

IBM TotalStorage FASSt Storage Manager Version 8.3



# Installation and Support Guide for Microsoft Windows NT and Windows 2000

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IBM TotalStorage FAStT Storage Manager Version 8.3



# Installation and Support Guide for Microsoft Windows NT and Windows 2000

**Note:**

Before using this information and the product it supports, be sure to read the general information in "Notices" on page 91.

**Second Edition (March 2003)**

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## About this document

This document provides information about how to plan, install, configure, and work with IBM® Fibre Array Storage Technology (FAStT) Storage Manager version 8.3 in a Microsoft® Windows NT® 4.0 or Windows® 2000 operating system environment. This guide is for system administrators. Use this guide to:

- Determine the hardware and software that you will require to install the storage-management software.
- Integrate the necessary hardware components into your network.
- Install the FAStT Storage Manager software.
- Upgrade controller firmware, if necessary.
- Identify storage-management features that are unique to your installation.

**Note:** Throughout this document, Storage Manager version 8.3 refers to software levels 8.30 or higher.

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## Who should read this document

This document is intended for system administrators and storage administrators who are responsible for installing software. Readers should have knowledge of RAID, SCSI, and Fibre Channel technology, and should also have working knowledge of the applicable operating systems that are used with the management software.

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## FAStT installation process overview

The following flow chart gives an overview of the installation process for the FAStT hardware and the FAStT Storage Manager software. Lined arrows in the flow chart indicate consecutive steps in the hardware and software installation process. Labeled arrows indicate which current documents provide detailed information about

those steps.

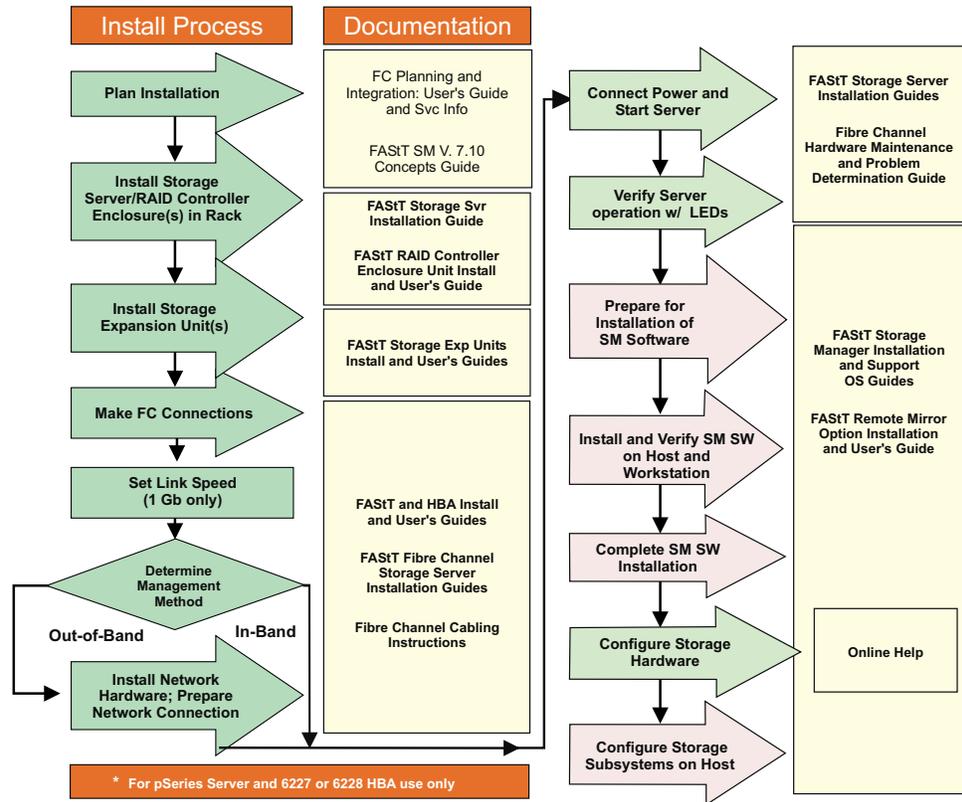


Figure 1. Installation process flow by current publications

## FASTt documentation

The following tables present an overview of the FASTt Storage Manager and the FASTt900, FASTt700, FASTt600, FASTt500, and FASTt200 Fibre Channel Storage Server document libraries, as well as related documents. Each table lists documents that are included in the libraries and where to locate the information that you need to accomplish common tasks.

## FAST Storage Manager Version 8.3 library

Table 1 associates each document in the FAST Storage Manager library with its related common user tasks.

Table 1. TotalStorage FAST Storage Manager Version 8.3 titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM TotalStorage FAST Storage Manager 8.3 Installation and Support Guide for Microsoft® Windows NT® and Windows 2000, GC26-7522	✓		✓	✓		
IBM TotalStorage FAST Storage Manager 8.3 Installation and Support Guide for Linux, GC26-7519	✓		✓	✓		
IBM TotalStorage FAST Storage Manager 8.3 Installation and Support Guide for Novell NetWare, GC26-7520	✓		✓	✓		
IBM TotalStorage FAST Storage Manager 8.3 Installation and Support Guide UNIX and AIX® Environments, GC26-7521	✓		✓	✓		
IBM FAST Remote Mirror Option Installation and User's Guide, 48P9821	✓		✓	✓	✓	
IBM FAST Storage Manager Script Commands (see product CD)				✓		
IBM FAST Storage Manager Version 7.10 Concepts Guide, 25P1661	✓	✓	✓	✓	✓	✓

## FAST900 Fibre Channel Storage Server library

Table 2 associates each document in the FAST900 Fibre Channel Storage Server library with its related common user tasks.

Table 2. TotalStorage FAST900 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM TotalStorage FAST900 Installation and Support Guide, GC26-7530	✓	✓		✓		
IBM TotalStorage FAST900 Fibre Channel Cabling Instructions, 24P8135	✓	✓				
IBM TotalStorage FAST900 User's Guide, GC26-7534				✓	✓	✓
IBM TotalStorage FAST FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAST FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM TotalStorage FAST900 Rack Mounting Instructions, 19K0900	✓	✓				
IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✓	✓			✓	✓
IBM FAST Management Suite Java User's Guide, 32P0081					✓	✓
IBM TotalStorage FAST Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						✓

## FAST700 Fibre Channel Storage Server library

Table 3 associates each document in the FAST700 Fibre Channel Storage Server library with its related common user tasks.

Table 3. TotalStorage FAST700 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM FAST700 Installation and Support Guide, 32P0171	✓	✓		✓		
IBM FAST700 Fibre Channel Cabling Instructions, 32P0343	✓	✓				
IBM FAST700 Fibre Channel Storage Server User's Guide, 32P0341				✓	✓	✓
IBM EXP700 Storage Expansion Unit Installation and User's Guide, 32P0178	✓	✓		✓	✓	✓
IBM FASiT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FASiT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FASiT Management Suite Java User's Guide, 32P0081					✓	✓
IBM Fibre Channel Hardware Maintenance Manual, 19K6130						✓
IBM Fibre Channel Problem Determination Guide, 48P9804						✓

## FAST600 Fibre Channel Storage Server library

Table 4 associates each document in the FAST600 Fibre Channel Storage Server library with its related common user tasks.

Table 4. TotalStorage FAST600 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM TotalStorage FAST600 Fibre Channel Storage Server Installation and User's Guide, GC26-7531	✓	✓		✓		
IBM TotalStorage FAST Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						✓
IBM TotalStorage FAST FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAST600 Rack Mounting Instructions, 24P8125	✓	✓				
IBM TotalStorage FAST600 Cabling Instructions, 24P8126	✓	✓				

## FAStT500 Fibre Channel Storage Server library

Table 5 associates each document in the FAStT500 Fibre Channel Storage Server library with its related common user tasks.

Table 5. TotalStorage FAStT500 and FAStT High Availability Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM FAStT500 RAID Controller Enclosure Unit User's Guide, 48P9847				✓	✓	✓
IBM FAStT EXP500 Storage Expansion Unit Installation and User's Guide, 59P5637	✓	✓		✓	✓	✓
IBM FAStT500 RAID Controller Enclosure Unit Installation Guide, 59P6244		✓			✓	
IBM FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FAStT Management Suite Java User's Guide, 32P0081					✓	✓
IBM Fibre Channel Hardware Maintenance Manual, 19K6130						✓
IBM Fibre Channel Problem Determination Guide, 48P9804						✓

## FAST200 Fibre Channel Storage Server library

Table 6 associates each document in the FAST200 Fibre Channel Storage Server library with its related common user tasks.

Table 6. TotalStorage FAST200 and FAST High Availability Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM FAST200 and FAST200 HA Storage Servers Installation and User's Guide, 59P6243	✓	✓		✓	✓	
IBM FAST200 Fibre Channel Cabling Instructions, 21P9094	✓	✓				
IBM FAST FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAST FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FAST Management Suite Java User's Guide, 32P0081					✓	✓
IBM Fibre Channel Hardware Maintenance Manual, 19K6130						✓
IBM Fibre Channel Problem Determination Guide, 48P9804						✓

## FAStT related documents

Table 7 associates each of the following documents related to FAStT operations with its related common user tasks.

Table 7. TotalStorage FAStT related document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM Safety Information, P48P9741					✓	
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✓				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

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## How this document is organized

Chapter 1, “Introduction”, on page 1 provides an overview of IBM FASiT Storage Manager version 8.3 and describes storage-subsystem management methods, configuration types, types of installations, and installation requirements.

Chapter 2, “Preparing for installation”, on page 21 discusses preparing for a network installation, including setting up a Dynamic Host Configuration Protocol/Boot Protocol (DHCP/BOOTP) server on Windows NT 4.0, Windows 2000, Novell NetWare, and UNIX® platforms.

Chapter 3, “Installing software in a standard configuration”, on page 39 provides instructions for installing the software components in a standard (noncluster) environment.

Chapter 4, “Installing the software in a cluster server environment”, on page 49 provides instructions for installing the software in a cluster server environment.

Chapter 5, “Completing the installation”, on page 67 discusses starting the Enterprise Management window, performing an automatic discovery of storage subsystems, adding devices, setting up alert notifications, downloading firmware and NVSRAM, creating arrays and logical drives, and other storage subsystem management tasks.

Chapter 6, “Using the storage-management software”, on page 77 provides information about adding and deleting logical drives, using the Hot Add and SMdevices utilities, starting and stopping the host-agent software, and uninstalling Storage Manager components.

Chapter 7, “Operating system support”, on page 85 discusses Windows NT and Windows 2000 operating system limitations and other operating-system issues.

“Storage subsystem and controller information record”, on page 89 provides a data sheet template that you can use to create a controller information record.

“Getting information, help, and service” on page xxi provides information about how to obtain help, service, or technical assistance.

“Notices” on page 91 provides product notices and trademark information.

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## Notices used in this document

This document contains the following notices designed to highlight key information:

- **Notes:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

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## Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM and IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information, what to do if you experience a problem with your xSeries™ or IntelliStation® system, and whom to call for service, if it is necessary.

### Before you call

Before you call, make sure that you take these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM Support Web site at <http://www.ibm.com/pc/support/> to check for technical information, hints, tips, and new device drivers.
- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the publications that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

### Using the documentation

Information about your IBM® xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support/> and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi/>

### Web sites

On the World Wide Web, the IBM Web site has up-to-date information about IBM xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is <http://www.ibm.com/eserver/xseries/>. The address for IBM IntelliStation information is <http://www.ibm.com/pc/intellistation/>.

You can find service information for your IBM products, including supported options, at <http://www.ibm.com/pc/support/>. If you click **Profile** from the support page, you can create a customized support page. The support page has many sources of information and ways for you to solve problems, including how to:

- Diagnose problems, using the IBM Online Assistant

- Download the latest device drivers and updates for your products
- View Frequently Asked Questions (FAQ)
- View hints and tips to help you solve problems
- Participate in IBM discussion forums
- Set up e-mail notification of technical updates about your products

For the latest information about operating system and HBA support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage FASTT Interoperability Matrix at the following Web site:  
<http://www.storage.ibm.com/disk/fastt/supserver.htm>

## Software service and support

Through the IBM Support Line, for a fee, you can get telephone assistance with usage, configuration, and software problems with xSeries servers, IntelliStation workstations and appliances. For information about which products are supported by Support Line in your country or region, go to <http://www.ibm.com/services/sl/products/>

For more information about Support Line and other IBM services, go to <http://www.ibm.com/services/> or go to <http://www.ibm.com/planetwide/> for support telephone numbers.

## Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to <http://www.ibm.com/planetwide/> for support telephone numbers.

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

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## How to send your comments

Your feedback is important to help us provide the highest quality of information. If you have any comments about this document, you can submit them in one of the following ways:

- E-mail

Submit your comments electronically to:

[starpubs@us.ibm.com](mailto:starpubs@us.ibm.com)

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

- Mail or fax

Fill out the Readers' Comments form (RCF) at the back of this document and return it by mail or fax (1-800-426-6209) or give it to an IBM representative. If the RCF has been removed, you may address your comments to:

International Business Machines Corporation  
RCF Processing Department  
Dept. M86/Bldg. 050-3  
5600 Cottle Road  
San Jose, CA 95193-0001  
U.S.A.



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## Chapter 1. Introduction

This document provides information on how to prepare, install, configure, and start IBM FASTT Storage Manager version 8.3 in a Windows NT 4.0 or Windows 2000 environment. All references to the Storage Manager refer to the IBM FASTT Storage Manager version 8.3.

Before you begin the installation of this product, consult the following documentation:

- *readme.txt* file  
Read this first. The *readme* file is located in the root directory of the installation CD. Refer to the IBM Web site at <http://www.ibm.com/pc/support/> for the latest installation and user information.
- *IBM FASTT Storage Manager Version 7.10 Concepts Guide*  
Use this document to become familiar with terminology and features of the IBM FASTT Storage Manager software. This book can be downloaded from the <http://www.ibm.com/pc/support/> Web site.

When you finish the installation process, refer to the following online help systems:

- Enterprise Management window help  
Use this online help system to learn more about working with the entire management domain.
- Subsystem Management window help  
Use this online help system to learn more about managing individual storage subsystems.

You can access these help systems from within the Storage Manager 8.3 Client. From either an Enterprise Management or Subsystem Management window, click **Help** or press F1.

After you install IBM FASTT Storage Manager Version 8.3, consider installing the FASTT MSJ and SANavigator diagnostic programs. You can use these programs to verify the status of the Fibre Channel connections before you use the storage subsystem.

The SANavigator program, the *IBM FASTT MSJ User's Guide*, and the FASTT MSJ program are located on the IBM FASTT Storage Manager version 8.3 CD. For information about how to install and run SANavigator, see the *FASTT Hardware Maintenance Manual and Problem Determination Guide*.

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## New features

This section describes the standard features that are part of the Storage Manager version 8.3 software. Your storage subsystem firmware must be version 5.3x.xx if you want to use any of the features listed in this section. If your controller firmware is version 04.x or earlier, you must purchase a firmware upgrade option.

The following list includes new standard features that have been added to the storage-management software:

- Support for IBM TotalStorage FAStT900 and FAStT600 Fibre Channel Storage Server
- Support for online Environmental Services Monitor (ESM) card firmware downloads

The ESM cards are customer replaceable unit (CRU) components in the IBM FAStT storage expansion units. The ESM firmware can be updated while the storage subsystem receives I/Os from the servers.

- Support for offline Fibre Channel hard drive firmware and mode page downloads  
The I/O from the servers must be suspended while the hard drive firmware and mode page download.
- Support for Media Scan without Parity repairs
- Support for forcibly disabling Fibre Channel drive-level write caching
- Support the controller state dump function for diagnostics
- Support for IBM TotalStorage FAStT600 Fibre Channel Storage Server

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## Premium features

### FAST600

The FlashCopy and Remote Mirror features are not supported on the FAStT600 Fibre Channel Storage Server.

There are two premium features, FlashCopy and the Remote Mirror option, that can be enabled by purchasing a premium feature key. Each of these features is described in the following sections:

### FlashCopy

This feature supports the creation and management of FlashCopy logical drives. A FlashCopy logical drive is a logical point-in-time image of another logical drive, called a base logical drive, that is in the storage subsystem. A FlashCopy is the logical equivalent of a complete physical copy, but you create it much more quickly and it requires less disk space. Because a FlashCopy is a host addressable logical drive, you can perform backups using the FlashCopy while the base logical drive remains online and user-accessible. In addition, you can write to the FlashCopy logical drive to perform application testing or scenario development and analysis. The maximum number of FlashCopy logical drives allowed is one half of the total number of logical drives supported by your controller model. For more information, see “Creating a FlashCopy logical drive” on page 79.

### Remote Mirror option

The Remote Mirror option is used for online, real-time replication of data between storage subsystems over a remote distance. In the event of a disaster or unrecoverable error on one storage subsystem, the Remote Mirror Option enables you to promote a second storage subsystem to take over responsibility for normal input/output (I/O) operations. When the Remote Mirror option is enabled, the maximum number of logical drives per storage subsystem is reduced. For more information, see “Using the Remote Mirror feature” on page 80.

## FAST600 restrictions

The following features are not supported on the FAST600 Fibre Channel Storage Server:

- FlashCopy
- the Remote Mirror Option

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## Supported machine types

Table 8 provides a list of machine types and supported storage-management software.

*Table 8. Machine types and supported storage-management software*

Product name	Machine type	Model	Firmware version	Supported storage-management software version
Netfinity Fibre Channel RAID Controller Unit	3526	1RU 1RX	4.x	7.0, 7.01, 7.02, 7.10, 8.0, 8.2, 8.21, 8.3
IBM FAST200 Storage Server	3542	1RU 1RX	4.x, 5.20.xx.xx, 5.30.xx.xx	7.02, 7.10, 8.0, 8.2, 8.21, 8.3
IBM FAST200 High Availability Storage Server	3542	2RU 2RX	4.x, 5.20.xx.xx, 5.30.xx.xx	7.02, 7.10, 8.0, 8.2, 8.21, 8.3
Netfinity FAST500 RAID Controller Enclosure Unit	3552	1RU 1RX	4.x, 5.00.xx.xx 5.20.xx.xx 5.21.xx.xx, 5.30.xx.xx	7.0, 7.01, 7.02, 7.10, 8.0, 8.2, 8.21, 8.3
IBM TotalStorage FAST700 Fibre Channel Storage Server	1742	1RU 1RX	5.00.xx.xx 5.20.xx.xx 5.21.xx.xx, 5.30.xx.xx	8.0, 8.2, 8.21, 8.3
IBM TotalStorage FAST900 Fibre Channel Storage Server	1742	90X, 90U	5.30.xx.xx	8.3
IBM TotalStorage FAST600 Fibre Channel Storage Server	1722	60X, 60U	5.33.xx.xx	8.3

**Note:** Storage subsystem firmware must be at version 04.00.02.xx or higher to be managed with Storage Manager 8.0, 8.2, 8.21, or 8.3.

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## Terms to know

If you are upgrading from a previous version of the storage-management software, some of the terms you are familiar with have changed. It is important that you familiarize yourself with the new terminology. Table 9 provides a list of some of the changed terms. Also a glossary is located in the Help section of the Storage Manager Enterprise Management window and the Storage Subsystem Management window.

*Table 9. New terminology*

Term used in previous versions	New term
RAID module	Storage subsystem

Table 9. New terminology (continued)

Term used in previous versions	New term
Drive group	Array
Volume	Logical drive

It is important to understand the distinction between the following two terms when you read this document:

#### **Management station**

A management station is a system that is used to manage the storage subsystem. It can be attached to the storage subsystem in the following ways:

- Through a TCP/IP Ethernet connection to the controllers in the storage subsystem
- Through a TCP/IP connection to the host-agent software that is installed on a host computer, which in turn is directly attached to the storage subsystem through the Fibre Channel input/output (I/O) path

#### **Host computer**

A host computer is a system that is directly attached to the storage subsystem through a Fibre Channel I/O path. This system is used to perform the following tasks.:

- Serve data (typically in the form of files) from the storage subsystem
- Function as a connection point to the storage subsystem for a remote-management station

#### **Notes:**

1. The terms host and host computer are used interchangeably throughout this book.
2. A host computer can also function as a management station.

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## **IBM FAStT Storage Manager version 8.3 software**

Storage Manager version 8.3 contains the following software components for Windows NT 4.0 and Windows 2000:

- Microsoft Virtual Machine (for Windows NT 4.0 only)
- Storage Manager 8.3 Client (SMclient)
- Redundant Disk Array Controller (RDAC)
- Storage Manager 8.3 Agent (SMagent)
- Storage Manager 8.3 Utility (SMutil)

### **Microsoft Virtual Machine**

For systems running Windows NT 4.0, the Microsoft Virtual Machine is required to support the following Storage Manager 8.3 components or options:

- Storage Manager 8.3 Agent
- Event Monitor option of the Storage Manager 8.3 Client

### **Storage Manager 8.3 Client**

The Storage Manager 8.3 Client (SMclient) component provides the graphical user interface (GUI) for managing storage subsystems. The SMclient contains two main components:

- **Enterprise Management.** You can use the Enterprise Management component to add, remove, and monitor storage subsystems within the management domain.
- **Subsystem Management.** You can use the Subsystem Management component to manage the components of an individual storage subsystem.

The Event Monitor is a separate program that is bundled with the SMclient. If installed, it monitors storage subsystems whenever the Enterprise Management window is closed. It runs continuously in the background and can send alert notifications in the event of a critical problem.

## Redundant Disk Array Controller

The Redundant Disk Array Controller (RDAC) contains the multi-path device driver that is necessary to provide controller failover support when a component on the Fibre Channel I/O path fails. For RDAC in Storage Manager 8 and higher, a maximum of four end-to-end fibre channel paths from the host to the storage subsystems are supported.

## Storage Manager 8.3 Agent

The Storage Manager Agent (SMAgent) provides a management conduit for the Storage Manager Client to configure and monitor the subsystem through the Fibre Channel I/O path. The agent also provides local or remote access to the Storage Manager 8.3 client depending on whether the client is installed on the host or in a network management station over the TCP/IP network.

## Storage Manager 8.3 Utility

The Storage Manager 8.3 Utility (SMutil) dynamically defines and maps new logical drives to the operating system. This software package contains the following components:

- **Hot Add utility.** The Hot Add utility enables you to register newly created logical drives with the operating system. For more information, see “Using the Hot Add utility” on page 80.
- **SMdevices utility.** The SMdevices utility enables you to associate storage subsystem logical drives with operating-system device names. For more information, see “Using the SMdevices utility” on page 81.
- **SMflashcopyassist utility.** The SMflashcopyassist utility enables you to perform the following tasks:
  - Flush cached data before creating a FlashCopy™ logical drive
  - Resolve duplicate logical drive signatures between the base logical drives and the FlashCopy logical drives (Windows NT 4.0 only)

For more information, see “Using the SMflashcopyassist utility” on page 81.

**Note:** FlashCopy is a premium feature that you must purchase and it is not supported on FAStT600. Contact your IBM service representative for more information.

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## Storage-subsystem management methods

The storage-management software provides the following two methods for managing storage subsystems:

- the host-agent management method
- the direct management method

Depending on your specific storage-subsystem configurations, you can use either or both methods. The management methods you select will determine where you will need to install the software components.

## Host-agent (in-band) management method

When you use the host-agent (in-band) management method, you manage the storage subsystems through the Fibre Channel I/O path to the host. The management information can either be processed in the host or passed to the management station through the network connection, as shown in Figure 2 on page 7.

Managing storage subsystems through the host-agent has the following advantages:

- Ethernet cables do not need to be run to the controllers.
- A DHCP/BOOTP server is not needed to connect the storage subsystems to the network.
- The controller network configuration tasks that are described in Chapter 2, “Preparing for installation”, on page 21, do not need to be performed.
- A host name or IP address must only be specified for the host instead of for the individual controllers in a storage subsystem. Storage subsystems that are attached to the host are automatically discovered.

