spine information:



IBM TotalStorage

DS Open API Reference