Managing storage subsystems through the host-agent has the following disadvantages:

- The host-agent requires a special logical drive, called an *access logical drive*, to communicate with the controllers in the storage subsystem. Therefore, you are limited to configuring one less logical drive than the maximum number that is allowed by the operating system and the host adapter that you are using.
- If the connection through the Fibre Channel is lost between the host and the subsystem, the subsystem cannot be managed or monitored.

**Note:** The access logical drive is also referred to as the *Universal Xport Device*.

**Important:** If your host already has the maximum number of logical drives configured, either use the direct management method or give up a logical drive for use as the access logical drive. For more information, see “Number of supported logical drives” on page 19.

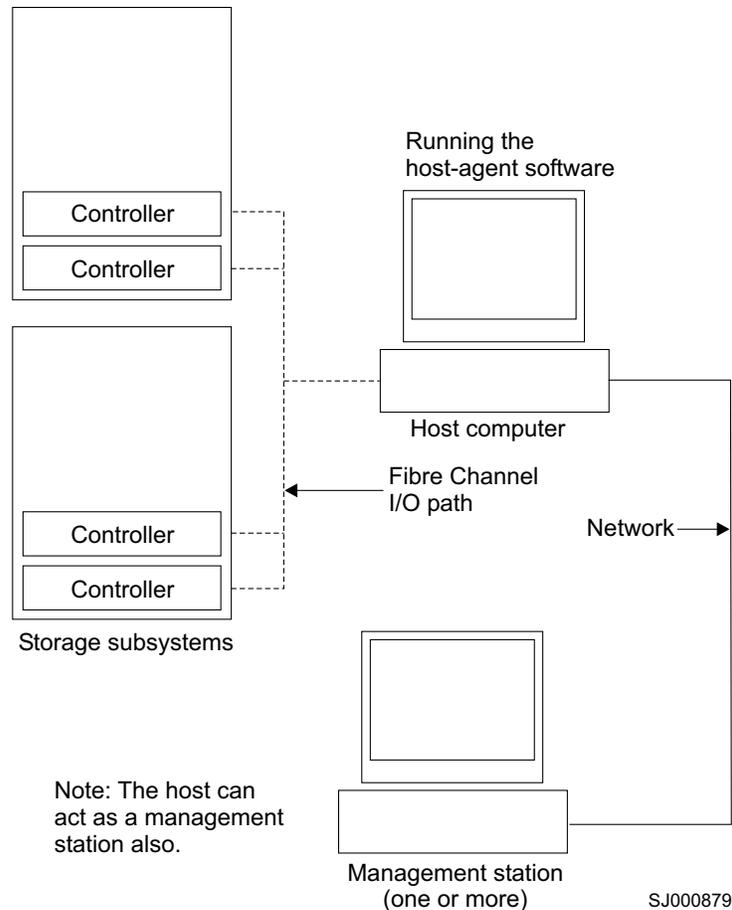


Figure 2. Host-agent (in-band) managed storage subsystems

## Direct-management (out-of-band) method

When you use the direct-management (out-of-band) method, you manage storage subsystems directly over the network through a TCP/IP Ethernet connection to each controller. To manage the storage subsystem through the Ethernet connections, you must define the IP address and host name for each controller. Each of the storage subsystem controllers must be connected, through a cable connected to the RJ-45 connector, to an Ethernet network, as shown in Figure 3 on page 9.

Managing storage subsystems using the direct-management (out-of-band) method has the following advantages:

- The Ethernet connections to the controllers enable a management station running SMclient to manage storage subsystems that are connected to a host running any of the operating systems that are supported by Storage Manager 8.3.
- An access logical drive is not needed to communicate with the controllers. You can configure the maximum number of logical drives that are supported by the operating system and the host adapter that you are using.
- The user can manage and troubleshoot the storage subsystem when there are problems with the Fibre Channel links.

Managing storage subsystems using the direct-management (out-of-band) method has the following disadvantages:

- You need two Ethernet cables to connect the storage subsystem controllers to a network.
- When adding devices, you must specify an IP address or host name for each controller.
- Network preparation tasks are required and you might need a DHCP/BOOTP server. For a summary of the preparation tasks, see “Preparing a network installation” on page 21.

You can avoid DHCP/BOOTP server and network tasks by assigning static IP addresses to the controller, or by using a default IP address.

- To assign a static IP address, see the IBM support Web site at [www.ibm.com/support/](http://www.ibm.com/support/) for Retain Tip #H171389 Unable To Setup Networking Without DHCP/BOOTP.
- If the storage subsystem controllers have firmware version 05.00.xx. or later, they have the following default settings.

<b>Controller</b>	<b>IP address</b>	<b>Subnet mask</b>
A	192.168.128.101	255.255.255.0
B	192.168.128.102	255.255.255.0

Figure 3 on page 9 shows a system in which storage subsystems are managed by using the direct-management (out-of-band) method.

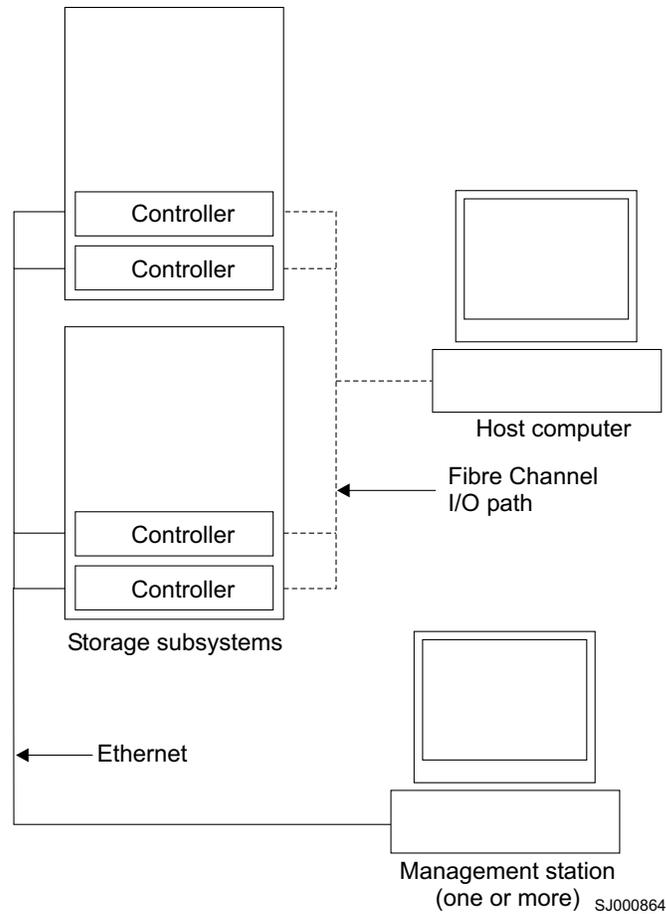


Figure 3. Direct-management (out-of-band) storage subsystems

## Reviewing a sample network

Figure 4 on page 10 shows an example of a network that contains both a directly-managed storage subsystem (Network A) and a host-agent-managed storage subsystem (Network B).

**Directly-managed storage subsystem:** Network A is a directly-managed storage subsystem. Network A contains the following components:

- A DHCP/BOOTP server
- A Network Management Station (NMS) for Simple Network Management Protocol (SNMP) traps
- A host that is connected to a storage subsystem through a Fibre Channel I/O path
- A management station that is connected by an Ethernet cable to the storage subsystem controllers

**Note:** If the controllers, static IP addresses or default IP addresses are used, you do not need to setup the DHCP/BOOTP server.

**Host-agent-managed storage subsystem:** Network B is a host-agent-managed storage subsystem. Network B contains the following components:

- A host that is connected to a storage subsystem through a Fibre Channel I/O path
- A management station that is connected by an Ethernet cable to the host computer

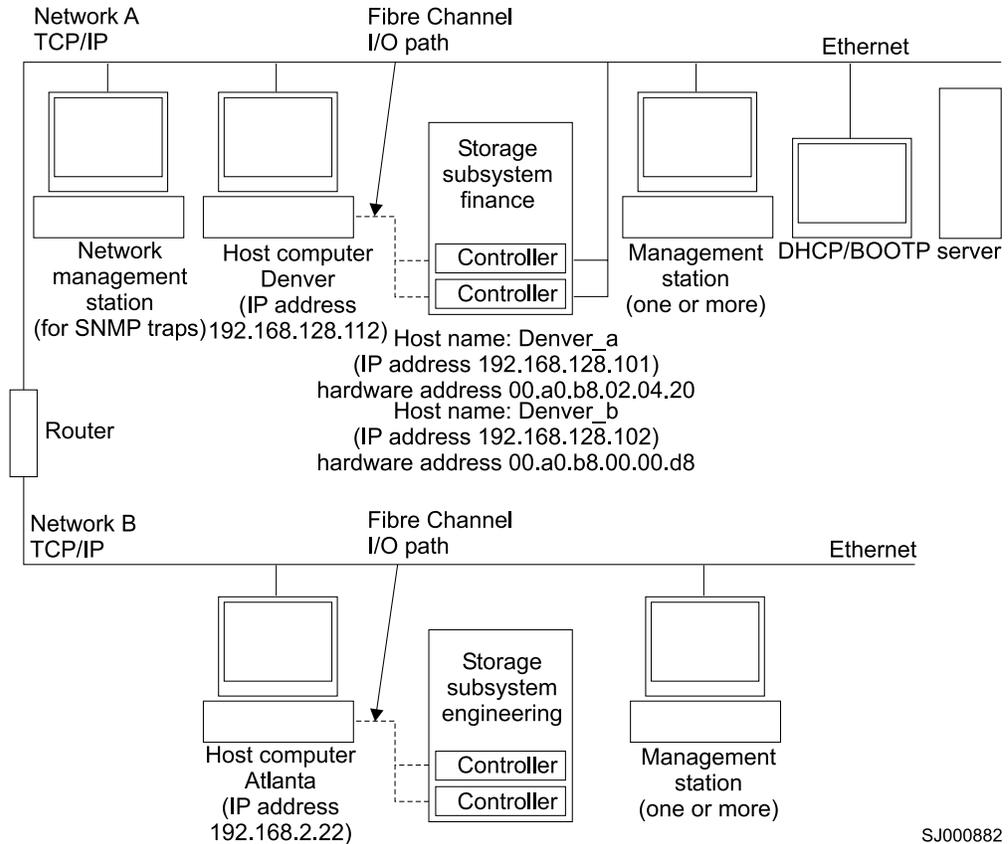


Figure 4. Sample network using directly-managed and host-agent managed storage subsystems

## Where to install the software components

How you manage the storage subsystems determines where you must install the various software components.

### Management stations

You must install the following software components on each management station:

- Storage Manager 8.3 Client (SMclient)
- Microsoft Virtual Machine (for Windows NT 4.0 only)

### Host computers

You must install the following software components on each host computer:

- Redundant Disk Array Controller (RDAC)
- Storage Manager 8.3 Utility (SMutil)

Depending on how you intend to manage the storage subsystems, you might need to install the following software components:

- Storage Manager 8.3 Agent (SMagent)
- Storage Manager 8.3 Client (SMclient)

You must install the SMagent on a host computer if you intend to manage the storage subsystems using the host-agent management method.

You must install the SMclient on a host computer if you intend the host computer to act as a management station. If the host computer is not connected to a network, you must install TCP/IP software and assign an IP address.

## Configuration types

You can install Storage Manager 8.3 in one of two configurations:

- Standard (noncluster) configuration
- Cluster server configuration

### Standard (noncluster) configuration

Figure 5 shows a sample standard (noncluster) configuration.

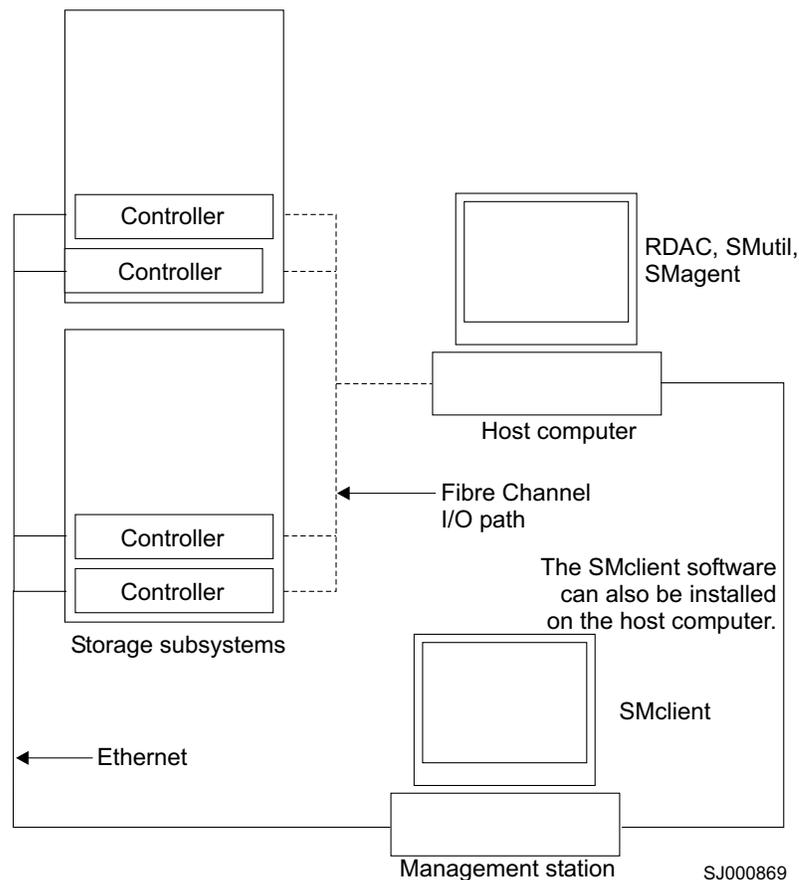


Figure 5. Sample standard (noncluster) configuration

## Cluster server configuration

Figure 6 shows a sample cluster server configuration.

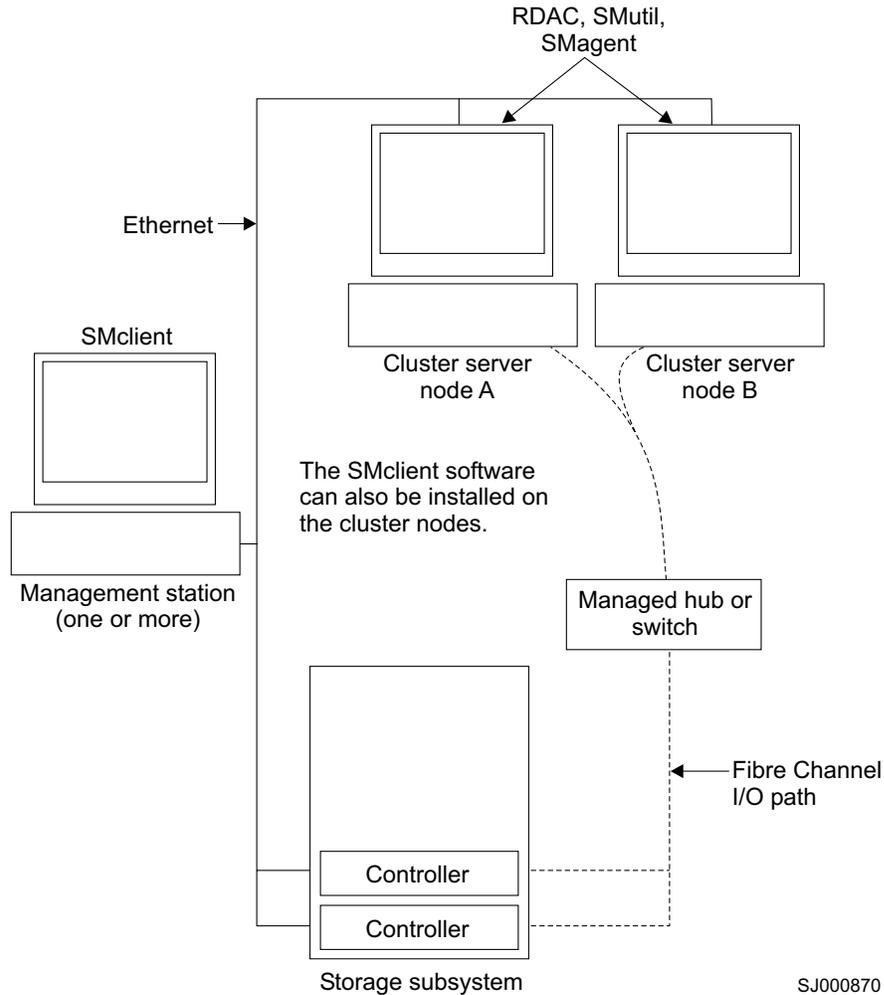


Figure 6. Sample cluster server configuration

## Installation types

You can install the storage-management software in two types of hardware environments:

- **New storage subsystem environment.** Use this hardware environment if you are installing the IBM TotalStorage FASiT Fibre Channel Storage Server using firmware 05.3x.xx.xx and you will manage storage subsystems using Storage Manager 8.3.
- **Existing storage subsystem environment.** If you are installing the storage-management software in an environment with existing storage subsystems, see Table 10 on page 13 for your installation options.

**Note:** When instructed to uninstall Storage Manager software in the following table, be sure to uninstall the management software on all management systems or hosts that have access to the storage subsystem that has firmware 5.3x.xx.xx. The Storage Manager 8.3 RDAC has new functionality and features and it is compatible with older versions of firmware. To ensure the

highest level of compatibility and error-free operation, the Storage Manager 8.3 RDAC must be installed on all host computers that have disks defined on storage subsystems that have firmware level 5.3x.xx.xx.

Table 10. Configurations for existing storage subsystems

Current environment	Planned environment	Action
<p>(Machine types 1742, 3552) Existing storage subsystems with controllers that have firmware versions 05.00.xx.xx or 05.2x.xx.xx</p> <p>(Machine type 3542) Existing storage subsystems with controllers that have firmware versions 05.20.xx.xx</p>	<p>Upgrade firmware to version 5.3x.xx.xx</p> <p>Manage all storage subsystems by using Storage Manager 8.3.</p>	<ol style="list-style-type: none"> <li>1. Uninstall Storage Manager 8.2x. See “Uninstalling storage-management software components” on page 82 for more information.</li> <li>2. Install Storage Manager 8.3. See “New installation process” on page 39 for more information.</li> <li>3. Discover the storage subsystems. See “Performing an initial automatic discovery of storage subsystems” on page 68 for more information.</li> <li>4. Download firmware and NVSRAM version 5.3x.xx.xx. See “Downloading firmware and NVSRAM” on page 72 for more information.</li> </ol>
<p>(Machine type 3552) Existing storage subsystems with controllers that have firmware versions 04.00.xx.xx through 04.01.xx.xx</p>	<p>Upgrade firmware to version 05.3x.xx.xx</p> <p>Manage all storage subsystems by using Storage Manager 8.3</p>	<ol style="list-style-type: none"> <li>1. Purchase an upgrade option. Contact your IBM service representative for more information.</li> <li>2. Uninstall Storage Manager version 7.x. Refer to “Uninstalling storage-management software components” on page 82 for more information.</li> <li>3. Install Storage Manager 8.3. Refer to “New installation process” on page 39 for more information.</li> <li>4. Discover the storage subsystems. Refer to “Performing an initial automatic discovery of storage subsystems” on page 68 for more information.</li> <li>5. Download firmware and NVSRAM version 5.3x.xx.xx. Refer to “Downloading firmware and NVSRAM” on page 72 for more information.</li> </ol>

Table 10. Configurations for existing storage subsystems (continued)

Current environment	Planned environment	Action
(Machine type 3542) Existing storage subsystems with controllers that have firmware versions 04.00.02.xx through 04.01.xx.xx	Upgrade the firmware to version 5.3x.xx.xx.  Manage all storage subsystems by using Storage Manager 8.3.	<ol style="list-style-type: none"> <li>1. Purchase the upgrade option. Contact IBM for more information.</li> <li>2. Uninstall Storage Manager 7.0. See “Uninstalling storage-management software components” on page 82 for more information.</li> <li>3. Install Storage Manager 8.3. See “New installation process” on page 39 for more information.</li> <li>4. Discover the storage subsystems. See “Performing an initial automatic discovery of storage subsystems” on page 68 for more information. Go to the IBM Web site to download the 04.01.02.30 or higher firmware and matching NVSRAM. <b>Important:</b> The storage subsystem controllers must be at firmware level 04.01.02.30 or higher before downloading firmware level 05.3x.xx.xx and NVSRAM to the controllers.</li> <li>5. Download firmware level 04.01.02.30 or higher and its associated NVSRAM. See “Downloading firmware and NVSRAM” on page 72 for more information.</li> <li>6. Download firmware and NVSRAM version 5.3x.xx.xx. See “Downloading firmware and NVSRAM” on page 72 for more information.</li> </ol>
(Machine types 3526, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.xx.xx through 04.00.01.xx	Upgrade firmware to version 04.00.02.xx or higher. The latest firmware version for the 4.xx.xx.xx firmware thread is 04.01.xx.xx.  Manage all storage subsystems by using Storage Manager 8.3.	<ol style="list-style-type: none"> <li>1. Uninstall Storage Manager version 7.x. Refer to “Uninstalling storage-management software components” on page 82 for more information.</li> <li>2. Install Storage Manager 8.3. Refer to “New installation process” on page 39 for more information.</li> <li>3. Discover the storage subsystems. Refer to “Performing an initial automatic discovery of storage subsystems” on page 68 for more information.</li> <li>4. Upgrade the firmware to version 4.00.02.xx or higher. Go to the IBM Web site; download the firmware and matching NVSRAM.</li> </ol>

Table 10. Configurations for existing storage subsystems (continued)

Current environment	Planned environment	Action
(Machine types 3526, 3542, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.02.xx through 04.01.xx.xx	Retain existing firmware versions.  Manage all storage subsystems using Storage Manager 8.3.	<ol style="list-style-type: none"> <li>1. Uninstall Storage Manager version 7.x. Refer to “Uninstalling storage-management software components” on page 82 for more information.</li> <li>2. Install Storage Manager 8.3. Refer to “New installation process” on page 39 for more information.</li> <li>3. Discover the storage subsystems. Refer to “Performing an initial automatic discovery of storage subsystems” on page 68 for more information.</li> </ol>
(Machine types 3526, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.xx.xx through 4.00.01.xx	Retain existing firmware versions.  Manage existing storage subsystems using Storage Manager 7.10.	Set up a separate management station with Storage Manager 7.10 installed to manage the storage subsystems with controllers that have back-level firmware.

## Managing coexisting storage subsystems

Storage subsystems are *coexisting storage subsystems* when the following conditions are met:

- Multiple storage subsystems with controllers are running different versions of firmware.
- These storage subsystems are attached to the same host.

For example, a coexisting situation exists when you have a new storage subsystem with controllers running firmware version 05.3x.xx.xx, and it is attached to the same host as one or more of the following configurations:

- A storage subsystem with controllers running firmware versions 04.00.xx.xx through 04.00.01.xx, which is managed by a separate management station with Storage Manager 7.10
- A storage subsystem with controllers running firmware versions 04.00.02.xx through 04.01.xx.xx, which is managed with Storage Manager 8.3

**Important:** The common host must have the latest level (8.3) of RDAC and Storage Manager Agent installed.

Figure 7 shows an example of an environment that includes coexisting storage subsystems.

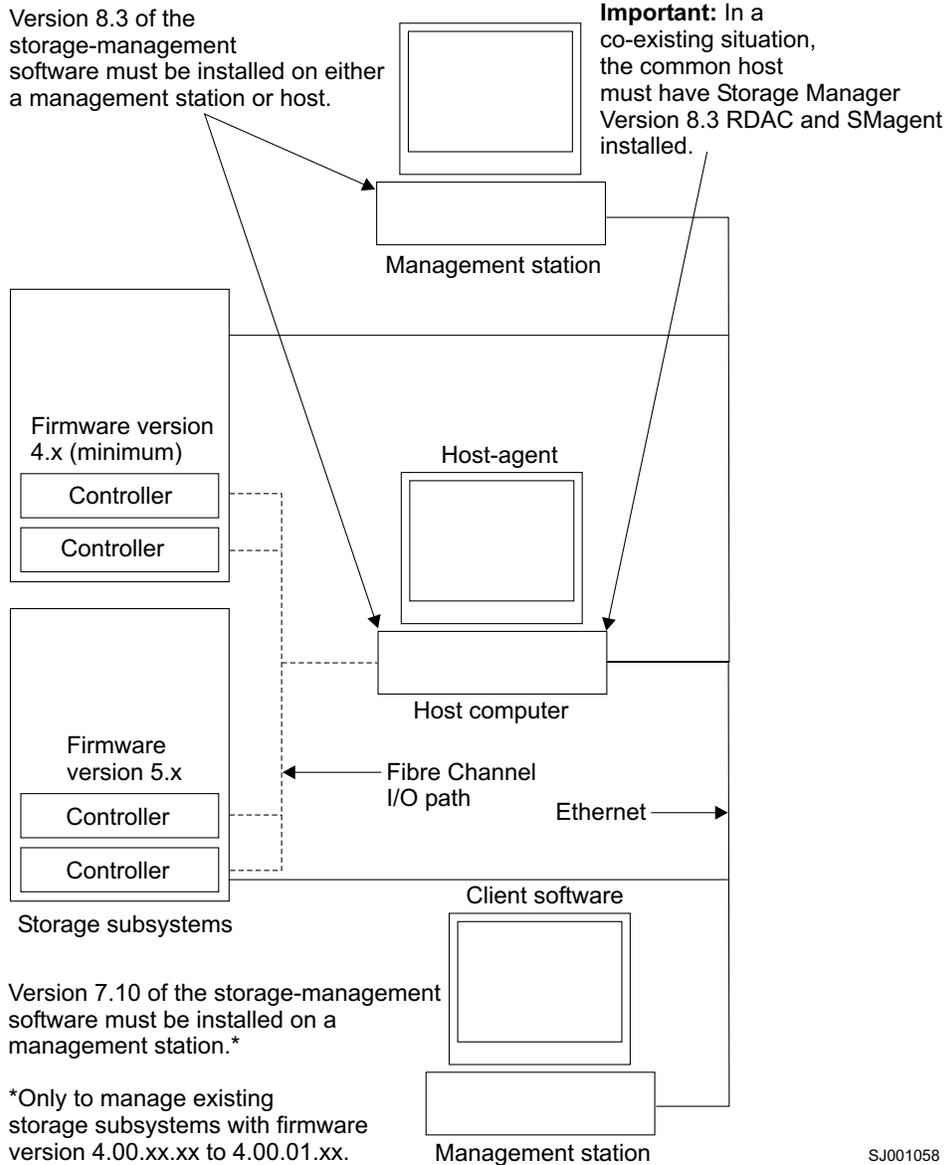


Figure 7. Sample coexistent installation

## System requirements

This section provides detailed information about the hardware, software, and operating system requirements for Storage Manager 8.3.

## Hardware requirements

Table 11 lists the hardware required for installing Storage Manager 8.3.

Table 11. Hardware requirements for Storage Manager 8.3 software

Hardware component	Requirements
A DHCP/BOOTP server (only for directly managed storage subsystems) <b>Note:</b> If the controllers static IP addresses or default IP addresses are used, you do not need to setup the DHCP/BOOTP server.	One of the following BOOTP or BOOTP-compatible servers: <ul style="list-style-type: none"> <li>• Microsoft BOOTP-compatible DHCP server for Windows NT</li> <li>• Microsoft BOOTP-compatible DHCP server for Windows 2000</li> <li>• UNIX BOOTP server</li> <li>• NetWare DHCP server</li> </ul>
Storage subsystems (one or more)	Storage subsystems with controllers running firmware version 04.00.02.xx through 05.3x.xx.xx.
Fibre Channel (FC) host adapters	The following Fibre Channel host adapters were tested with the storage-management software: <ul style="list-style-type: none"> <li>• IBM FAStT host adapter (part number: 00N6881)</li> <li>• An IBM FAStT FC2 Host Bus Adapter (part number 19K1246), IBM FAStT single port FC2-133 Host Bus Adapter (part number 24P0960), or dual port FC2-133 Host Bus Adapter (part number 24P8053)</li> </ul> For information on specific host adapter requirements: <ul style="list-style-type: none"> <li>• Refer to the readme file in the \Host_Adapter directory on the installation CD.</li> <li>• Read the host adapter documentation.</li> <li>• Go to the <a href="http://www.ibm.com/pc/support/">http://www.ibm.com/pc/support/</a> Web site.</li> </ul>
Fibre Channel (FC) fabric switches (if needed for the desired configuration)	The following Fibre Channel fabric switches were tested with the storage-management software: <ul style="list-style-type: none"> <li>• IBM 8-port Fibre Channel switch (machine type: 2109-S08)</li> <li>• IBM 16-port Fibre Channel switch (machine type: 2109-S16)</li> <li>• IBM 16-port 2 Gbps Fibre Channel switch (machine type: 2019-F16)</li> <li>• IBM 8-port 2 Gbps Fibre Channel switch (machine type: 3534-F08)</li> </ul> For specific Fibre Channel switch setup requirements: <ul style="list-style-type: none"> <li>• Read the switch documentation.</li> <li>• Go to the <a href="http://www.ibm.com/storage/fcswitch/">http://www.ibm.com/storage/fcswitch/</a> Web site.</li> </ul>
Fibre Channel (FC) managed hub (if needed for the desired configuration)	The Fibre Channel managed hub (machine type: 3534) was tested with the storage management software. For specific Fibre Channel managed hub setup requirements: <ul style="list-style-type: none"> <li>• Read the managed hub documentation.</li> <li>• Go to the <a href="http://www.ibm.com/storage/fchub/">http://www.ibm.com/storage/fchub/</a> Web site.</li> </ul>

Table 11. Hardware requirements for Storage Manager 8.3 software (continued)

Hardware component	Requirements
Management station (for client software)	<p>Your management station computer will require:</p> <ul style="list-style-type: none"> <li>• Intel® Pentium® or Pentium-equivalent microprocessor (450 MHz or faster)</li> <li>• CD-ROM drive</li> <li>• Mouse or similar pointing device</li> <li>• System memory:               <ul style="list-style-type: none"> <li>– For Windows NT 4.0: A minimum of 64 MB (128 MB recommended)</li> <li>– For Windows 2000: A minimum of 128 MB (256 MB recommended)</li> </ul> </li> <li>• Ethernet network interface adapter</li> <li>• AGP or PCI video adapter (AGP preferred); ISA adapters are not supported</li> <li>• Monitor setting of 1024 x 768 pixels with 64,000 colors. The minimum display setting that is allowed is 800 x 600 pixels with 256 colors.</li> <li>• Hardware-based Windows acceleration. Desktop computers that use system memory for video memory are not preferred for use with the storage-management software.</li> </ul> <p><b>Important:</b> Many PC-based servers are not designed to run graphic-intensive software. If your server has difficulty running the storage-management software smoothly without video artifacts, you might need to upgrade the server video adapter.</p>

**Note:** For more information about host adapters, fabric switches, and managed hubs, go to the ServerProven™ Web site at <http://www.ibm.com/pc/us/compat/>.

## Firmware requirements

To utilize all of the features of Storage Manager 8.3, your storage subsystem must contain controllers with firmware version 5.3x.xx.xx for machine types 1722, 1742, 3552, and 3542. To manage storage subsystems with Storage Manager 8.3, your storage subsystems must contain controllers with firmware versions 04.00.02.xx or higher.

To upgrade your firmware from version 04.xx.xx.xx to 05.3x.xx.xx for machine types 3552 and 3542, you must purchase a firmware option. For more information, contact your IBM reseller or IBM marketing representative.

Storage Manager 8.3 also supports two premium feature options: FlashCopy and Remote Mirroring. For more information about these premium features, see “Creating a FlashCopy logical drive” on page 79 and “Using the Remote Mirror feature” on page 80, or contact your IBM reseller or IBM marketing representative.

## Software requirements

Table 12 on page 19 lists the disk space and administrator privileges required to install version 8.3 of the storage-management software.

**Note:** The disk space listed in table 5 is for the packages after the installation. During the installation of each software package, you might need up to 120M

of free disk space.

Table 12. Installation requirements by software package

Package	Disk space requirement (Windows NT / Windows 2000)	Administrator privilege (Windows NT / Windows 2000)
Microsoft Virtual Machine	1 MB / NA	Required / NA
Storage Manager 8.3 Client (SMclient)	40 MB	Not required / Not Required
Redundant Disk Array Controller (RDAC)	1 MB / 1 MB	Required
Storage Manager 8.3 Agent (SMagent)	1 MB / 1 MB	Required
Storage Manager 8.3 Utility (SMutil)	4 MB / 4 MB	Required

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## Operating system requirements

Each management station, host computer, or cluster node requires one of the following operating systems:

**Management stations.** Install one of the following operating systems:

- Windows NT 4.0 Server with Service Pack 6a
- Windows NT 4.0 Enterprise Edition with Service Pack 6a
- Windows NT 4.0 Workstation with Service Pack 6a
- Windows 2000 Server with Service Pack 3
- Windows 2000 Professional with Service Pack 3
- Windows 2000 Advanced Server with Service Pack 3

**Host computers.** Install one of the following operating systems:

- Windows NT 4.0 Server with Service Pack 6a
- Windows NT 4.0 Enterprise Edition with Service Pack 6a
- Windows NT 4.0 Workstation with Service Pack 6a
- Windows 2000 Server with Service Pack 3
- Windows 2000 Professional with Service Pack 3
- Windows 2000 Advanced Server with Service Pack 3

**Cluster nodes.** Install one of the following operating systems:

- Windows NT 4.0 Enterprise Edition with Service Pack 6a
- Windows 2000 Advanced Server with Service Pack 3

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## Number of supported logical drives

Supported logical drive limits for Windows NT 4.0 and Windows 2000 are as follows:

- Windows NT 4.0 with Service Pack 6a supports up to 32 logical drives per storage subsystem (LUNs 0-31) when you use IBM-approved FASTt adapters and their supported device drivers.

- Windows 2000 supports up to 32 logical drives per storage subsystem (LUNs 0 through 31) when you use IBM-approved FAStT adapters and their supported device drivers.
- The maximum number of logical drives that a FAStT storage subsystem supports with firmware version 05.3x.xx.xx depends on the model of the FAStT storage subsystem.

Table 13. Logical drives without the remote mirror option enabled

Model Type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum flashcopy logical drives
3542	512 <sup>1</sup>	32 <sup>5</sup>	256 <sup>2</sup>
3552	512 <sup>1</sup>	32 <sup>5</sup>	256 <sup>2</sup>
1742	2048 <sup>1</sup>	32 <sup>5</sup>	1024 <sup>2</sup>
1722	1024 <sup>1</sup>	32	N/A

Table 14. Logical drives using the remote mirror option

Model Type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum flashcopy logical drives
3542	N / A	N / A	N / A
3552	128 <sup>3,6</sup>	32 <sup>5</sup>	64 <sup>2</sup>
1742	256 <sup>1,4,6</sup>	32 <sup>5</sup>	128 <sup>2</sup>
1722	N/A	N/A	N/A

**Note:** The access logical drive is also referred to as the Universal Xport Device.

<sup>1</sup>When using firmware version 5.xx.xx.xx, the firmware reserves one logical drive for use by the system.

<sup>2</sup> Maximum of four Flashcopy logical drives for each standard logical drive

<sup>3</sup> Maximum of eight remote mirror pairs

<sup>4</sup> Maximum of 16 remote mirror pairs

<sup>5</sup>The host-agent management method uses a special logical drive, called an *access logical drive*, to communicate with the controllers on the storage subsystem. The access logical drive uses one of the available LUNs. Therefore, managing storage subsystems with the host-agent software limits you to one fewer LUN than the maximum number supported by the operating system and the host adapter.

<sup>6</sup>For firmware version 05.2x.xx.xx and higher, the maximum number of logical drives includes the flashcopy repository logical drives and the remote mirror logical drives in addition to the standard data logical drives. If the remote mirror option is enabled, two logical drives are reserved for use by the system.

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## Chapter 2. Preparing for installation

This chapter provides information to help you plan the installation of the storage-management software.

Table 15 contains information about where you need to install the Storage Manager software components.

*Table 15. Software component installation in a Windows environment*

<b>System type</b>	<b>Software installation sequence</b>
Management station	<ol style="list-style-type: none"><li>1. Microsoft Virtual Machine (for Windows NT 4.0 only)<ul style="list-style-type: none"><li>• Optional package</li><li>• Necessary if you plan to install the Event Monitor option of the SMclient</li></ul></li><li>2. Storage Manager 8.3 Client (SMclient)</li></ol>
Host computer / cluster node	<ol style="list-style-type: none"><li>1. Microsoft Virtual Machine (for Windows NT 4.0 only)<ul style="list-style-type: none"><li>• Optional package</li><li>• Necessary if you plan to install the Event Monitor option of the SMclient.</li></ul></li><li>2. Storage Manager 8.3 Client (SMclient)<ul style="list-style-type: none"><li>• Optional component</li><li>• Necessary if you intend to manage the storage subsystem from the host computer.</li></ul></li><li>3. Redundant Disk Array Controller (RDAC)<ul style="list-style-type: none"><li>• Required component</li><li>• On Windows NT 4.0, you must assign static drive letters to existing local drives before you install RDAC. This process requires a minimum of two disk partitions (the BOOT partition and one other partition).</li></ul></li><li>4. Storage Manager 8.3 Agent (SMagent)<ul style="list-style-type: none"><li>• Optional component</li><li>• Necessary if you intend to use the host-agent management method.</li></ul></li><li>5. Storage Manager 8.3 Utility (SMutil)<ul style="list-style-type: none"><li>• Required component</li><li>• Contains the Hot Add, SMdevices, and SMflashcopyassist utilities</li></ul></li></ol>

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### Preparing a network installation

To begin installing the storage-management software, ensure that the network components are set up and operating properly, and that you have all the host and controller information needed for the software to operate correctly.

The following steps provide an overview of the tasks involved in setting up a network installation:

1. Install all hardware components (host computers, storage subsystems, and cables) that you want to connect to the network. You might need to refer to the installation guides specific to the hardware components.

2. Establish a naming convention for the storage subsystems connected to the network. Refer to “Naming the storage subsystems” on page 23 for more information.
3. Record the storage subsystem names and management types in Table 20 on page 89. An example of a completed information record is shown in Table 16.

**Note:** Throughout the remaining steps, you will need to return to Table 20 on page 89 to record information such as hardware Ethernet addresses and IP addresses.

4. (For a directly-managed system only) Determine the hardware Ethernet address for each controller in storage subsystems connected to the network. Refer to “Identifying the hardware Ethernet MAC address for each controller” on page 23 for more information.
5. (For a directly-managed system only) If you are using a default controller IP address, go to step 7. Otherwise, obtain the TCP/IP address and host name for each of the controllers in the storage subsystems on the network from the network administrator. Refer to “Assigning IP addresses to hosts and controllers” on page 25.

(For a host-managed system only) Obtain the IP address and host name of the host computer on which the host-agent software will run from the network administrator. Refer to “Assigning IP addresses to hosts and controllers” on page 25.

6. (For a directly-managed system only) Set up the DHCP/BOOTP server to provide network configuration information for a specific controller. If you are using a controller static IP addresses, skip this step.
7. Verify that the TCP/IP software is installed. For more information, see “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.
8. (For a directly-managed system only) Set up the host or Domain Name Server (DNS) table. For more information, see “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.
9. Power on the devices connected to the network.

Table 16 shows a sample information record for the network shown in Figure 4 on page 10. This network contains storage subsystems that are managed by using both the direct-management and host-agent-management method.

*Table 16. Sample information record*

Storage subsystem name	Management method	Controllers-Ethernet and IP addresses, and host name		Host-IP address and host name
		Controller A	Controller B	
Finance	Direct	Hardware Ethernet address = 00a0b8020420	Hardware Ethernet address = 00a0b80000d8	
		IP address = 192.168.128.101	IP address = 192.168.128.102	
		Host = Denver_a	Host = Denver_b	
Engineering	Host-agent			IP address = 192.168.2.22
				Host = Atlanta

---

## Naming the storage subsystems

As you set up your network, decide on a naming convention for the storage subsystems. When you install the storage-management software and start it for the first time, all storage subsystems in the management domain are displayed as <unnamed>. Use the Subsystem Management window to rename the individual storage subsystems.

Consider the following factors when naming storage subsystems:

- There is a 30-character limit. All leading and trailing spaces are deleted from the name.
- Use a unique, meaningful naming scheme that is easy to understand and remember.
- Avoid arbitrary names or names that might quickly lose their meaning.
- The software displays storage-subsystem names with the prefix Storage Subsystem. Therefore, if you rename a storage subsystem to Engineering, it is displayed as:

Storage Subsystem Engineering

After you decide on a naming scheme, record the storage-subsystem names in the information record (Table 20 on page 89).

If you plan to manage your storage subsystem using the direct-management method, go to “Identifying the hardware Ethernet MAC address for each controller”. If you plan to manage your storage subsystem using the host-agent management method, go to “Assigning IP addresses to hosts and controllers” on page 25.

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## Identifying the hardware Ethernet MAC address for each controller

To manage your storage subsystem using the direct-management method, you need to identify the hardware Ethernet Medium Access (MAC) address for each controller.

To identify the hardware Ethernet MAC address for machine type 3542 and 1722, perform the following steps:

1. Locate the Ethernet MAC address at the back of the unit, under the controller Fibre Channel Host ports, as shown in Figure 8 on page 24. The number will be in the form xx.xx.xx.xx.xx.xx (for example, 00.a0.b8.20.00.d8).
2. Record each Ethernet address in the information record (Table 20 on page 89).

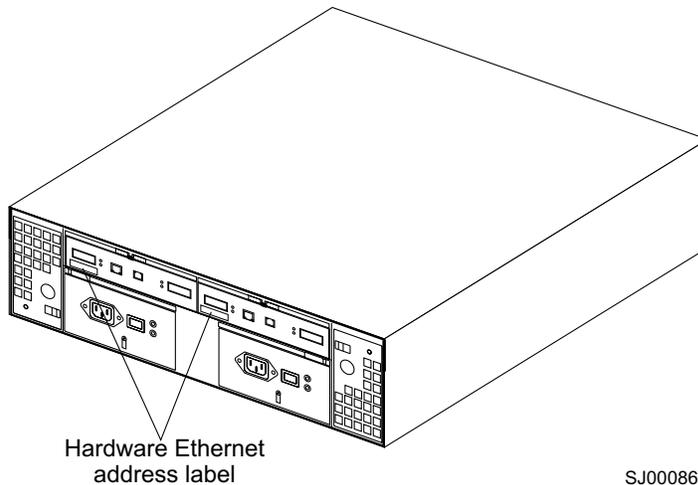


Figure 8. Locating the Ethernet MAC address for machine type 3542 and 1722

To identify the hardware Ethernet MAC address for machine types 3552 and 1742, perform the following steps:

1. Remove the front bezel from the storage subsystem, as shown in Figure 9. Carefully pull the bottom of the bezel out **1** to release the pins; then, slide the bezel down **2**.

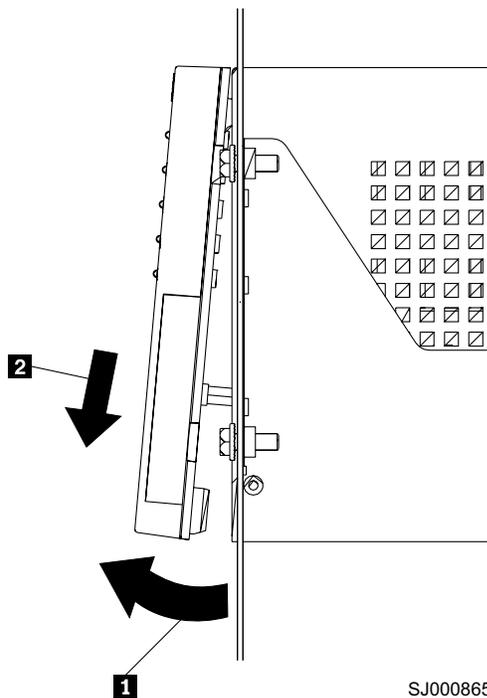


Figure 9. Removing the controller-unit bezel (machine types 3552 and 1742)

2. On the front of each controller, look for a label with the hardware Ethernet MAC address. The number will be in the form xx.xx.xx.xx.xx.xx (for example, 00.a0.b8.20.00.d8).
3. Record each Ethernet address in the information record (Table 20 on page 89).

4. To replace the bezel, slide the top edge under the lip on the chassis **1**; then, push the bezel bottom until the pins snap into the mounting holes **2**, as shown in Figure 10.

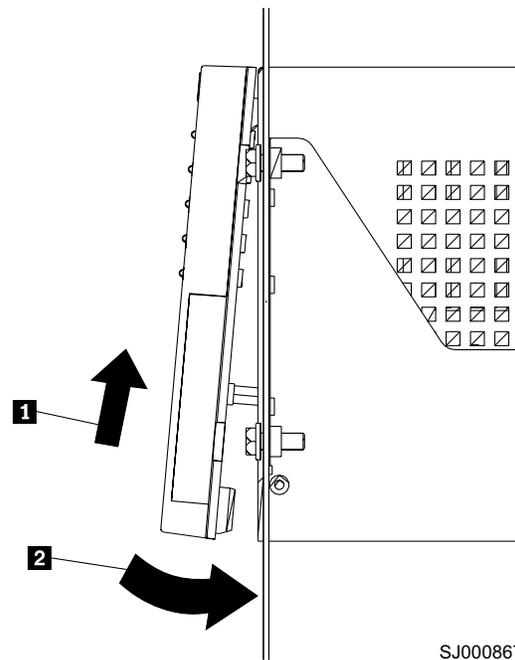


Figure 10. Replacing the controller-unit bezel (machine types 3552 and 1742)

5. Continue with “Assigning IP addresses to hosts and controllers”.

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## Assigning IP addresses to hosts and controllers

If you plan to manage your storage subsystem using the direct-management method, assign a unique IP address for every controller in all storage subsystems on the network. Record the IP address for each controller in the information record (Table 20 on page 89). Then, go to “Setting up the DHCP or BOOTP-compatible server”.

**Note:** If you want to assign static IP addresses for the controllers, refer to the IBM support Web site at [www.ibm.com/support/](http://www.ibm.com/support/) for Retain Tip #H171389 *Unable to setup networking without DHCP/BOOTP*. Then go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.

If you plan to manage your storage subsystem using the host-agent management method, assign an IP address for each host on which you will install the host-agent software. Record the IP address for each host in the information record (Table 20 on page 89). Then, go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.

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## Setting up the DHCP or BOOTP-compatible server

To directly manage storage subsystems through the Ethernet connection to each controller, you will need to set up a DHCP or BOOTP-compatible server and configure the following options:

- Router/Gateway

- DNS Server
- Hostname
- DNS

This section provides instructions for setting up a DHCP server on Windows NT 4.0, Windows 2000, and Novell NetWare, as well as instructions for setting up a UNIX BOOT server.

**Note:** The remote management station (RMS) and network management station (NMS) entries used in previous versions of the storage-management software are not required when using Storage Manager 8.3.

## Setting up a Windows NT 4.0 DHCP server

You must use a version of DHCP that supports BOOTP static addressing. To use a DHCP server, you must have a DHCP Manager installed. If a DHCP Manager is installed on the system, go to “Setting up a DHCP server”. If a DHCP Manager is not installed, use the following installation procedure to install one.

### Installing the DHCP Manager

Use the following procedure to install the DHCP Manager:

1. Click **Start** → **Settings** → **Control Panel**. A Control Panel window opens.
2. Double-click **Network**. The Network window opens.
3. Click **Services**.
4. From the **Services** tab, click **Add**.
5. Click **Microsoft DHCP Server**. Click **OK**.
6. Specify the path to the Windows NT Install file. Click **Continue**. A dialogue window opens, stating that a static IP address is required.
7. Click **OK**. The Network window opens.
8. Click **Protocols**.
9. Click **TCP/IP Protocol**. Click **Properties**.
10. Verify that the IP address information is correct. Then click **OK**.
11. Continue to “Setting up a DHCP server”.

**Note:** After you install the DHCP Manager, you can refer to its online help for additional information.

### Setting up a DHCP server

Use the following procedure, along with the information you recorded in Table 20 on page 89, to set up a DHCP server:

1. Click **Start** → **Programs** → **Administrative Tools** → **DHCP Manager**. The DHCP Manager window opens.
2. Create a scope. A scope defines a group of TCP/IP addresses that you want the DHCP server to use to assign to the controllers.
  - a. Click **Local Machine**.
  - b. Click **Scope** → **Create**. The Create Scope - (Local) window opens.

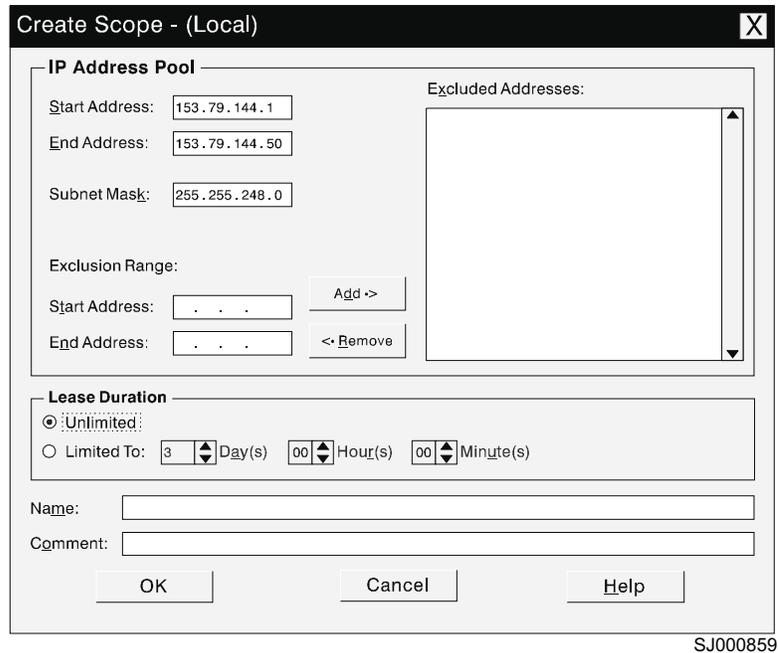


Figure 11. Create Scope - (Local) window

- c. Type the starting and ending IP addresses of the controllers that you are configuring for the network.

For example, if you are configuring 50 controllers on a 153.79.144.0 subnet, set the starting address to 153.79.144.1 and the ending address to 153.79.144.50.

**Note:** If each field does not contain at least three characters, press the period (.) key to advance to the next field. If you have only one controller, type its address for both the starting and ending address.

- d. Type the subnet mask (obtained from your network administrator).
  - e. Set the Lease Duration to **Unlimited**. This makes the DHCP connection permanent.
  - f. Type a scope name and comment.
  - g. Click **OK**.
  - h. When the scope successfully completes, click **Yes** to activate it. This returns you to the DHCP Manager window.
3. Configure global scope options. Table 17 shows the global options that you need to set.

Table 17. Global options for a Windows NT 4.0 DHCP server

Number	Description	Notes
003	Router/Gateway	
006	DNS Server	
012	Host name	Unique for each controller
015	DNS domain name	For example, ibm.com
165	Network Management Station	Defines where the controller should send SNMP alerts

You can apply options to specific controllers later by using step 5 on page 29.

- a. Click **DHCP Options** → **Global**. The DHCP Options: Global window opens.

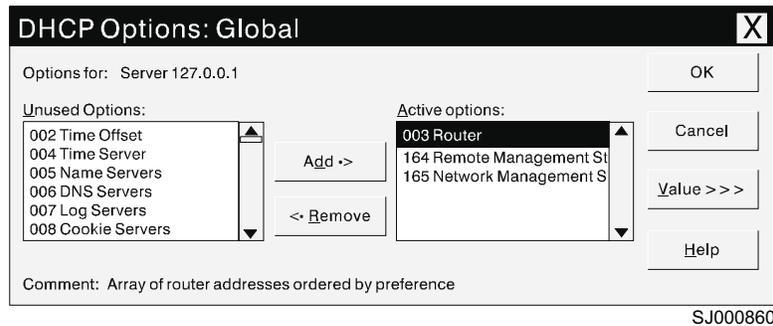


Figure 12. DHCP Options: Global window

- b. To make a global option active, select an item in the Unused Options list. Click **Add** to move it to the Active options list.
- c. Click **Value** to assign a value to the active option.  
If the **Value** field is not available, click **Edit Array**. The Edit Array Editor window opens. Perform one of the following actions:
  - If you need to add an IP address, complete the following procedure:
    - 1) Click **Edit Array**. The IP Address Array Editor window opens.

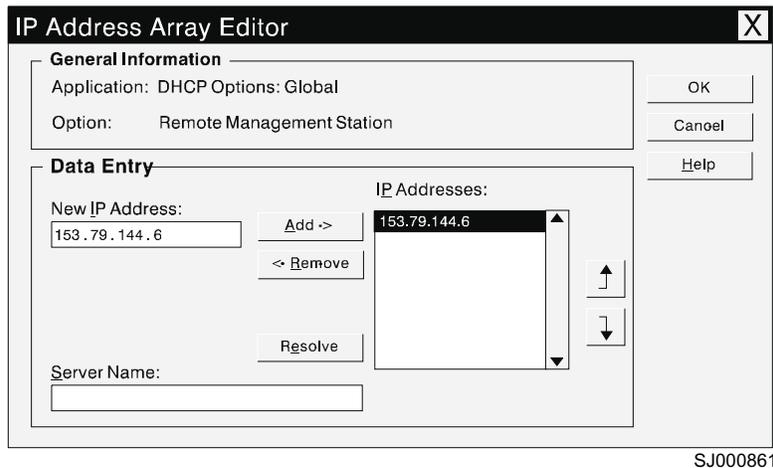


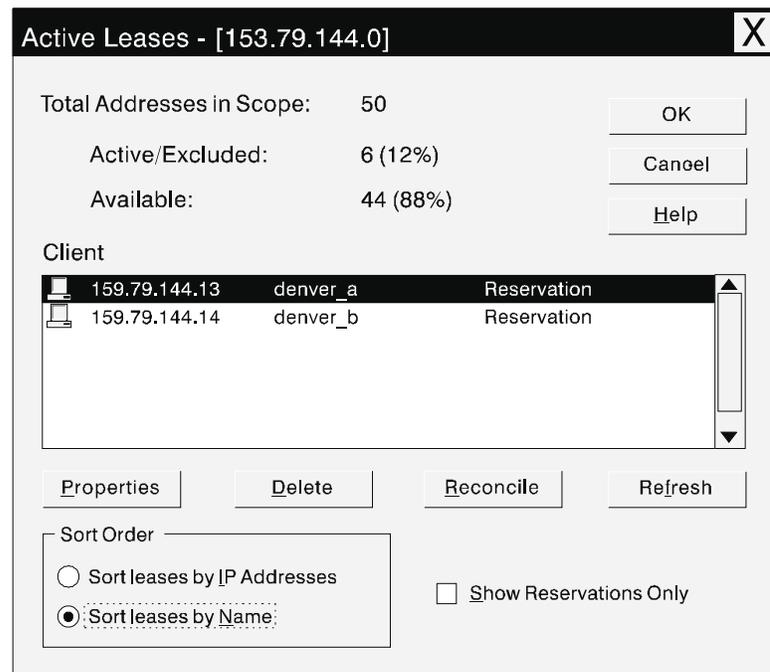
Figure 13. IP Address Array Editor window

- 2) Type a unique IP address for the option that you added.
- 3) Click **Add** to move the New IP Address to the IP Addresses list.
- 4) Click **OK**. This returns you to the DHCP Options: Global window.
- If you do not need to add an IP address, click **Cancel**. This returns you to the DHCP Options: Global window.
- d. Repeat step 3b through step 3c until all global options are added.
- e. When you finish adding the Global Scope Options, click **OK** at the DHCP Options: Global window.
4. Create a reservation for each controller. Use the information record (Table 20 on page 89) to make sure that you include all of the controllers on the network.
  - a. Click **Scope** → **Add Reservations**.

- b. In the **IP Address** field, type the IP address for the first controller on your data sheet.
  - c. In the **Unique Identifier** field, type the controller hardware Ethernet address. Do not type decimal points or spaces.
  - d. In the **Client Name** field, type the controller eight-character name.
  - e. Click **Add**.
  - f. Repeat step 4b on page 29 through step 4e on page 29 for each controller that is listed on the information record (Table 20 on page 89).
  - g. When you finish adding the information for all of the controllers, click **Close**. This returns you to the DHCP Manager window.
5. Configure controller-specific options. By creating a controller-specific option, you can associate a controller configuration entry with a specific controller.

**Note:** If you set an option as **Global Scope**, it applies to every controller in this group and you do not need to add it again.

- a. Click **Scope → Active Leases**. The Active Leases window opens.



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Figure 14. Active Leases window

- b. Select a controller in the list.
- c. Click **Properties**. The Add Option Type window opens. The Unique Identifier is the hardware Ethernet address from step 4c.

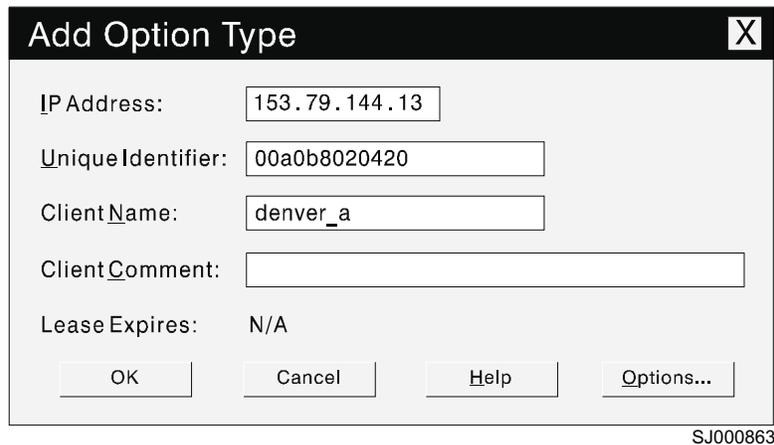


Figure 15. Add Option Type window

- d. Click **Options**. The DHCP Options: Reservations window opens.
  - e. Select an option from the Unused Options list and click **Add** to move it to the Active Options list.
  - f. Click **Value** to assign a value to the active option.
  - g. Type the information for the value of the option. For example, type the host name for the controller from your information record (Table 20 on page 89) in the String field. Click **Edit** if the value that you need to add is an IP address for a router.
  - h. Repeat step 5e through step 5g until you finish adding specific options for this controller.
  - i. Click **OK**. This returns you to the Add Option Type window.
  - j. Click **OK**. This returns you to the Active Leases window.
  - k. Repeat step 5b on page 29 through step 5j until you finish adding controller-specific options for every controller.
  - l. Click **OK** on the Active Leases window. This returns you to the DHCP Manager window.
6. Continue with “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.

## Setting up a Windows 2000 DHCP server

You must use a version of DHCP that supports BOOTP static addressing. To use a DHCP server, you must have a DHCP Manager installed. If a DHCP Manager is installed on the system, go to “Creating a scope and setting up a DHCP server” on page 31.

### Installing the DHCP Manager

To install the DHCP Manager, perform the following steps:

1. Click **Start** → **Administrative Tools** → **Configure Your Server**. The Configure Your Server window opens.
2. In the left pane, double-click **Networking**. Click **DHCP**.
3. In the right pane, click **Start**. The Windows Components Wizard starts.
4. In the **Components** field, select **Networking Services**. Then click **Details**. The Networking Services window opens.

**Note:** Do not select the check box; you do not want to install all of the Networking Services subcomponents.

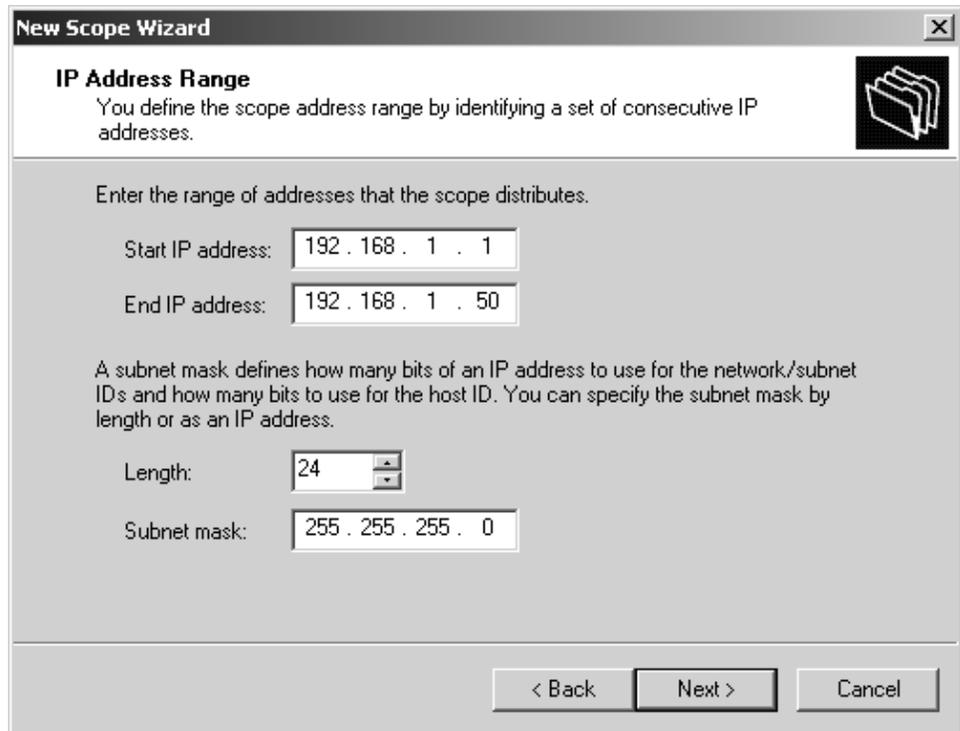
5. In the **Subcomponents of Networking Services** field, select **Dynamic Host Configuration Protocol (DHCP)**.
6. Click **OK**. The Windows Components Wizard window opens.
7. Click **Next** to start the installation process.
8. If prompted, type the full path to the Windows 2000 distribution files and click **Continue**.
9. When the installation has successfully completed, the Windows Components Wizard window closes and the Configure Your Server Window opens.
10. Click **Next**.
11. Click **Open the DHCP Manager**. The DHCP window opens.
12. Continue with step 2 of “Creating a scope and setting up a DHCP server”.

**Note:** After you install the DHCP Manager, you can refer to the DHCP Manager online help for additional information.

### **Creating a scope and setting up a DHCP server**

Use the following procedure to create a scope and to set up a DHCP server. A scope defines a group of controllers by their IP addresses. You must create and configure a scope so that dynamic IP addresses can be assigned to controllers on your network. Refer to the information record (Table 20 on page 89). Before you begin, read through the instructions to determine what information is required. Then request the information from your network administrator.

1. Click **Start → Programs → Administrative Tools → DHCP**. The DHCP window opens.
2. In the Console tree, right-click the server you want to configure; click **New Scope**. The New Scope Wizard starts.
3. Follow the on-screen instructions to define the scope of IP addresses for TCP/IP clients. You will define the following fields:
  - a. Scope name and description
  - b. IP address range for the subnet mask, and the controllers you are configuring.



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Figure 16. New Scope Wizard: IP Address Range window

- c. IP addresses that you want to exclude from the IP address range
- d. IP address lease duration
- e. Common DHCP options:
  - IP address for a router
  - Domain name and DNS servers
4. When you have defined the scope, click **Yes, I want to activate this scope now**. The wizard ends, and the DHCP window appears.
5. In the Console tree, open the scope folder.
6. Right-click **Reservations**. Then select **New Reservations**. The New Reservations window opens.
7. To define the IP address reservation, type the following information:
  - a. Reservation name
  - b. IP address
  - c. Ethernet hardware MAC address
  - d. Description
8. In the **Supported Type** field, select **Both (DHCP and BOOTP)**.
9. Click **Add**.
10. Repeat step 5 through step 9 for each controller in the network.
11. Restart the DHCP server and then restart the storage subsystem so that all modifications are applied.
12. Go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 36.

## Setting up a Novell NetWare DHCP server

A Novell NetWare DHCP server automatically assigns IP addresses and other configuration information to clients upon request or when the clients are restarted.

To set up a Novell NetWare DHCP server, you must complete the following tasks:

1. Install DNS/DHCP Services, either during or after installing NetWare 6.
2. Install the DNS/DHCP Management Console.
3. Create the DHCP server object.
4. Create the subnet address.
5. Create the subnet address range.
6. Create the IP address object.
7. Start the DHCP server.

Each of these tasks is described in detail in the sections that follow.

### **Adding Novell DNS/DHCP Services during the NetWare 6.0 installation:**

Perform the following steps to add Novell DNS/DHCP Services during the Netware installation:

1. From the Installation Options window, select **Custom**.
2. From the Components window, select the **Novell DNS/DHCP Services** check box.
3. Follow the on-screen instructions to complete the NetWare installation.

### **Adding Novell DNS/DHCP Services after the NetWare 6.0 installation:**

Perform the following steps to add Novell DNS/DHCP Services after the Netware installation:

1. Insert the NetWare 6.0 Installation CD into the CD-ROM drive. Then mount the CD as a volume.
2. Load NWCONFIG and select **Product Options**.
3. Select **Install a Product not Listed**.
4. Press F3 and specify the volume name of the CD. The X Server-Graphical Console window opens.
5. In the **Additional Products and Services** dialog box, select the **Novell DNS/DHCP Services** check box.
6. Follow the on-screen instructions to complete installation.

**Note:** Installing the DNS/DHCP Service will extend the Novell Directory Services (NDS) schema and create the following NDS objects:

- DNSDHCP-GROUP Group object
- DNS/DHCP Locator object
- RootServerInfo Zone object

### **Installing the DNS/DHCP Management Console**

Perform the following steps to install the DNS/DHCP Management Console and NetWare Administrator snap-in files on the client workstation you will use to administer DNS and DHCP:

1. If you have not done so, install the latest version of Novell Client 32 on your workstation.
2. From the workstation, run the SYS:PUBLIC\DNSDHCP\SETUP.EXE program.

3. Install the DNS/DHCP Management Console on the local hard-disk drive.
4. Install the NetWare Administrator snap-in files in the SYS:PUBLIC\WIN32 directory.
5. Restart the workstation.
6. To start the DNS/DHCP Management Console, double-click the shortcut icon on the desktop, enter the NDS Tree NAME, and click **Launch**.

**Note:** You can install the DNS/DHCP Management Console on a workstation, or you can access it from the Tools menu of the NetWare Administrator utility.

### Creating the DHCP server object

Use the DHCP Management Console to create a DHCP server object. You can create a DHCP server object under any of the following objects:

- Organization (O)
- Organization Unit (OU)
- Country (C)
- Locality (L)

Perform the following steps to create a DHCP server object:

1. From the DHCP Management Console, click the **DHCP Service** tab.
2. In the left pane, select **Our Network**.
3. Click **Create**. The Create New DHCP Object window opens.
4. Select **DHCP Server**. Click **OK**. The Create DHCP Server window opens.
5. Select a server. Click **Create**. This creates the DHCP server object, called DHCP\_servername, in NDS.
6. In the DHCP Management Console, locate the icon for the DHCP server object at the bottom of the DHCP Service tab. The server object is displayed with a red line through it. The red line indicates that the DHCP server has not been started.
7. Continue with "Creating the DHCP subnet object".

### Creating the DHCP subnet object

Perform the following steps to create a DHCP subnet object for each of the subnets for which you want to assign addresses:

1. In the DNS/DHCP Management Console, click the **DHCP Service** tab.
2. Select **Our Network** or the **DHCP Server Object**.
3. Click **Create**. The Create New DHCP Object window opens.
4. Select **Subnet**. Then click **OK**. The Create Subnet window opens.
5. For each subnet, type the following information:
  - Subnet name
  - NDS context
  - Subnet address
  - Subnet mask
  - Default DHCP Server
6. Click **Create**. The DHCP subnet object is created and displayed in the DNS/DHCP Management Console.

### Creating the subnet address range

Perform the following steps to create a subnet address range object:

1. From the DNS/DHCP Management Console, click the **DHCP Service** tab.

2. Select the subnet object under which you want to create the subnet address range object. Then click **Create**. The Create New DHCP Record window opens.
3. Select **Subnet Address Range**. Then click **OK**. The Create New Subnet Address Range window opens.
4. Type the following information for the subnet address range:
  - Subnet address range name
  - Starting address
  - Ending address
5. Click **Create**.
6. Select the **Define Additional Properties** check box. Then set the Range Type to **Dynamic BOOTP and DHCP**.

### Creating the IP address object

Use the DNS/DHCP Management Console to create IP address objects. You use IP address objects for the following purposes:

- To exclude an IP address from assignment
- To assign an IP address manually to a specific host
- To record dynamic IP address leases

Perform the following steps to create an IP address object:

1. From the DNS/DHCP Management Console, click the **DHCP Service** tab.
2. Select the subnet object of the target IP address. Then click **Create**.
3. Select **IP Address**. Click **OK**. The Create IP Address window opens.
4. In the **IP Address** field, type the IP address for the first controller.
5. In the **Assignment** field, select **Manual**.
6. In the **Client Identifier** field, specify the MAC address.
7. In the **MAC Address** field, enter the hardware Ethernet MAC address for the controller.
8. Select the **Define Additional Properties** check box.
9. In the **Hostname** field, type the eight-character name for the controller.
10. In the Usage field, select **Permanent**.
11. Repeat step 3 through step 10 for each controller.

### Starting the DHCP server

To start the DHCP server, at the DHCP server console, type:

```
LOAD DHCP SRVR
```

The DHCP server can now respond to client requests and assign IP addresses.

#### Notes:

1. To load the DHCP server automatically each time the server starts, place the DHCP SRVR command in the SYS:\SYSTEM\AUTOEXEC.NCF directory.
2. For additional information about setting up, configuring, or using Novell DNS/DHCP Services, refer to the Novell Documentation CD or go to <http://www.novell.com/documentation/>.

## Setting up a UNIX BOOTP server

To use a UNIX BOOTP server, you must set up a BOOTP table. Table 18 on page 36 and the information record (Table 20 on page 89) provide the necessary information.

Table 18. Required entries for setting up the UNIX BOOTP server

Entry	Description	Sample format in BOOTP server
Subnet mask	Mask that is used to route packets to defined subnets	dot notation (sm=255.255.0.0)
Router	IP address of the host computer that routes packets to networks	dot notation (gw=192.168.128.1)
Host name for the controller	Host name that is associated with the controller (refer to Table 20 on page 89)	host name (Denver_a)
IP address	IP address of the controller (refer to Table 20 on page 89)	dot notation (ip=192.168.128.101)
Ethernet address	The Ethernet address of the controller hardware (refer to Table 20 on page 89)	hexadecimal notation (ha=00a0b8020420)

To set up a UNIX BOOTP server, perform the following steps:

1. Use a text editor to edit the **bootptab** file in the /etc directory.  
Use the following example of the BOOTP table to configure the Network A server shown in Figure 4 on page 10:

```
s4.default:\ (common settings)
ht=ether:\
sm=255.255.255.0:\
gw=192.168.128.1:\
hn:
denver_a:\
tc=s4.default:\ (common settings)
ip=192.168.128.101:\
ha=00a0b8020420:
denver_b:\
tc=s4.default:\
ip=192.168.128.102:\
ha=00a0b80000d8:
```

where the s4.default:\ entry denotes settings that are common to all controllers, and the tc=s4.default:\ entry associates this common setting group to a specific controller.

2. If the storage subsystem is running, shut down and then restart the subsystem. This will ensure that the parameters in the BOOTP table take effect.
3. Continue with “Verifying the TCP/IP protocol and setting up the host or DNS table”.

---

## Verifying the TCP/IP protocol and setting up the host or DNS table

Use the following procedure to verify that the TCP/IP protocol software is installed on the management station and to set up the host or DNS table.

**Note:** Make sure that the host names for the controller match the IP addresses for the controllers.

**For Windows NT 4.0, perform the following steps:**

1. Right-click **Network Neighborhood**.
2. Select **Properties**. The Network window opens.

3. Click the **Protocols** tab. If the TCP/IP protocol entry does not appear in the Network Products box, click **Add**. The Select Network Protocol window opens.
4. In the **Network Protocol** field, select **TCP/IP Protocol**.
5. Click **OK**. Then follow the on-screen instructions to install the TCP/IP protocol.
6. Update the DNS table to specify a host name to associate with an IP address.

If you do not have a DNS server, use a text editor to update the hosts file to link the IP address and controller name entries. The following example shows the host tables for the controllers that are connected to Network A as shown in Figure 4 on page 10:

```
# Copyright (c) 1993-1999 Microsoft Corp.
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should be placed
# in the first column followed by the corresponding host name. The IP address
# and the host name should be separated by at least one space.
# Additionally, comments (such as these) might be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
# For example:
# 102.54.94.97 rhino.acme.com # source server
# 38.25.63.10 x.acme.com # x client host
127.0.0.1 local host
192.168.128.101 denver_a
192.168.128.102 denver_b
```

7. If you want to manage storage subsystems through a firewall, configure the firewall to open port 2463 to TCP data.

**For Windows 2000, perform the following steps:**

1. Right-click **My Network Places**.
2. Select **Properties**. The Network and Dial-up Connections window opens.
3. Right-click a defined network connection.
4. Select **Properties**. Make sure that the Internet Protocol TCP/IP box under the Components checked that are used by this connection is marked. If not, mark it, click **Install**, and follow the instructions that display.
5. Update the DNS table to specify a host name to associate with an IP address.  
If you do not have a DNS server, use a text editor to update the hosts file to link the IP address and controller name entries. The following example shows the host tables for the controllers that are connected to Network A as shown in Figure 4 on page 10:

```
# Copyright (c) 1993-1999 Microsoft Corp.
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should be placed
# in the first column followed by the corresponding host name. The IP address
# and the host name should be separated by at least one space.
# Additionally, comments (such as these) might be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
# For example:
# 102.54.94.97 rhino.acme.com # source server
# 38.25.63.10 x.acme.com # x client host
127.0.0.1 local host
192.168.128.101 denver_a
192.168.128.102 denver_b
```

6. To manage storage subsystems through a firewall, configure the firewall to open port 2463 to TCP data.

---

## Chapter 3. Installing software in a standard configuration

This chapter describes how to install the storage-management software in a standard (noncluster) configuration. Before you install the software, make sure that you have read the following information:

- If you intend to configure your system for clustering, see Chapter 4, “Installing the software in a cluster server environment”, on page 49.
- If you have existing storage systems, see “Installation types” on page 12 and “Managing coexisting storage subsystems” on page 15.
- To ensure proper installation, make sure you have completed all preparation tasks described in Chapter 2, “Preparing for installation”, on page 21.

**Important:** Always check for a readme file on any installation media. The readme file contains important information that was not available when the guide was prepared.

---

### New installation process

You must install the Storage Manager 8.3 software components on both host computers and management stations.

**Management station:** A management station is a system that you use to manage the storage subsystem. You can attach it to the storage subsystem in the following ways:

- Through a TCP/IP Ethernet connection to the controllers in the storage subsystem
- Through a TCP/IP network connection to a host computer with host-agent software installed on it, which in turn is directly attached to the storage subsystem through the Fibre Channel input/output (I/O) path

You *must* install storage-management software on a management station in the following order:

1. Microsoft Virtual Machine (Windows NT 4.0 only)
2. Storage Manager 8.3 Client

**Host computer:** A host computer (or host) is a system that is directly attached to the storage subsystem through a Fibre Channel I/O path.

**Important:** Be sure you install the host-bus adapter and driver before you install the storage-management software.

You *must* install storage management software on each host computer in the following order:

1. Microsoft Virtual Machine (Windows NT 4.0 only)
2. Storage Manager 8.3 Client
3. Redundant Disk Array Controller
4. Storage Manager 8.3 Agent
5. Storage Manager 8.3 Utility

If you are installing the Storage Manager software on a Windows NT 4.0 platform, see “Microsoft Virtual Machine” on page 40 to begin the installation.

If you are installing the Storage Manager software on a Windows 2000 platform, see “Storage Manager 8.3 Client” to begin the installation.

---

## Microsoft Virtual Machine

On Windows NT 4.0, Microsoft Virtual Machine is required to support the following components:

- Event Monitor option of Storage Manager 8.3 Client
- Storage Manager 8.3 Agent

To install Microsoft Virtual Machine on management stations and host computers running Windows NT 4.0, perform the following steps:

1. Close all programs.
2. Insert the IBM FASiT Storage Manager version 8.3 CD into the CD-ROM drive.
3. Click **Start → Run**. The Run window opens.
4. Click **Browse**. The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\MSVM\NT folder. Click **Open**.
7. Select the MSJavx86-3805.exe file. Click **Open** and follow the instructions on the screen. The Setup Complete window opens.
8. Click **No, do not restart the system at this time**. Click **Finish**.
9. Continue with “Storage Manager 8.3 Client”.

---

## Storage Manager 8.3 Client

This section describes how to install Storage Manager 8.3 Client on management stations and host computers that run Windows NT 4.0 and Windows 2000.

Before you install the software, make sure that:

- The management station or host computer has at least 40 MB of available disk space.
- (Windows NT 4.0 only) Microsoft Virtual Machine software has been installed on the device.

**Important:** When you install Storage Manager 8.3 Client on a stand-alone host and manage storage subsystems through the Fibre Channel I/O path rather than through the network, you must install the TCP/IP software on the host and assign an IP address to the host.

## Installing Storage Manager 8.3 Client

To install Storage Manager 8.3 Client on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Insert the IBM FASiT Storage Manager version 8.3 CD into the CD-ROM drive.
2. Click **Start → Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SMclient folder. Click **Open**.
6. Select the setup.exe file. Click **Open**. The InstallShield Wizard window opens. The Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.

**Note:** For Windows NT 4.0, ensure that the Microsoft Virtual Machine is installed before you install the Event Monitor.

8. Read the license agreement and click **Yes**. The Event monitor window opens.
9. At the prompt, click **Yes** if you want to install the Event Monitor. The Choose Destination Location window opens.
10. Click **Browse** to change the destination location.
11. Click **Next** to start the installation. When the installation is complete, the Operation Complete window opens.
12. Click **Finish**.
13. Continue with “Verifying the Storage Manager 8.3 Client installation”.

## Verifying the Storage Manager 8.3 Client installation

To verify that Storage Manager Client v08.33.G5.xx is installed correctly on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Click **Start → Programs**.
2. Verify that IBM FAStT Storage Manager Client v08.33.G5.xx appears in the Program list. If the IBM FAStT Storage Manager Client v08.33.G5.xx appears, go to step 3.  
Otherwise, repeat “Installing Storage Manager 8.3 Client” on page 40. If the IBM FAStT Storage Manager Client v08.33.G5.xx still does not appear, a failure has occurred. Contact your IBM technical support representative.
3. If you installed the optional Event Monitor service, go to “Verifying the Event Monitor installation”. Otherwise, continue to step 4.
4. If you are installing Storage Manager 8.3 Client on a host computer, go to “Redundant Disk Array Controller” on page 42. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

## Verifying the Event Monitor installation

This section describes how to verify that the Event Monitor service has been installed correctly on Windows NT 4.0 and Windows 2000.

### Windows NT 4.0

To verify that the Event Monitor service is installed correctly, perform the following steps:

1. Click **Start → Settings → Control Panel**. The Control Panel window opens.
2. Double-click **Services**. The Services window opens.
3. Verify that the IBM FAStT Storage Manager 8 Event Monitor service is displayed with the status Started. If it is not, click **Start**. If the service does not start, reinstall the Storage Manager 8.3 Client. If the failure persists, call your IBM technical support representative.
4. If you are installing the storage-management software on a host computer, go to “Redundant Disk Array Controller” on page 42. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

### Windows 2000

To verify that the Event Monitor service is installed correctly, perform the following steps:

1. Click **Start → Programs → Administrative Tools → Services**. The Services window opens.

2. Verify that the Storage Manager 8 Event Monitor service is displayed with the startup type Automatic and status Started. If it is not, click **Start**. If it does not start, reinstall the Storage Manager 8.3 Client. If the failure persists, call your IBM technical support representative.
3. If you are installing the storage-management software on a host computer, go to “Redundant Disk Array Controller”. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

---

## Redundant Disk Array Controller

This section describes how to install RDAC on Windows NT 4.0 and Windows 2000. RDAC must be installed on each host computer. RDAC contains the multipath device driver that is necessary for controller failover support.

Before you install the software, ensure that the following conditions are met:

- You have Administrator privileges on the host computer.
- The host computer has at least 1 MB of available disk space.
- All programs are closed.
- You have installed the host bus adapter and driver.

If you are installing RDAC on Windows NT 4.0, continue with “Assigning static drive letters”.

If you are installing RDAC on Windows 2000, continue with “Installing the Redundant Disk Array Controller” on page 43.

### Assigning static drive letters

**Important:** Before you install RDAC, you *must* assign static drive letters to existing local drives. Otherwise, problems might occur during new installations and upgrades. When RDAC is installed, the RDAC utility installs the RDAC device driver before the Windows NT 4.0 class driver. If static drive letters have not previously been assigned to local drives, the system will detect storage subsystem arrays and assign them drive letters before detecting and assigning drive letters to local drives. If you have software applications using non-permanent drive letters that are assigned to local drives, and this occurs, application errors will result.

Use the following procedure to manually assign static drive letters on host computers running Windows NT 4.0:

1. Determine how many partitions are on the system. Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and check the number of partitions.
2. Check that the following conditions are met:
  - A boot partition exists.
  - The last partition has been created with Disk Administrator or Disk Management.
  - The partition has an assigned drive letter with either an unknown status or a status other than Unformatted.

If all conditions are met, go to “Installing the Redundant Disk Array Controller” on page 43. Otherwise, continue to step 3.

3. Create a new partition on your local system or on a storage subsystem by using the following procedure:

- a. Select a drive with free space. Click **Partition → Create**. The partition is created with a status of Unformatted and a drive letter is assigned. You can delete or change the logical drive at a later time without causing reassignment of the boot partition.
  - b. Click **Partition → Commit Changes Now**. The partition status changes to Unknown, and static drive letters are assigned to all existing partitions.
4. Continue with “Installing the Redundant Disk Array Controller”.

## Installing the Redundant Disk Array Controller

To install RDAC on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Insert the IBM FASTT Storage Manager version 8.3 CD into the CD-ROM drive.
2. Click **Start → Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select one of the following directories.

For Windows NT 4.0	\Win32\SMrdac\NT
For Windows 2000 Server or Professional	\Win32\SMrdac\W2K

6. Select the setup.exe file. Click **Open**. The InstallShield Wizard window opens. The Welcome window opens. Click **Next**. The End User License Agreement window opens.
7. Click **Yes** to start the installation. After you install RDAC, the InstallShield Wizard Complete window opens.
8. Select **Yes I want to restart my computer now**. Click **Finish**.
9. Continue with “Verifying the RDAC installation”.

## Verifying the Redundant Disk Array Controller installation

This section describes how to verify that you have installed RDAC correctly on Windows NT 4.0 and Windows 2000.

### Windows NT 4.0

To verify that you have installed RDAC correctly, perform the following steps:

**Note:** Make sure that all storage subsystems are connected to the host computer and are powered on.

1. Click **Start → Settings → Control Panel**. The Control Panel window opens.
2. Double-click **Devices**. The Devices window opens.
3. Scroll to symarray.
  - If symarray appears with a device status of Started, go to step 4.
  - If symarray does not appear, an error might have occurred. Repeat the procedure outlined in “Installing the Redundant Disk Array Controller”. If the failure persists, call your IBM technical support representative. Otherwise, go to step 4.
4. Perform one of the following tasks:
  - If you are managing the storage subsystems using the host-agent method, continue with “Storage Manager 8.3 Agent” on page 44.
  - If you are managing your storage subsystems directly, go to “Storage Manager 8.3 Utility” on page 46.

## Windows 2000

To verify that you have installed RDAC correctly, perform the following steps:

1. Click **Start** → **Programs** → **Administrative Tools** → **Computer Management**. The Computer Management window opens. Go to the \System Tools\Software Information\Software environment\drivers directory.
2. Scroll through the list of device drivers until you find rdacfltr.
3. Verify that rdacfltr is displayed with the state type Running and status OK. If it is not, repeat the procedure outlined in “Installing the Redundant Disk Array Controller” on page 43. If the failure persists, call your IBM technical support representative. Otherwise,
  - If you are managing the storage subsystems using the host-agent method, continue with “Storage Manager 8.3 Agent”.
  - If you are managing your storage subsystems using the direct-management method, go to “Storage Manager 8.3 Utility” on page 46.

---

## Storage Manager 8.3 Agent

This section describes how to install Storage Manager 8.3 Agent software on Windows NT 4.0 and Windows 2000. You *must* install the Storage Manager 8.3 Agent software if you want to manage the storage subsystem using the host-agent management method.

Before you install the software, ensure that the following conditions are met:

- You have Administrator privileges on the host computer.
- The host computer has at least 1 MB of available disk space.
- RDAC is installed on each host computer. If not, refer to “Redundant Disk Array Controller” on page 42.
- (For Windows NT 4.0) Microsoft Virtual Machine is installed (refer to “Microsoft Virtual Machine” on page 40).
- All storage subsystems are connected to the host computer and are powered on.

## Installing Storage Manager 8.3 Agent

To install Storage Management 8.3 Agent on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Close all programs.
2. Insert the IBM FASiT Storage Manager version 8.3 CD in the CD-ROM drive.
3. Click **Start** → **Run**. The Run window opens.
4. Click **Browse**. The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\SMagent folder. Click **Open**.
7. Select the setup.exe file. Click **Open**. The InstallShield window opens, showing the status of the file unpacking. The Welcome window opens.
8. Click **Next**. The End User License Agreement window opens.
9. Read the license and click **Yes** to begin the installation. The software installation ends, and the Operation Complete window opens.
10. Click **Finish**.
11. Continue with “Verifying the Storage Manager 8.3 Agent installation” on page 45

## Verifying the Storage Manager 8.3 Agent installation

This section provides instructions on how to verify that you have installed Storage Manager 8 Agent correctly on Windows NT 4.0 and Windows 2000.

### Windows NT 4.0

To verify that you have installed the Storage Manager 8.3 Agent correctly, perform the following steps:

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
2. Double-click **Services**. The Services window opens.
3. Scroll through the list of services until you find IBM FAStT Storage Manager 8 Agent.
  - If IBM FAStT Storage Manager 8 Agent appears with a startup type of Started, close the Services window and continue to step 4.
  - If IBM FAStT Storage Manager 8 Agent does not appear with a startup type of Started, click **Start**. If the status changes to Started, go to step 4. If not, refer to Table 19 on page 85 for a possible cause. Otherwise, reinstall IBM FAStT Storage Manager 8.3 Agent. If the problem persists, contact your IBM technical support representative.
4. Perform one of the following procedures:
  - If you plan to use the host-agent software to manage one or more storage subsystems, go to “Storage Manager 8.3 Utility” on page 46.
  - If you do not plan to use the host-agent software to manage one or more storage subsystems, perform the following procedures to disable the host-agent service:
    - a. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
    - b. Double-click **Services**. The Services window opens.
    - c. From the list of displayed services, right-click **IBM FAStT Storage Manager 8 Agent**.
    - d. Click **Properties** → **Startup Type** → **Manual**.
    - e. Click **OK**.
5. Continue with “Storage Manager 8.3 Utility” on page 46.

### Windows 2000

To verify that you have installed the Storage Manager 8 Agent correctly, perform the following steps:

**Note:** Make sure that all storage subsystems are connected to the host computer and are powered on.

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
2. Scroll through the list of services until you find IBM FAStT Storage Manager 8 Agent.
3. If IBM FAStT Storage Manager 8 Agent does not appear with a startup type of Started, click **Start**. If the status changes to Started, go to step 4. If not, refer to Table 19 on page 85 for a possible cause. Otherwise, reinstall IBM FAStT Storage Manager 8.3 Agent. If the problem persists, contact your IBM technical support representative.
4. Perform one of the following steps:
  - If you plan to use the host-agent software to manage one or more storage subsystems, go to “Storage Manager 8.3 Utility” on page 46.

- If you do not plan to use the host-agent software to manage one or more storage subsystems, perform the following procedure to disable the host-agent service:
  - a. Click **Start** → **Programs** → **Administrative Tools** → **Computer Management**. The Computer Management window opens.
  - b. Click **Services**.
  - c. From the list of displayed services, right-click **IBM FAStT Storage Manager 8 Agent**.
  - d. Click **Properties** → **Startup Type** → **Manual**.
  - e. Click **OK**.
- 5. Continue with “Storage Manager 8.3 Utility”.

---

## Storage Manager 8.3 Utility

This section describes how to install Storage Manager 8.3 Utility on host computers that run both Windows NT 4.0 and Windows 2000. This component contains utilities that will register and map new logical drives to the operating systems.

### Installing Storage Manager 8.3 Utility

To install Storage Manager 8.3 Utility on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Close all programs and insert the IBM FAStT Storage Manager version 8.3 installation CD in the CD-ROM drive.
2. Click **Start** → **Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SMutil folder. Click **Open**.
6. Select the setup.exe file. Click **Open**. The InstallShield Wizard window opens, displaying the status of the files unpacking. The Welcome window opens.
7. Click **Next**.
8. The End User License Agreement window opens. Click **Yes** to begin the installation. After the installation is complete, the Operation Complete window opens.
9. Click **Finish**.
10. Continue with “Verifying the Storage Manager 8.3 Utility installation”.

### Verifying the Storage Manager 8.3 Utility installation

To verify that you have installed the Storage Manager 8.3 Utility correctly on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Go to the following directory:

*installation\_directory*\IBM\_FAStTUtil

where *installation\_directory* is the directory where you installed the Storage Manager 8.3 Utility.

2. Verify that the directory contains the following files:
  - hot\_add.exe
  - SMdevices.bat
  - SMflashcopyassist.exe

If it does not, reinstall the Storage Manager 8.3 Utility by using the procedure outlined in “Installing Storage Manager 8.3 Utility” on page 46. If the problem persists, contact your IBM technical support representative.

3. Go to Chapter 5, “Completing the installation”, on page 67.



---

## Chapter 4. Installing the software in a cluster server environment

This chapter describes how to install the storage-management software in a cluster server environment. Before you install the software, make sure that you have read the following information:

- If you have existing storage systems, read “Installation types” on page 12 and “Managing coexisting storage subsystems” on page 15.
- If you are upgrading from a previous version of Storage Manager on an existing cluster, go to “Upgrading from a previous version of the storage-management software” on page 60.
- To ensure proper installation, complete all preparation tasks described in Chapter 2, “Preparing for installation”, on page 21.

**Important:** Always check for a readme file on any installation media. A readme file contains important information that was not available when this guide was prepared.

---

### Preinstallation considerations

The hardware installation involves installing host adapters and storage subsystems. Before you begin the installation of the software, make sure that all hardware components are installed correctly for the cluster server configuration.

### Configuration options

You can connect the storage subsystem to the cluster nodes either directly or through Fibre Channel switches. Both configurations offer full redundancy. The following figure illustrates both configurations.

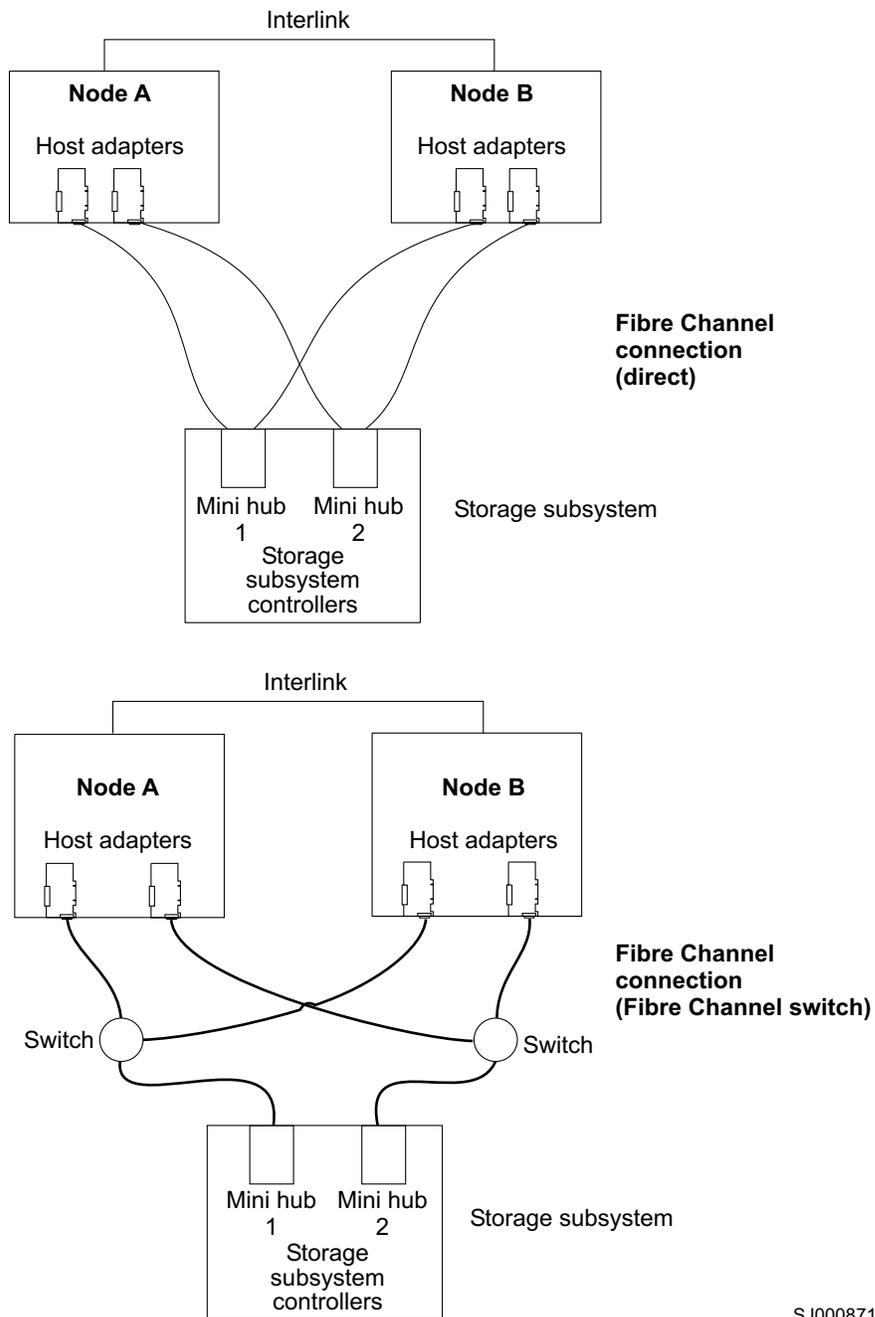


Figure 17. Installing the storage subsystem on a Fibre Channel network

## Host adapters

Refer to the appropriate host-adaptor documentation for specific installation requirements and procedures. The following considerations apply:

- To use the dual-path configuration, perform the following tasks:
  - Install two host adapters in each node.
  - Run two Fibre Channel cables from each node to the storage subsystem.

- If you connect the storage subsystem through a Fibre Channel Arbitrated Loop (FC-AL), ensure that every adapter on the loop has been assigned a unique hard ID. For instructions about changing hard IDs, refer to the documentation provided with your host adapters.
- The correct device driver is installed for the host adapter. Refer to the readme file in the \Host\_Adapter directory on the IBM FASTT Storage Manager version 8.3 CD for information on supported host adapters and device drivers.

## Storage subsystems

Refer to the appropriate hardware documentation for specific installation requirements and procedures. If you are managing storage subsystems directly, you must connect Ethernet cables to both controllers in each storage subsystem.

---

## Overview: Installing the storage-management software in a cluster environment

Perform the following steps to install the storage-management and cluster service software on Windows NT 4.0 and Windows 2000:

1. Be sure that the host bus adapter and driver are installed in each cluster node.
2. Power down node B. Start node A.
3. Install the storage-management software on node A. Refer to “Installing the storage-management software” on page 52 for instructions.
4. Complete the procedures detailed in Chapter 5, “Completing the installation”, on page 67.
5. Run the Hot Add utility on node A. Refer to “Using the Hot Add utility” on page 80 for instructions.

**Note:** You might have to restart node A in order to see the newly-added logical drives.

6. Format all shared logical drives as NTFS (NT File System), assign volume labels, and specify a drive letter for each.

**Important:** You must assign a permanent (sticky) drive letter to the shared logical drive on both cluster nodes. The two nodes must have the same drive letters on each shared drive. If you do not assign permanent drive letters, Windows might assign different drive letters on each node. Assigning a permanent drive letter ensures that Windows assigns the same drive letter to the partition on both cluster nodes.

7. Shut down node A. Start node B.
8. Install the storage-management software on node B. Refer to “Installing the storage-management software” on page 52 for instructions.
9. To verify the drive letters for the cluster configuration, perform one of the following procedures:
  - For Windows NT 4.0, click **Start → Programs → Administrative Tools → Disk Administrator**.
  - For Windows 2000, perform the following steps:
    - a. Click **Start → Programs → Administrative Tools → Computer Management**. The Computer Management window opens.
    - b. Click **Storage → Disk Management**.
10. Verify that the following conditions are met:
  - The same logical drives appear on each cluster node.

- Each cluster node has the same number of partitions defined on the logical drives.
  - Drive letters are assigned to the configured logical drives.
  - The drive letters on the partitions are the same on both cluster nodes.
11. Shut down node B.
  12. Install the cluster server software. Refer to “Installing the cluster server software” on page 59 for instructions.
  13. Go to Chapter 5, “Completing the installation”, on page 67.

---

## Installing the storage-management software

This section describes how to install the storage-management software on Windows NT 4.0 and Windows 2000. Before you begin an installation with existing storage subsystems, refer to your hardware installation documentation for the specific configuration. A specific configuration might be required for your hardware to support the storage-management software in a cluster configuration.

You must install the Storage Manager 8.3 software components on both management stations and cluster nodes.

**Management station:** A management station is a system that is used to manage the storage subsystem. It can be attached to the storage subsystem in the following ways:

- Through a TCP/IP Ethernet connection to the controllers in the storage subsystem
- Through a TCP/IP network connection to a cluster node with the host-agent software installed

You must install storage-management software on a management station in the following order:

1. Microsoft Virtual Machine (Windows NT 4.0 only)
2. Storage Manager 8.3 Client

**Cluster node:** The cluster nodes are directly attached to the storage subsystem through a Fibre Channel I/O path.

You must install storage management software on each cluster node in the following order:

1. Microsoft Virtual Machine (Windows NT 4.0 only)
2. Storage Manager 8.3 Client
3. Redundant Disk Array Controller
4. Storage Manager 8.3 Agent
5. Storage Manager 8.3 Utility

If you are installing the Storage Manager software on a Windows NT 4.0 platform, see “Installing the Microsoft Virtual Machine in Windows NT 4.0” on page 53 to begin the installation.

If you are installing the Storage Manager software on a Windows 2000 platform, see “Installing the Storage Manager 8.3 Client” on page 53 to begin the installation.

## Installing the Microsoft Virtual Machine in Windows NT 4.0

On Windows NT 4.0, Microsoft Virtual Machine is required to support the following components:

- Event Monitor option of Storage Manager 8.3 Client
- Storage Manager 8.3 Agent

To install Microsoft Virtual Machine on management stations or cluster nodes, perform the following steps:

1. Close all programs.
2. Insert the IBM FAStT Storage Manager version 8.3 CD into the CD-ROM drive.
3. Click **Start → Run**. The Run window opens.
4. Click **Browse**. The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\MSVM\NT folder; then, click **Open**.
7. Select the MSJavx86-3805.exe file; then, click **Open**.
8. Click **Finish** and follow the instructions on the screen. When the software is installed, the Setup Complete window opens.
9. Click **No, do not restart the system at this time**.
10. Continue with “Installing the Storage Manager 8.3 Client”.

## Installing the Storage Manager 8.3 Client

This section provides instructions for installing Storage Manager 8.3 Client on management stations and cluster nodes that run on Windows NT 4.0 and Windows 2000.

Before you install the software, make sure that:

- The management station or host computer has at least 40 MB of available disk space.
- All programs are closed.
- For Windows NT 4.0 systems, that the Microsoft Virtual Machine software has been installed on the device. Refer to “Installing the Microsoft Virtual Machine in Windows NT 4.0”.

**Important:** When you install Storage Manager Client on a stand-alone host and manage storage subsystems through the Fibre Channel I/O path rather than through the network, you must install the TCP/IP software on the host and assign an IP address to the host.

### Installing Storage Manager 8.3 Client

To install Storage Manager 8.3 Client on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Insert the IBM FAStT Storage Manager version 8.3 CD into the CD-ROM drive.
2. Click **Start → Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SMclient folder; then, click **Open**.
6. Select the setup.exe file; then, click **Open**. The InstallShield Wizard window opens. The Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.

**Note:** For Windows NT 4.0, ensure that the Microsoft Virtual Machine is installed before you install the Event Monitor.

8. Read the license agreement and click **Yes**. The Event monitor window opens.
9. At the prompt, click **Yes** if you want to install the Event Monitor. The Choose Destination Location window opens.
10. Click **Browse** to change the destination location.
11. Click **Next** to start the installation. When the installation is complete, the Operation Complete window opens.
12. Click **Finish**.
13. Continue with “Verifying the Storage Manager 8.3 Client installation”.

### **Verifying the Storage Manager 8.3 Client installation**

Perform the following steps to verify that the Storage Manager 8.3 Client v08.33.G5.xx software is installed correctly on Windows NT 4.0 and Windows 2000:

1. Click **Start** → **Programs**.
2. Verify that the Storage Manager Client v08.33.G5.xx appears in the Program list. If the Storage Manager Client v08.33.G5.xx appears, go to step 3. Otherwise, repeat “Installing Storage Manager 8.3 Client” on page 53. If the Storage Manager Client v08.33.G5.xx still does not appear, a failure occurred. Contact your IBM technical support representative.
3. If you installed the optional Event Monitor service, go to “Verifying the Event Monitor installation”. Otherwise, continue to step 4.
4. If you are installing Storage Manager 8.3 Client on a host computer, go to “Redundant Disk Array Controller” on page 55. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

### **Verifying the Event Monitor installation**

This section describes how to verify that you installed the Event Monitor correctly on Windows NT 4.0 and Windows 2000.

**Windows NT 4.0:** To verify that you installed the Event Monitor service correctly on Windows NT 4.0, perform the following steps:

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
2. Double-click **Services**. The Services window opens.
3. Verify that Storage Manager 8 Event Monitor service is displayed with the status Started. If it is not, click **Start**. If the service does not start, reinstall the Storage Manager 8.3 Client. If the failure persists, call your IBM technical support representative.
4. If you are installing the storage-management software on a cluster node, go to “Redundant Disk Array Controller” on page 55. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

**Windows 2000:** To verify that you installed the Event Monitor service correctly on Windows 2000, perform the following steps:

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
2. Verify that the Storage Manager 8 Event Monitor service is displayed with the startup type Automatic and status Started. If it is not, click Start. If the service does not start, reinstall the Storage Manager 8.3 Client. If the failure persists, call your IBM technical support representative.

3. If you are installing the storage-management software on a host computer, go to “Redundant Disk Array Controller”. Otherwise, go to Chapter 5, “Completing the installation”, on page 67.

## Redundant Disk Array Controller

This section describes how to install RDAC on Windows NT 4.0 and Windows 2000. RDAC must be installed on each cluster node. RDAC contains the multipath device driver that is necessary for controller failover support.

Before you install the software, ensure that the following conditions are met:

- You have Administrator privileges on the cluster nodes.
- Each cluster node has at least 1 MB of available disk space.
- You close all programs.
- The appropriate host bus adapter driver is installed.

If you are installing RDAC on Windows NT 4.0, continue with “Assigning static drive letters”.

If you are installing RDAC on Windows 2000, continue with “Installing the Redundant Disk Array Controller” on page 56.

### Assigning static drive letters

**Important:** Before you install RDAC, you *must* assign static drive letters to existing local drives. Otherwise, problems might occur during new installations and upgrades. When RDAC is installed, the RDAC utility installs the RDAC device driver before the Windows NT 4.0 class driver. If static drive letters have not previously been assigned to local drives, the system will detect storage subsystem arrays and assign them drive letters before detecting and assigning drive letters to local drives. If this occurs and you have software applications that use non-permanent drive letters that are assigned to local drives, application errors will result.

Use the following procedure to manually assign drive letters on cluster nodes running Windows NT 4.0:

1. Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and check the number of partitions.
2. Check that the following conditions are met:
  - A boot partition exists.
  - The last partition has been created with Disk Administrator or Disk Management.
  - The partition has an assigned drive letter and either an unknown status or a status other than Unformatted.

If all conditions are met, go to “Installing the Redundant Disk Array Controller” on page 56. Otherwise, continue to step 3.

3. Create a new partition on your local system or on a storage subsystem using the following procedure:
  - a. Select a drive with free space; then, click **Partition** → **Create**. The partition is created with a status of Unformatted and a drive letter is assigned. You can delete or change the logical drive at a later time without causing reassignment of the boot partition.
  - b. Click **Partition** → **Commit Changes Now**. The partition status changes to Unknown, and static drive letters are assigned to all existing partitions.

4. Continue with “Installing the Redundant Disk Array Controller”.

### Installing the Redundant Disk Array Controller

To install RDAC on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Insert the IBM FASiT Storage Manager version 8.3 CD into the CD-ROM drive.
2. Click **Start** → **Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select one of the following directories.

For Windows NT 4.0 Enterprise Edition	\Win32\SMrdac\NT
Windows 2000 Advanced Server	\Win32\SMrdac\W2K

6. Select the setup.exe file; then, click **Open**. The InstallShield window opens, showing the file unpacking. The Welcome window opens.
7. Click **Next** to begin the installation. After installing RDAC, the InstallShield Wizard window opens.
8. Click **Yes** to restart your computer.
9. Continue with “Verifying the RDAC installation”.

### Verifying the Redundant Disk Array Controller installation

The following sections describes how to verify that you installed RDAC correctly on Windows NT 4.0 and Windows 2000.

**Windows NT 4.0:** To verify that you installed RDAC correctly on Windows NT 4.0, perform the following steps:

**Note:** Make sure that all storage subsystems are connected to the host computer and are powered on.

1. Click **Start** → **Settings** → **Control Panel**. A Control Panel window opens, double-click **Devices**.
2. When the Devices window opens, scroll to symarray.
  - If symarray appears with a device status of Started, go to step 3.
  - If symarray does not appear, an error might have occurred. Repeat the procedure outlined in “Installing the Redundant Disk Array Controller”. If the failure persists, call your IBM technical support representative. Otherwise, go to step 3.
3. Perform one of the following procedures:
  - If you are managing the storage subsystems using the host-agent method, continue with “Storage Manager 8.3 Agent software” on page 57.
  - If you are managing your storage subsystems directly, go to “Storage Manager 8.3 Utility software” on page 59.

**Windows 2000:** To verify that you installed RDAC correctly on Windows 2000, perform the following steps:

**Note:** Make sure that all storage subsystems are connected to the host computer and are powered on.

1. Click **Start** → **Programs** → **Administrative Tools** → **Computer Management**. The Computer Management window opens. Go to the \System Tools\System Information\Software environment\Drivers directory.

2. Scroll through the list of device drivers until you find rdacfltr.
3. Verify that rdacfltr is displayed with the state type Running and status OK. If it is not, repeat the procedure outlined in “Installing the Redundant Disk Array Controller” on page 56. If the failure persists, call your IBM technical support representative. Otherwise, go to step 4.
4. Perform one of the following procedures:
  - If you are managing the storage subsystems using the host-agent method, continue with “Storage Manager 8.3 Agent software”.
  - If you are managing your storage subsystems directly, go to “Storage Manager 8.3 Utility software” on page 59.

## Storage Manager 8.3 Agent software

The following section describes how to install the Storage Manager 8.3 Agent software on Windows NT 4.0 or Windows 2000. You *must* install the Storage Manager 8.3 Agent software if you want to manage the storage subsystem using the host-agent method.

Before you install the software on Windows NT 4.0 or Windows 2000, ensure that the following conditions are met:

- You have Administrator privileges on the cluster nodes.
- Each cluster node has at least 1 MB of available disk space.
- You have installed RDAC on each cluster node. If you have not done so, refer to “Redundant Disk Array Controller” on page 55.
- (For Windows NT 4.0) You have installed Microsoft Virtual Machine (refer to “Installing the Microsoft Virtual Machine in Windows NT 4.0” on page 53).

### Installing Storage Manager 8.3 Agent

To install Storage Management 8.3 Agent on Windows NT 4.0 or Windows 2000, perform the following steps:

1. Close all programs.
2. Insert the IBM FAST Storage Manager version 8.3 CD in the CD-ROM drive.
3. Click **Start** → **Run**. The Run window opens.
4. Click **Browse**. The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\SMagent folder; then, click **Open**.
7. Select the setup.exe file; then, click **Open**. The InstallShield window opens, showing the status of the file unpacking. The Welcome window opens.
8. Click **Next**. The End User License Agreement window opens.
9. Read the license and click **Yes** to begin the installation. The software installation ends, and the Operation Complete window opens.
10. Click **Finish**.
11. Continue with “Verifying the Storage Manager 8.3 Agent”.

### Verifying the Storage Manager 8.3 Agent

The following section describes how to verify that you installed the Storage Manager 8.3 Agent correctly on Windows NT 4.0 and Windows 2000.

**Windows NT 4.0:** To verify that you installed the Storage Manager 8.3 Agent correctly on Windows NT 4.0, perform the following steps:

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
2. Double-click **Services**. The Services window opens.

3. Scroll through the list of services until you find Storage Manager 8 Agent.
  - If Storage Manager 8 Agent appears with a startup type of Started, close the Services window, and continue to step 4.
  - If Storage Manager 8 Agent does not appear with a startup type of Started, click **Start**. If the status changes to Started, go to step 4 on page 45. If not, refer to Table 19 on page 85 for a possible cause. Otherwise, reinstall Storage Manager 8.3 Agent. If the problem persists, contact your IBM technical support representative.
4. Perform one of the following procedures:
  - If you plan to use the host-agent software to manage one or more storage subsystems, go to “Storage Manager 8.3 Utility software” on page 59.
  - If you do not plan to use the host-agent software to manage one or more storage subsystems, perform the following steps to disable the host-agent service:
    - a. Click **Start → Programs → Administrative Tools → Manage**. The Computer Management window opens.
    - b. Click **Services**.
    - c. From the list of displayed services, right-click **Storage Manager 8 Agent**.
    - d. Click **Properties → Startup Type → Manual**.
    - e. Click **OK**.
5. Continue with “Storage Manager 8.3 Utility software” on page 59.

**Windows 2000:** To verify that you installed the Storage Manager 8.3 Agent correctly on Windows 2000, perform the following steps:

1. Click **Start → Programs → Administrative Tools → Services**. The Services window opens.
2. Scroll through the list of services until you find Storage Manager 8 Agent.
3. Verify that Storage Manager 8 Agent is displayed with the startup type Automatic and status Started. If Storage Manager 8 Agent does not appear with a startup type of Started, click **Start**. If the status changes to Started, go to step 4 on page 45. If not, refer to Table 19 on page 85 for a possible cause. Otherwise, reinstall Storage Manager 8.3 Agent. If the problem persists, contact your IBM technical support representative.
4. Perform one of the following procedures:
  - If you plan to use the host-agent software to manage one or more storage subsystems, go to “Storage Manager 8.3 Utility software” on page 59.
  - If you do not plan to use the host-agent software to manage one or more storage subsystems, perform the following procedure to disable the host-agent service:
    - a. Click **Start → Programs → Administrative Tools → Computer Management**. The Computer Management window opens.
    - b. Click **Services**.
    - c. From the list of displayed services, right-click **Storage Manager 8 Agent**.
    - d. Click **Properties → Startup Type → Manual**.
    - e. Click **OK**.
5. Continue with “Storage Manager 8.3 Utility software” on page 59.

## Storage Manager 8.3 Utility software

This section provides instructions for installing the Storage Manager 8.3 Utility software on cluster nodes that run Windows NT 4.0 and Windows 2000. This component contains utilities that will register and map new logical drives to the operating systems.

### Installing Storage Manager 8.3 Utility

To install Storage Manager 8.3 Utility on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Close all programs and insert the IBM Storage Manager version 8.3 installation CD in the CD-ROM drive.
2. Click **Start → Run**. The Run window opens.
3. Click **Browse**. The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SMutil folder. Then click **Open**.
6. Select the setup.exe file. Then click **Open**. The InstallShield Wizard window opens, displaying the status of the files unpacking. The Welcome window opens.
7. Click **Next**.
8. The End User License Agreement window opens. Click **Yes** to begin the installation. After the installation is complete, the Operation Complete window opens.
9. Click **Finish**.
10. Continue with “Verifying the Storage Manager 8.3 Utility installation” on page 46.

### Verifying the Storage Manager 8.3 Utility installation

To verify that you installed the Storage Manager 8.3 Utility correctly on Windows NT 4.0 and Windows 2000, perform the following steps:

1. Go to the following directory:

*installation\_directory\IBM\_FAST\Util*

where *installation\_directory* is the directory where you installed the Storage Manager 8.3 Utility.

2. Verify that the directory contains the following files:

- hot\_add.exe
- SMdevices.bat
- SMflashcopyassist.exe

If it does not, reinstall the Storage Manager 8.3 Utility using the procedure outlined in “Installing Storage Manager 8.3 Utility” on page 46. If the problem persists, contact your IBM technical support representative.

3. Go to “Overview: Installing the storage-management software in a cluster environment” on page 51.

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## Installing the cluster server software

The following section describes how to install the cluster server software on Windows NT 4.0 and Windows 2000. **Important:** Do not perform this procedure unless you installed the necessary storage-management software components on both cluster nodes.

To install the cluster server software on Nodes A and B, perform the following steps:

1. Install the cluster server software on Node A, as follows:
  - a. Refer to the appropriate Microsoft Cluster Server (MSCS) documentation for the correct procedure to install the cluster server software.

**Note:** During installation, specify that you want to form a new cluster.

- b. After the system restarts, leave Node A running.
2. Install the cluster server software on Node B, as follows:
  - a. Refer to the appropriate MSCS documentation for the correct procedure to install the Cluster Server software.

**Note:** During installation, specify that you want to join the existing cluster.

- b. After the system restarts, leave Node B running.
3. After installing MSCS, perform one of the following tasks:
  - For systems running Windows NT 4.0, reinstall Service Pack 6a.
  - For systems running Windows 2000, reinstall Service Pack 3.

**Note:** Refer to Microsoft knowledge base article Q174799 for more information about installing a service pack in a cluster environment.

4. Verify the software installation, as follows:
  - a. On either node A or node B, click **Start** → **Programs** → **Administrative Tools** → **Cluster Administration**.
  - b. In the **Cluster** or **Server Name** field, type either the name of the cluster or the name or IP address of one of the nodes.

If the installation is successful, the computer names of both nodes appear on the left side of the Cluster Administrator window.
  - c. Make sure that the cluster disk groups can be moved between cluster nodes.
5. If both node names do not appear on the left side of the Cluster Administrator window, reinstall the cluster server software. If the problem persists, contact your IBM technical support representative.

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## Upgrading from a previous version of the storage-management software

Be sure that you are familiar with the steps required in a new installation before you continue with the following upgrade procedure.

Choose one of the following two procedures:

- **Performing a scheduled upgrade:** A scheduled upgrade requires scheduling downtime on your cluster server to upgrade the controller firmware and storage-management software. The services and resources offered by the cluster are not available during the upgrade.

**Note:** The scheduled upgrade is the preferred procedure for upgrading a cluster server configuration.

- **Performing a rolling upgrade:** A rolling upgrade requires upgrading the storage-management software first in node A and then in node B, so that the services and resources offered by the cluster are always available.

**Important:** Do not upgrade your storage subsystem firmware until you have upgraded the storage-management software on all cluster nodes and management stations. If you upgrade your storage subsystem controller firmware to version 05.3x.xx.xx, you will not be able to communicate with the controller until you have upgraded to Storage Manager 8.3 software on your management station and cluster nodes. Previously installed versions of Storage Manager will not recognize controllers running version 05.3x.xx.xx firmware.

## Performing a scheduled upgrade

To perform a scheduled upgrade from Storage Manager version 7.xx, 8.0, or 8.2x to Storage Manager 8.3 on machines that are running Windows NT 4.0 or Windows 2000, perform the following procedures:

1. Before installing the storage-management software, perform the following steps:
  - a. Click **Start → Programs → Administrative Tools → Services**. The Services window opens.
  - b. From the list of displayed services, right-click the cluster server. Then click **Manual**.
  - c. Stop the cluster server on all nodes in the cluster configuration.
2. Shut down node B.
3. From node A, uninstall the components from the previous version of the storage-management software. To uninstall the storage-management software for Storage Manager version 7.x, 8.0, or 8.2x see “Uninstalling storage-management software components” on page 82.

**Note:** Uninstall the storage-management components in the following order:

- a. Storage Manager Agent
  - b. Storage Manager Utility
  - c. Redundant Disk Array Controller
  - d. Storage Manager Client
4. Verify that the IBM host adapter device driver versions are current. If they are not current, refer to the readme file located in the \Host\_Adapter directory on the installation CD and upgrade the device drivers.
  5. Install the Storage Manager 8.3 Client on node A. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
  6. Install the Redundant Disk Array Controller on node A. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
  7. Install the Storage Manager 8.3 Agent on node A. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
  8. Install the Storage Manager 8.3 Utility on node A. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
  9. Shut down node A.
  10. Restart node B.
  11. From node B, uninstall the components from the previous version of the storage-management software. To uninstall the storage-management software for Storage Manager version 7.x, 8.0 or 8.2x, refer to “Uninstalling storage-management software components” on page 82.
  12. Verify that the IBM host adapter device driver versions are current. If they are not current, refer to the readme file located in the \Host\_Adapter directory on the installation CD and upgrade the device driver versions before continuing.

13. Install the Storage Manager 8.3 Client on node B. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
14. Install the Redundant Disk Array Controller on node B. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
15. Install the Storage Manager 8.3 Agent on node B. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
16. Install the Storage Manager 8.3 Utility on node B. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
17. Shut down node B.
18. Start up one node at a time and complete the following procedure:
  - a. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
  - b. From the list of displayed services, right-click the cluster server. Click **Automatic** to change the cluster server startup option.
  - c. Start the cluster server service on node B.
19. Go to Chapter 5, “Completing the installation”, on page 67.

## Performing a rolling upgrade

This section describes how to perform a rolling upgrade on Windows NT 4.0 and Windows 2000.

**Important:** If you have applications installed in the cluster server environment that do not support a rolling upgrade, perform one of the following tasks:

- Put those resources offline before the upgrade; then, put them back online after the upgrade.
- Perform a scheduled upgrade. A scheduled upgrade requires scheduling downtime on your cluster server to upgrade the controller firmware and storage-management software.

To perform a rolling upgrade from Storage Manager version 7.xx, 8.0, or 8.2x to Storage Manager 8.3 on machines that are running Windows NT 4.0 and Windows 2000, perform the following steps:

1. From node A, open Cluster Administrator.
2. Double-click the Active Groups folder in the right pane of the Cluster Administrator window.
3. Select each group listed and move them to node B.
4. Select node A. Then click **File** → **Pause Node** to pause cluster service in node A.
5. From node A, uninstall the components from the previous version of the software. To uninstall the software for Storage Manager version 7.x, 8.0 or 8.2x, refer to “Uninstalling storage-management software components” on page 82.

**Note:** Uninstall the components in the following order:

- a. Storage Manager Agent
- b. Storage Manager Utility
- c. Redundant Disk Array Controller
- d. Storage Manager Client

6. Verify that the IBM host adapter device driver versions are current. If they are not current, refer to the readme file located in the \Host\_Adapter directory on the installation CD and upgrade the device drivers.
7. Install the Storage Manager 8.3 Client on node A. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
8. Install the Redundant Disk Array Controller on node A. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
9. Install the Storage Manager 8.3 Agent on node A. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
10. Install the Storage Manager 8.3 Utility on node A. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
11. Run Cluster Administrator. Then click **File** → **Resume Node** to resume cluster service in node A.
12. From node B, open Cluster Administrator.
13. Double-click the Active Groups folder in the right pane of the Cluster Administrator window.
14. Select each group listed and move them to node A.
15. Select node B. Then click **File** → **Pause Node** to pause cluster service in node B.
16. From node B, uninstall the components from the previous version of the software. To uninstall the storage-management software for Storage Manager version 7.x, 8.0 or 8.2x, refer to “Uninstalling storage-management software components” on page 82.
17. Verify that the IBM host adapter device driver versions are current. If they are not current, refer to the readme file located in the \Host\_Adapter directory on the installation CD and upgrade the device drivers.
18. Install the Storage Manager 8.3 Client on node B. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
19. Install the Redundant Disk Array Controller on node B. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
20. Install the Storage Manager 8.3 Agent on node B. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
21. Install the Storage Manager 8.3 Utility on node B. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
22. Run Cluster Administrator. Then click **File** → **Resume Node** to resume cluster service in node B.
23. Go to Chapter 5, “Completing the installation”, on page 67.

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## Upgrading from Windows NT 4.0 to Windows 2000 in a standard configuration

If you have an existing storage subsystem running Windows NT 4.0, you can upgrade to Windows 2000 if the following conditions apply:

- Your storage subsystem is *not* the startup (boot) device.
- Your controllers are running firmware versions 04.00.00.00 or later.

**Attention:** To avoid possible data loss, you must uninstall any previous versions of the storage-management software (refer to “Uninstalling storage-management software components” on page 82) before upgrading your operating system. All storage-management configuration information is deleted during the uninstallation process. A complete reinstallation of the storage-management software is required.

To upgrade from Windows NT 4.0 to Windows 2000, perform the following steps:

1. Verify that the storage subsystem contains no system-dependent files or directories, such as paging files.
2. Uninstall Storage Manager. Refer to “Uninstalling storage-management software components” on page 82.
3. Use the instructions from Microsoft to upgrade to Windows 2000.
4. Reinstall Storage Manager. Either refer to the instructions in “Installing Storage Manager 8.3 Client” on page 40 or to the procedure that came with the version of the storage-management software you are currently running.

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## Upgrading from Windows NT 4.0 to Windows 2000 in a cluster configuration

To ensure that the services and resources offered by the cluster are always available, you must perform a rolling upgrade. A rolling upgrade requires upgrading the controller firmware, storage-management software, and operating system first in node A and then in node B.

**Important:** If you have applications installed in the cluster server environment that do not support a rolling upgrade, perform one of the following tasks:

- Put those resources offline before the upgrade; then, put them back online after the upgrade.
- Perform a scheduled upgrade. A scheduled upgrade requires scheduling downtime on your cluster server to upgrade the controller firmware and storage-management software.

To upgrade from Windows NT 4.0 Enterprise Edition to Windows 2000 Advanced Server, perform the following steps:

1. On node A, open Cluster Administrator.
2. Double-click the Active Groups folder in the right pane of Cluster Administrator.
3. Make sure that all of the groups failover to node B successfully.
4. Select node A. Then click **File** → **Pause Node** to pause cluster service in node A.
5. From node A, uninstall all software components. To uninstall the software, refer to “Uninstalling storage-management software components” on page 82. Uninstall the components in the following order:
  - a. Storage Manager 8.3 Agent
  - b. Storage Manager 8.3 Utility
  - c. Redundant Disk Array Controller
  - d. Storage Manager 8.3 Client
6. Follow the instructions from Microsoft to upgrade node A from Windows NT 4.0 Enterprise Edition to Windows 2000 Advanced Server.

**Note:** During the upgrade, the existing cluster server installation is detected and clustering for Windows 2000 Advanced Server is installed. When the upgrade is complete, node A will rejoin the cluster and remain paused.

7. Verify that the host bus adapter (HBA) device driver versions are correct. If they are not the certified versions, refer to the readme file in the \Host\_Adapter directory on the installation CD and upgrade the device driver versions before you continue.

8. Verify that node A was successfully upgraded to Windows 2000 Advanced Server.
9. Install the Storage Manager 8.3 Client on node A. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
10. Install the Redundant Disk Array Controller on node A. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
11. Install the Storage Manager 8.3 Agent on node A. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
12. Install the Storage Manager 8.3 Utility on node A. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
13. Run Cluster Administrator. Then click **File → Resume Node** to resume cluster service in node A.
14. On node B, open Cluster Administrator.
15. Double-click the Active Groups folder in the right pane of Cluster Administrator.
16. Make sure that all of the groups failover to node A successfully.
17. Select node B. Then click **File → Pause Node** to pause cluster service in node B.
18. From node B, uninstall all software components. To uninstall the software, refer to “Uninstalling storage-management software components” on page 82. Uninstall the components in the following order:
  - a. Storage Manager Agent
  - b. Storage Manager Utility
  - c. Redundant Disk Array Controller
  - d. Storage Manager Client
19. Follow the instructions from Microsoft to upgrade node B from Windows NT 4.0 Enterprise Edition to Windows 2000 Advanced Server.

**Note:** During the upgrade, the existing cluster server installation is detected and clustering for Windows 2000 Advanced Server is installed. When the upgrade is complete, node B will rejoin the cluster and remain paused.
20. Verify that the host bus adapter (HBA) device driver versions are correct. If they are not the certified versions, refer to the readme file in the \Host\_Adapter directory on the installation CD and upgrade the device driver versions before you continue.
21. Verify that node B was successfully upgraded to Windows 2000 Advanced Server.
22. Install the Storage Manager 8.3 Client on node B. Refer to “Installing the Storage Manager 8.3 Client” on page 53 for instructions.
23. Install the Redundant Disk Array Controller on node B. Refer to “Redundant Disk Array Controller” on page 55 for instructions.
24. Install the Storage Manager 8.3 Agent on node B. Refer to “Storage Manager 8.3 Agent software” on page 57 for instructions.
25. Install the Storage Manager 8.3 Utility on node B. Refer to “Storage Manager 8.3 Utility software” on page 59 for instructions.
26. Run Cluster Administrator. Then click **File → Resume Node** to resume cluster service in node B.
27. Go to Chapter 5, “Completing the installation”, on page 67.



---

## Chapter 5. Completing the installation

This chapter contains procedures on how to use Enterprise Management and Subsystem Management to complete the following installation tasks:

1. Install SANavigator, if you want.
2. Perform an initial automatic discovery of storage subsystems.
3. Add devices, if necessary.
4. Set up alert notifications, if you want.
5. Name the storage subsystems.
6. Download firmware and NVSRAM.
7. Create arrays and logical drives.
8. Verify and define the default host type.
9. Configure the heterogeneous hosts.
10. Perform other storage subsystem tasks.

Each of these steps is discussed in detail in the sections that follow.

The Enterprise Management window opens when you start the FAStT Storage Manager. Use the Enterprise Management window to:

- Add and discover the storage subsystems.
- View all storage subsystems in your management domain.
- Perform batch storage subsystem management tasks using the Script Editor.

---

### Introduction to SANavigator

This section provides an overview of the functions of SANavigator. SANavigator is an application that enables you to easily monitor and manage your storage area network (SAN). It is a powerful diagnostic tool that detects SAN failures and displays them in a graphical manner. When you use SANavigator with the problem determination maps found in the *FAStT Hardware Maintenance Manual and Problem Determination Guide*, you can detect and diagnose SAN malfunctions easily. Install SANavigator after you have installed the IBM FAStT Storage Manager and the FAStT Management Suite Java (FAStT MSJ).

### SANavigator features

SANavigator enables you to easily monitor and manage your SAN through the following features:

- Discovery

SANavigator uses TCP/IP (out-of-band) and Fibre Channel (in-band) to establish contact with a large number of SAN devices, gather embedded information, and then depict it graphically. SANavigator discovers the devices that are attached to your SAN. It then presents a visual map of devices and their interconnections to enable you to identify any problem components in the map.

- Monitoring

SANavigator generates events and messages about the status of devices and their respective properties. The self-monitoring event logging and messaging feature enables you to stay informed about the current state of the SAN.

- Launching device applications and utilities

You can launch applications and utilities such as IBM FAStT Storage Manager and IBM FAStT MSJ from SANavigator by right-clicking the respective devices. A

pop-up menu displays that allows you to select the applications and link to the IBM Fibre Channel Solution Support Web site at:

[www.pc.ibm.com/support/](http://www.pc.ibm.com/support/)

- Reporting  
SANavigator enables you to generate, view, and print reports.

To learn more about the features of SANavigator, see the *FASTT Hardware Maintenance Manual and Problem Determination Guide*.

## System requirements

The following list outlines the minimum requirements for SANavigator:

- Microsoft Windows operating systems (Windows NT 4.0 service pack 6a and Windows 2000 Professional, Enterprise Server, and Advanced Server)
  - 700 MHz Intel Pentium III and up
  - CD-ROM
  - 512 MB RAM
  - Disk space: 150 MB
  - VGA: 256 colors or greater
- Linux operating systems (Red Hat 7.2 and above)
  - 700 MHz Intel Pentium III and up
  - 512 MB RAM
  - Disk space: 150 MB
  - VGA: 256 colors or greater

## Installing SANavigator

SANavigator installation is easy and fast. After installing IBM FASTT Storage Manager Version 8.3, consider installing the FASTT MSJ and SANavigator diagnostic programs. You can use these programs to verify the status of the fibre-channel connections before you use the storage subsystem.

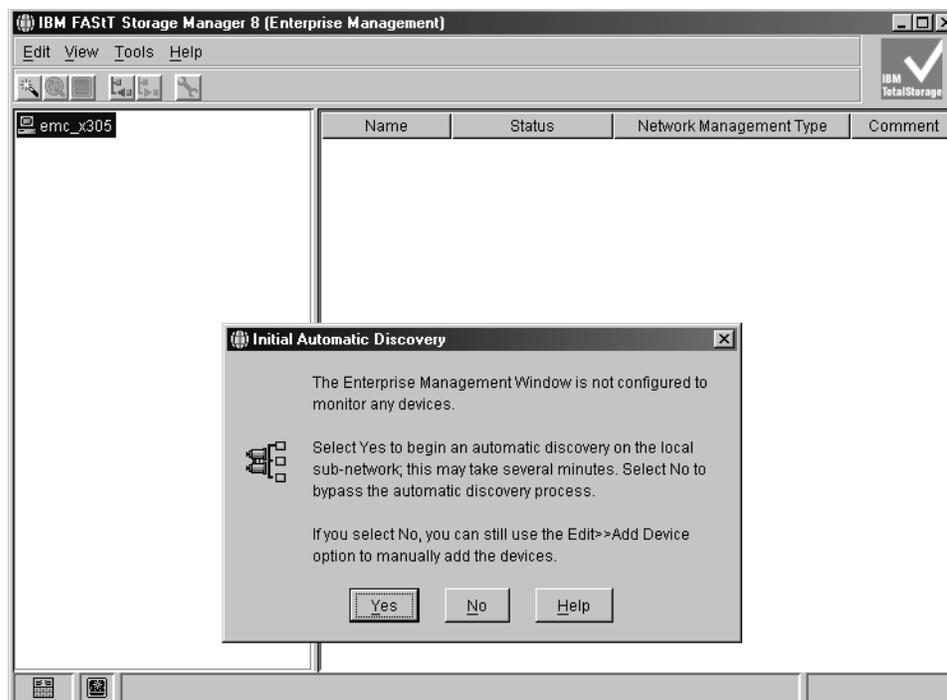
The SANavigator program, the *IBM FASTT MSJ User's Guide*, and FASTT MSJ program are located on the IBM FASTT Storage Manager version 8.3 CD. For information about how to install and run SANavigator, see the *FASTT Hardware Maintenance Manual and Problem Determination Guide*.

---

## Performing an initial automatic discovery of storage subsystems

To perform an initial automatic discovery of storage subsystems, perform the following steps:

1. Click **Start** → **Programs**.
2. Click **IBM FASTT Storage Manager Client v08.33.G5.xx**. The client software starts and displays the Enterprise Management window and the Confirm Initial Automatic Discovery window.



SJ000872

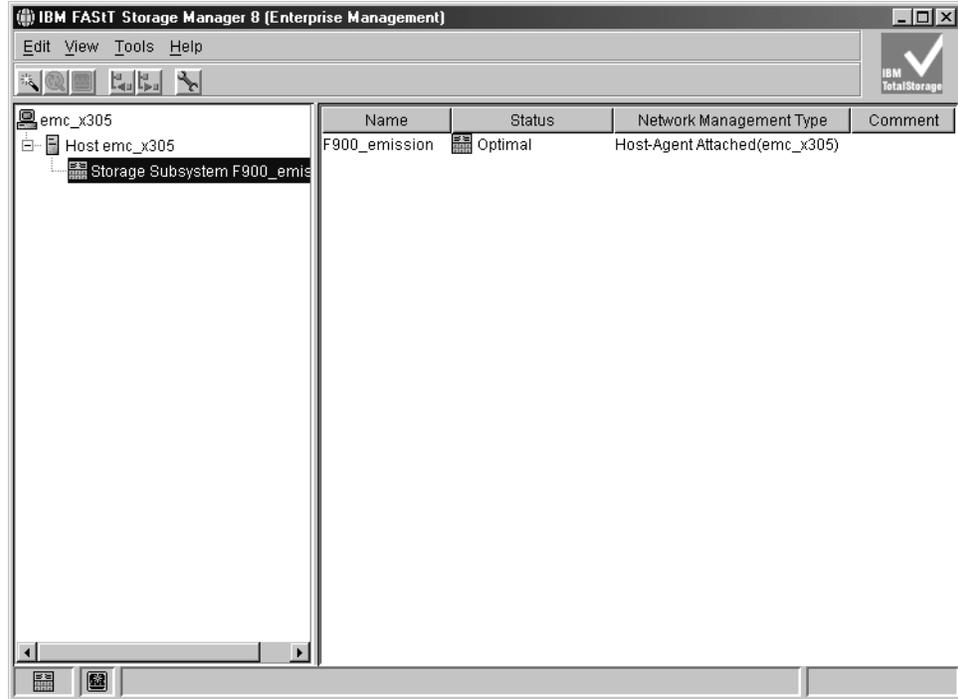
Figure 18. Confirm Initial Automatic Discovery window

**Note:** The Enterprise Management window can take several minutes to open. No wait cursor (such as an hourglass) is displayed.

3. Click **Yes** to begin an initial automatic discovery of hosts and storage subsystems attached to the local subnetwork.

After the initial automatic discovery is complete, the Enterprise Management window displays all hosts and storage subsystems attached to the local subnetwork.

**Note:** The Enterprise Management window can take up to a minute to refresh after an initial automatic discovery.



SJ000873

Figure 19. Enterprise Management window

4. Verify that each host and storage subsystem is displayed in the Enterprise Manager window.
  - If a host or storage subsystem is not displayed, perform the following tasks:
    - Check the hardware and hardware connections for possible problems (refer to the hardware documentation for specific procedures).
    - Refer to the Enterprise Management online help for additional information about discovering storage subsystems.
    - If you are using the direct-management method, verify that all hosts and storage subsystems are connected to the same subnet network. If you are using the host-agent method, ensure that the Fibre Channel connection between the host and storage subsystems is made.
    - Make sure that all of the preparation steps for setting up the storage subsystem for a directly-managed system in Chapter 2, “Preparing for installation”, on page 21 are completed. If they are, use the Add Device option to add the IP addresses of the Storage subsystem. Add both IP addresses of the controller. Otherwise, you will get a “partially-managed device” error message when you try to manage the storage subsystem.
    - If you are using the host-agent management method, perform the following steps:
      - a. Make sure that the Storage Manager 8.3 Agent is installed in the host.
      - b. Verify that you have a Fibre Channel connection from the storage subsystems to the host that has the Storage Manager 8.3 Agent installed.
      - c. Verify that all of the preparation steps outlined in Chapter 2, “Preparing for installation”, on page 21 have been completed. If they have, perform the following steps:
        - 1) Run the Hot Add Utility.

- 2) Restart the Storage Manager 8.3 Agent using the information in “Stopping and restarting the host-agent software” on page 82.
- 3) Click **Tools** → **Rescan** in the Enterprise management window.

**Note:** In certain situations, a storage subsystem might be duplicated in the device tree after an automatic discovery. You can remove a duplicate storage-management icon from the device tree by using the Remove Device option in the Enterprise Management window.

5. Verify that the status of each storage subsystem is Optimal. If a device shows a status of Unresponsive, right-click the device and select **Remove Device** to delete it from the management domain. Then use the Add Device option to add it to the management domain again. Refer to the Enterprise Management window online help for instructions on removing and adding devices.
6. Continue with “Adding devices”.

---

## Adding devices

You can manually add more hosts or storage subsystems. You can use this option to selectively manage a group of storage subsystems from a Storage Manager Client. You can also use this option to add additional devices to be managed that were not discovered during the Storage Manager Client initial discovery. For more information about this option, refer to the Enterprise Management window online help.

### Important:

- When you add new storage subsystems to the existing storage subsystems in a Storage Area Network (SAN) that are managed through the host-agent software, you must stop and restart the host-agent service. When the host-agent service restarts, the new storage subsystem is detected. For more information, refer to “Stopping and restarting the host-agent software” on page 82. Then, go to the Enterprise Management window and click **Tools** → **Rescan** to add the new storage subsystems to the management domain.
- When you add new storage subsystems to existing storage subsystems that are managed using the direct-management method, be sure to specify the IP addresses for both controllers.

Continue with “Setting up alert notifications”.

---

## Setting up alert notifications

After you add devices to the management domain, you can set up alert notifications to report critical events on the storage subsystems. The following alert-notification options are available:

- Notification to a designated network management station (NMS) using Simple Network Management Protocol (SNMP) traps
- Notification to designated e-mail addresses
- Notification to designated alphanumeric pagers (requires separately supplied software to convert e-mail messages)

**Note:** You can only monitor storage subsystems within the management domain. If you do not install the Event Monitor service, the Enterprise Management window must remain open. If you close the window, you will not receive any alert notifications from the managed storage subsystems. Refer to the Enterprise Management window online help for additional information.

To set up alert notification to an NMS using SNMP traps, perform the following steps:

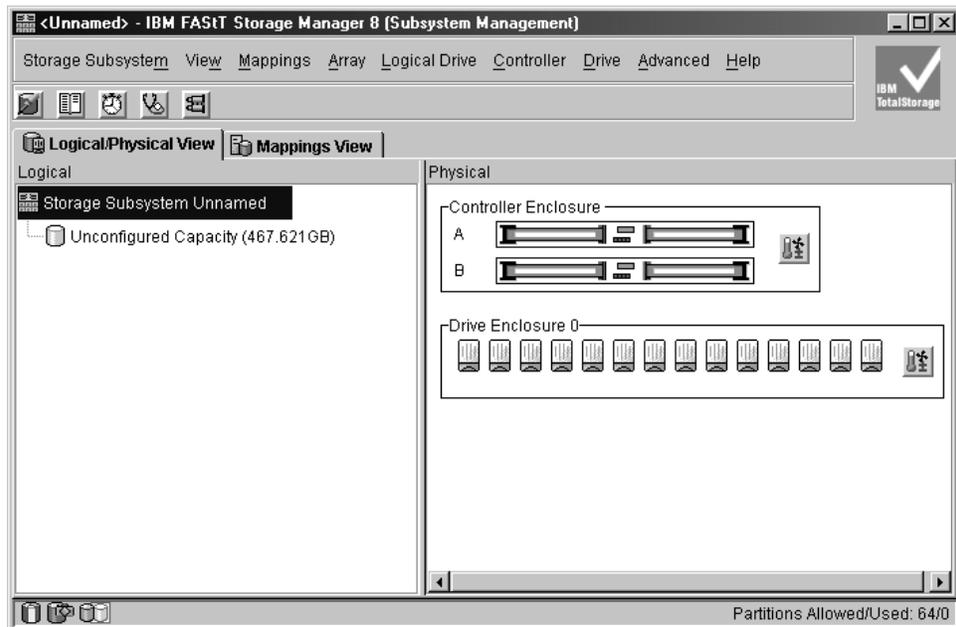
1. Insert the IBM FASTT Storage Manager version 8.3 CD into the CD-ROM drive on an NMS. You need to set up the designated management station only once.
2. Copy the SM820.MIB file from the SM820.mib directory to the NMS.
3. Follow the steps required by your NMS to compile the management information base (MIB) file. (For details, contact your network administrator or see the documentation specific to the storage management product you are using.)
4. Continue with “Naming storage subsystems”.

---

## Naming storage subsystems

To name your storage subsystem, perform the following steps:

1. In the Enterprise Management window, select a storage subsystem.
2. Click **Tools** → **Manage Device**. The Subsystem Management window opens, as shown in Figure 20.



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Figure 20. Subsystem Management window

3. Click **Storage Subsystem** → **Rename**. The Rename Storage Subsystem window opens.
4. Type the name of the storage subsystem (see Table 20 on page 89). Then click **OK**.
5. Repeat for each unnamed storage subsystem. For more information, see the topic on renaming storage subsystems in the Subsystem Management window online help.
6. Continue with “Downloading firmware and NVSRAM”.

---

## Downloading firmware and NVSRAM

This section provides instructions for downloading firmware and NVSRAM. You must download firmware version 05.3x.xx before you download NVSRAM.

## Downloading firmware

To download firmware version 05.3x.xx, perform the following steps:

1. From the Enterprise Management window, select a storage subsystem.
2. Click **Tools** → **Manage Device**. The Subsystem Management window opens.
3. Click **Storage Subsystem** → **Download** → **Firmware**. Follow the instructions that display.
4. Continue with “Downloading NVSRAM”.

## Downloading NVSRAM

To download NVSRAM, perform the following steps:

1. From the Enterprise Management window, select a storage subsystem.
2. Click **Tools** → **Manage Device**. The Subsystem Management window opens.
3. Click **Storage Subsystem** → **Download** → **NVSRAM**. Follow the instructions that display.
4. Continue with “Creating arrays and logical drives”.

---

## Creating arrays and logical drives

### Important:

You should create a storage subsystem profile and save it in a safe place whenever you modify the arrays and logical drives in your storage server. This profile contains detailed controller information including logical and physical disk configuration information that can be used to help recover the configuration in the event of a catastrophic failure.

To create a storage subsystem profile, select **View** → **Storage Subsystem Profile** in the Storage Subsystem Management window and click the **Save As** button when the Storage Subsystem Profile window opens.

If you have a storage server with firmware 04.01.xx.xx or earlier, you must also perform a controller state capture in addition to saving the storage subsystem profile. To use the Capture State Information feature, you must upgrade the controller to firmware 04.01.02.34 or later and install the FAS/T Storage Manager Field Tool version 5.21 program. This program is available at the following Web site:<http://ssddom02.storage.ibm.com/techsup/webnav.nsf/support/disk/>.

To create a storage subsystem profile using the Capture State Information feature, perform the following steps:

1. Click **Tools** → **Capture State Information**. A State Capture window opens.
2. Click the **Browse** button to specify the file name for the state capture information.
3. Click the **Start** button to start the capture process.
4. Click the **Cancel** button to close the State Capture window when the capturing is completed.

An array is a set of Fibre Channel hard drives that are logically grouped together to form a RAID set. The maximum number of hard drives for each array is 30 if the hard drive capacities are 73.4GB or less and 14 if the hard drive capacities are 146GB. Each array can be divided into 1 to 256 logical drives. A *logical drive* is a logical structure, which is the basic structure that you create to store data on the

storage subsystem. The operating system recognizes a logical drive as a single drive. Choose a RAID level to meet application needs for data availability and maximize Fibre Channel I/O performance.

To create arrays and logical drives, perform the following steps:

1. From the Enterprise Management window, select a storage subsystem.
2. Click **Tools** → **Manage Device**. The Subsystem Management window opens.
3. Click the **Logical/Physical View** tab.
4. Click **Logical Drive** → **Create**. The Logical Drive Create wizard starts. Follow the online instructions to create arrays and logical drives.
5. Continue with “Verifying and defining the default host type”.

**Note:** For cluster configurations, if you add or delete logical drives, you must make them known to both node A and node B.

---

## Verifying and defining the default host type

Before you use the logical drives in a host computer, you must specify the host type. The host type determines how the storage subsystem controllers will work with each particular operating system on the hosts to which it is connected. If all of the host computers connected to the same storage subsystem are running the same operating system, and you do not want to define partitioning, you can define a default host type.

To verify the current default host type, perform the following steps:

1. In the Subsystem Management window, click **View** → **Storage subsystem profile**. A Storage Subsystem Profile window opens.
2. Click the **Mappings folder** tab and scroll down to NVSRAM Host Type Internal Definitions. The host type name of the index that has the word DEFAULT next to it is the default host type.
3. Click **Close**.

To define a default host type, perform the following steps:

1. Click **Storage subsystem** → **Change** → **Default host-type**. The Default Host-type window opens.
2. From the pull-down list, select the host type.
3. Click **OK**.

If you have hosts with different operating systems or if you want to define partitions for the hosts, continue with “Configuring heterogeneous hosts”.

---

## Configuring heterogeneous hosts

The heterogeneous hosts feature enables hosts running different operating systems to access a single storage subsystem. Previous releases of FAST Storage Manager (versions 7.02 or earlier) required that hosts run the same operating system in order to access a single storage subsystem.

Host computers can run completely different operating systems (for example, Solaris and Windows NT) or variants of the same operating system (for example, Windows NT running in a cluster environment or Windows NT running in a noncluster environment). When a host type is specified in the Define New Host Port

window, the heterogeneous hosts feature enables the controllers in the storage subsystem to tailor their behavior (such as LUN reporting) to the needs of the host.

**Important:** To use the heterogeneous host feature, you must meet the following conditions:

- You must enable storage partitioning.
- During host-port definition, you must set each host type to the appropriate operating system so that the firmware on each controller can respond correctly to the host.

To start the heterogeneous host configuration, perform the following steps:

1. From the Subsystem Management window, click **Mappings View**.
2. Follow the on-screen instructions.
3. Continue with “Performing other storage-subsystem management tasks”.

**Note:** Partitioning is a premium feature. If you disable partitioning, you *must* contact your IBM technical support representative to obtain a key to reenabling partitioning.

---

## Performing other storage-subsystem management tasks

The following list includes other storage subsystem management tasks that you can perform:

- Locating a storage subsystem
- Viewing a storage subsystem profile or event log
- Entering or changing a storage subsystem password
- Creating and managing logical drives and arrays
- Using the Performance Monitor
- Creating storage partitions (if applicable) and heterogeneous hosts
- Viewing or changing media scan settings
- Increasing capacity of an array or logical drive
- Changing RAID level for an array
- Monitoring read-link-status error counts
- Downloading ESM firmware or Fibre Channel drive firmware

**Note:** To create storage partitions, you must obtain the worldwide name or port of each host adapter in every host connected to the storage subsystem.

For more information about these and other storage subsystem management tasks, refer to the appropriate topics in the Subsystem Management online help.



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## Chapter 6. Using the storage-management software

This chapter provides information about how to add or delete logical drives, create FlashCopy logical drives, use the Hot Add and SMdevices utilities, start and stop the host-agent software, and uninstall Storage Manager components.

---

### Adding or deleting logical drives

Use the following instructions to add or delete logical drives in a standard (noncluster) configuration.

#### Standard (noncluster) configuration for Windows NT 4.0

##### Creating logical drives

When you create logical drives with the storage-management software, you must add the new logical drives to Windows NT 4.0. Refer to the Windows NT 4.0 documentation for details about how to add a drive. Each logical drive (not array) is recognized by Windows NT as a single drive.

After you create logical drives, run the Hot Add and SMdevices utilities that are provided with the storage-management software. The Hot Add utility adds newly created logical drives to the operating system. The SMdevices utility identifies logical drives by their associated operating system device names. For more information, see “Using the Hot Add utility” on page 80 and “Using the SMdevices utility” on page 81.

##### Deleting logical drives

**Important:** If you have data or logical drives that you want to keep, do not click **Configure → Reset for SM 8.3**. This action resets the controller unit and deletes *all* previously-configured logical drives.

Before you delete logical drives with the storage-management software or using **Configure → Reset for SM 8.3**, perform the following steps:

1. Use Cluster Administrator to delete the cluster physical disk resources that own the logical drives that will be deleted.
2. Use Disk Administrator to delete any partitions and to unassign drive letters that are associated with the logical drives.
3. Restart the system to remove the configuration information.

**Attention:** You must use Cluster Administrator and Disk Administrator to delete the cluster physical disk resources, delete OS partitions, and unassigned drive letters before deleting logical drives or resetting the configuration in Storage Manager. This will avoid damage to your registry information.

#### Cluster server configuration for Windows NT 4.0

To add logical drives in a Windows NT 4.0 cluster server environment, perform the following steps:

1. Using the IBM FAStT Storage Manager Client, create arrays and assign them to the appropriate host group by using storage partitioning.
2. Stop the cluster server service in node A. Make sure that all of the cluster groups and resources failover to node B.
3. Perform the following steps to disable the cluster server service and the cluster disk device in node A:

- a. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
  - b. Click **Services**. The Services window opens.
  - c. Select **Cluster Server**, and click **Startup**. The Service window opens.
  - d. Change the Startup Type Setting to **Disabled**; then, click **OK**.
  - e. Close the Services window.
  - f. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens
  - g. Click **Devices**. The Device window opens.
  - h. Select **Cluster Disk**; then, click **Startup**. The Devices window opens.
  - i. Select **Disabled**; then, click **OK**.
  - j. Close the Devices window.
4. Restart node A.
  5. Use Disk Administrator to create and format your operating system partitions.
  6. Enable cluster server service and the cluster disk device in node A. Make sure that the start-up type is set to System for cluster disk device and Automatic for cluster server service.
  7. Restart node A. Then make sure that the cluster server service has started and that the cluster groups and resources have failed back correctly.
  8. Stop the cluster server service in node B.
  9. Using the procedure outlined in step 3 on page 77, disable cluster server service and the cluster disk device in node B.
  10. Restart node B.
  11. Use Disk Administrator to reassign the drive letters to match the ones that were assigned to a given disk in node A.
  12. Enable cluster server service and the cluster disk device in node B. Make sure that the start-up type is set to System for cluster disk device and Automatic for cluster server service.
  13. Restart node B. Then make sure that the cluster server service started and the cluster groups and resources failed back correctly.
  14. Stop the cluster server service in node A.
  15. Restart node A.
  16. After cluster server service has started, use Cluster Administrator to create your physical disk resources.
  17. Verify that the physical disk resources can be brought online in both nodes.

## Standard (noncluster) configuration for Windows 2000

Use the following instructions to create or delete logical drives in a cluster server environment.

### Creating logical drives

When you create logical drives with the storage-management software, you must add the new logical drives to the Windows 2000 operating system. Each logical drive (not array) is recognized by Windows 2000 as a single drive.

After creating logical drives, run the HotAdd and SMdevices utilities that are provided with the storage-management software. The Hot Add utility adds newly created logical drives to the operating system, and the SMdevices utility identifies logical drives by their associated operating system device names. For more information, see “Using the Hot Add utility” on page 80 or “Using the SMdevices utility” on page 81.

## Deleting logical drives

**Important:** If you have data or logical drives that you want to keep, do not click **Configure → Reset for SM 8.3**. This action resets the controller unit and deletes *all* previously-configured logical drives.

Before you delete logical drives with the storage-management software or use **Configure → Reset for SM 8.3** perform the following steps:

1. Use Cluster Administrator to delete the cluster physical disk resources that own the logical drives that will be deleted.
2. Use Disk Administrator to delete any partitions and to unassign drive letters that are associated with the logical drives.
3. Restart the system to remove the configuration information.

**Attention:** You must use Cluster Administrator and Disk Administrator to delete the cluster physical disk resources, delete OS partitions, and unassigned drive letters before you delete logical drives or reset the configuration in Storage Manager. This action will avoid damage to your registry information.

## Cluster server configuration for Windows 2000

To add logical drives in a Windows 2000 cluster server environment, perform the following steps:

1. Using the IBM FASTT Storage Manager Client, create arrays and assign them to the appropriate host group by using storage partitioning.
2. Use the Hot Add utility to add the new logical drives to node A.
3. Using the Disk Administrator, create, format, and assign drive letters to the disk partitions on the new logical drives.
4. Use the Hot Add utility to add the new logical drives to node B.
5. Using the Disk Administrator, ensure that the drive letters assigned to the disk partitions on the logical drives are the same on both node A and node B.
6. Restart node A. Then use the Cluster Administrator to create cluster physical disk resources using the new disk partitions on the new logical drives.
7. Bring the cluster resources online in node A.
8. Use cluster administrator to move the cluster physical disk resources to node B.
9. Verify that the resources come online in node B.

---

## Creating a FlashCopy logical drive

### **FASTT600**

The FlashCopy feature is not supported on the FASTT600 Fibre Channel Storage Server.

A FlashCopy logical drive is a logical point-in-time image of a logical drive, called a base logical drive. A FlashCopy logical drive has the following features:

- It is created quickly and requires less disk space than an actual logical drive.
- It can be assigned to a host address, so that you can perform backups using the FlashCopy logical drive while the base logical drive is online and accessible.
- You can use the FlashCopy logical drive to perform application testing or scenario development and analysis. This does not effect the actual production environment.

- The maximum number of FlashCopy logical drives allowed is one half of the total logical drives supported by your controller model.

For additional information about the FlashCopy feature and how to manage Flash Copy logical drives, refer to the Storage Manager Subsystem Management online help.

**Note:** FlashCopy is a purchased premium feature. Contact your IBM reseller or IBM marketing representative for more information.

To create a FlashCopy logical drive, perform the following steps:

1. To ensure that you have the accurate point-in-time image of the base logical drive, stop applications and flush cache I/O to the base logical drive. For instructions, see “Using the SMflashcopyassist utility” on page 81.
2. Open the Subsystem Management window. From the Logical View, right-click the base logical drive.
3. Select **Create FlashCopy Logical Drive**. The Create FlashCopy Logical Drive Wizard starts.
4. Follow the on-screen instructions.
5. Refer to the Subsystem Management online help for instructions on how to add the FlashCopy logical drive to the host.

---

## Using the Remote Mirror feature

### FAST600

The Remote Mirror feature is not supported on the FAST600 Fibre Channel Storage Server.

The Remote Mirror feature is a purchased premium feature. The Remote Mirror Option is used for online, real-time replication of data between storage subsystems over a remote distance. In the event of a disaster or unrecoverable error at one storage subsystem, you can promote a second storage subsystem to take over responsibility for normal I/O operations. Consult the *IBM FAST Remote Mirror Option Installation and User's Guide*, or contact your IBM reseller or IBM marketing representative for more information.

---

## Using the Hot Add utility

The Hot Add utility enables you to add new logical drives without restarting the system. The utility registers the new logical drives with the operating system so that you can use Disk Administrator to create partitions, add device names, and so on. The Hot Add utility is part of the Storage Manager 8.3 Utility software package. If you run the program twice and the new logical drives are not displayed in the Disk Administrator window, you must either run Fibre Channel diagnostics or restart (reboot) the host.

When you finish creating logical drives on a particular storage subsystem, go to the host that is attached to that storage subsystem and perform the following steps to use the Hot Add utility:

1. From a DOS or command prompt, change to the  
*installation\_directory\IBM\_FAST\Util*

- where *installation\_directory* is the directory where you installed the Storage Manager 8.3 Utility.
2. From a DOS or command prompt, type the following command:  
hot\_add
  3. Press Enter. The new logical drives are available through the Disk Administrator.

---

## Using the SMdevices utility

The Storage Manager 8.3 Utility software includes a utility called SMdevices that you can use to view the storage subsystem logical drive that is associated with a particular operating system device name. This utility is helpful when you want to create drive letters or partitions by using Disk Administrator.

When you finish creating the logical drives on a particular storage subsystem, go to the host that is attached to that storage subsystem, and perform the following steps to use SMdevices:

1. From a DOS or command prompt, change to the *installation\_directory\IBM\_FAStUtil* where *installation\_directory* is the directory where you installed the Storage Manager 8.3 Utility.

2. Type:  
SMdevices

3. Press Enter. The software displays device identification information. For example, you might see the following information:

```
\\.\PHYSICALDRIVE $x$  [Storage Subsystem Finance, Logical Drive DEBIT, LUN  $xx$ ,  
WWN  $\langle$ worldwide_name $\rangle$ ]
```

where:

- $x$  is the Disk number that displays in Disk Administrator
- *Finance* is the name of the storage subsystem
- *DEBIT* is the name of the logical drive
- $xx$  is the LUN associated with the logical drive
- *worldwide\_name* is the worldwide name for the logical drive

---

## Using the SMflashcopyassist utility

**Note:** This utility requires that you enable the FlashCopy feature. The FlashCopy feature is not supported in FASt600.

You can use SMflashcopyassist utility to perform the following tasks:

- Flush cached data for a logical drive.
- Resolve duplicate logical drive signatures between the base logical drives and the FlashCopy logical drives. (Windows NT 4.0 only)

To flush cached data in a logical drive, perform the following steps:

1. From a DOS or command prompt, change to the *installation\_directory\IBM\_FAStUtil* where *installation\_directory* is the directory where you installed the Storage Manager 8.3 Utility.
2. Type the following command:

```
smflashcopyassist -f logical_drive_letter:
```

where *logical\_drive\_letter* is the operating system drive letter that was assigned to the disk partition created on the logical drive.

3. Press Enter.

After you create a FlashCopy logical drive and map it to the same host as the base logical drive, (for Windows NT 4.0 only) to resolve duplicate logical drive signatures:

1. Type:

```
smflashcopyassist -r
```

2. Press Enter.

---

## Stopping and restarting the host-agent software

You must stop and restart the host-agent software if you add additional storage subsystems to the management domain of the host-agent software. When you restart the service, the host-agent software discovers the new storage subsystems and adds them to the management domain.

**Note:** If none of the access logical drives are detected after a restart, the host-agent software automatically stops running. Make sure that there is a good Fibre Channel connection from the host to the Storage Area Network that the storage subsystem is connected to. Then restart the host or cluster node so that new host-agent-managed storage subsystems can be discovered.

### Windows NT 4.0

To stop and restart the host-agent software, perform the following steps:

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
2. Double-click **Services**. The Services window opens.
3. Click **IBM FAStT Storage Manager 8 Agent**; then, click **Stop**. The Confirmation window opens.
4. Click **Yes**.
5. Click **Start**. The Storage Agent Manager starts.
6. Close the Services window.

### Windows 2000

To stop and restart the host-agent software, perform the following steps:

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
2. Right-click **IBM FAStT Storage Manager 8 Agent**.
3. Click **Restart**. The IBM FAStT Storage Manager 8 Agent stops and then starts again.
4. Close the Services window.

---

## Uninstalling storage-management software components

Use the following procedure to uninstall one or more of the components of Storage Manager 8.3. If you are uninstalling components released with an earlier version of the storage-management software, use the uninstall procedure that came with the version of the storage-management software that you are currently running.

**Important:** Do not uninstall the RDAC unless instructed by an IBM technical support representative. The host-agent package requires RDAC to function properly. If you uninstall RDAC in a coexistence environment, you will lose Fibre Channel I/O path failover support for both the version 7.xx and version 8.xx of Storage Manager.

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens. Select **Add/Remove programs**. The Add/Remove Programs Properties window opens.

**Note:** Uninstall the Storage Manager components in the following order:

- a. Storage Manager 8.3 Agent
  - b. Storage Manager 8.3 Utility
  - c. Redundant Disk Array Controller
  - d. Storage Manager 8.3 Client
2. Select the component you want to uninstall from the list of programs (for example, IBM FASTT Storage Manager Client).
  3. Click **Add/Remove**. The Confirm File Deletion window opens.
  4. Click **Yes** to start the uninstallation process.
  5. When the uninstallation is complete, click **OK**.



## Chapter 7. Operating system support

This chapter contains information related to operating the storage-management software in a Windows NT 4.0 or Windows 2000 environment.

### Windows NT 4.0 and Windows 2000 limitations

**Important:** Always check for a readme file. A readme file contains important information that was not available when this Installation and Support Guide was prepared.

Table 19 explains limitations that apply when you use the IBM FASTT Storage Manager Version 8.3 with Windows NT 4.0 and Windows 2000.

*Table 19. Windows NT 4.0 and Windows 2000 limitations*

Limitation	Workaround
If you click a vertical scroll arrow either up or down, the scroll box will move all the way to the opposite end of the scroll bar.	This is a known defect in the Java Runtime Environment. Click the scroll box and slide it until you reach the position that you want in the Help window.
Data or configuration loss might occur during a logical drive migration (removing configured physical drives from one storage subsystem and inserting them into another storage subsystem).	Contact an IBM technical support representative for assistance in performing this procedure.
Array migration is not supported because it could cause loss of configuration and data. Array migration consists of removing a set of drives configured with arrays from one storage subsystem and inserting them into another storage subsystem.	Contact an IBM technical support representative.
If you manage storage subsystems through the host-agent software and use the storage management software to download controller firmware, the download process can take up to 10 minutes to complete.	None.
When you configure a new storage subsystem with a single controller, you must place the controller in slot A. The controller firmware cannot recognize or communicate with a single controller until slot A is populated. This restriction does not apply to storage subsystems that were originally configured with two controllers.	None.
The following loop configuration is not supported: IBM Fibre Channel Hub (machine type 3523) in conjunction with the IBM Fibre Channel Switch (machine types 2109-S16 and 2109-S8) or the IBM Fibre Channel Switch (machine types 3534-F08 and 2109-F16).	None.

Table 19. Windows NT 4.0 and Windows 2000 limitations (continued)

Limitation	Workaround
<p>A controller failover occurs in an active/active controller pair, and ownership of arrays transfers from the failed preferred owner to the other controller of the repair. The failed controller is replaced and brought online. The array ownership is not automatically transferred back to the preferred controller owner.</p>	<p>Immediately after you replace the controller, click <b>Storage subsystem</b> → <b>Redistribute Arrays</b> in the Subsystem Management window to redistribute arrays back to their preferred controller owners. For more information, refer to the Enterprise Management online help.</p>
<p>After adding a host device to the management domain of more than five clients, the host-agent managed storage subsystems attached to that host become unresponsive.</p>	<p>A single instance of the host-agent software can communicate with no more than five clients.</p>
<p>When you connect a FASiT EXP700 Storage Expansion Unit to a FASiT200, you must set the drive speed to 1 GB per second.</p>	<p>None.</p>

Table 19. Windows NT 4.0 and Windows 2000 limitations (continued)

Limitation	Workaround
<p>After you install the host-agent software, the error message: Service Error 100  is displayed on the host.</p>	<p>The cause includes:</p> <ul style="list-style-type: none"> <li>• The host-agent software does not find any controllers with firmware version 04.00.02.00 or later. Upgrade the firmware to the latest firmware level from the IBM support Web site at <a href="http://www.ibm.com/support/">www.ibm.com/support/</a>. For more information, see the section that follows on “Direct-management method workaround”.</li> <li>• The access logical drive has been removed from NVSRAM or the storage partition defined for the host. Perform one of the following tasks: <ul style="list-style-type: none"> <li>– Manage the storage subsystem by using the direct-management method. See the section that follows on “Direct-management method workaround”.</li> <li>– Define the access logical drive for the host and restart SMagent. See the “SMagent workaround for defining additional Access LUN mapping” on page 88.</li> </ul> </li> <li>• The NVSRAM on the controllers in a storage subsystem that you want to manage contains an access logical drive LUN that is in use by another logical drive, or is not supported by the operating system or installed patches. For example, the access logical drive is configured at LUN 31, and the operating system and service packs support only eight LUNs. Perform one of the following tasks: <ul style="list-style-type: none"> <li>– Manage the storage subsystem by using the direct-management method. See the section that follows on “Direct-management method workaround”.</li> <li>– Change the LUN mapping for the host access logical drive to a LUN that is not in use and is supported by the operating system either from a different computer that has management access to the storage subsystem, or establish a direct management connection to the storage subsystem from the current host. For more information, see the “SMagent workaround for changing existing Access LUN mapping” on page 88.</li> </ul> </li> </ul>

## Direct-management method workaround

Use these instructions for the direct-management method workaround:

1. Connect the two controller Ethernet ports to the network.
2. Follow the direct-management setup instructions in Chapter 2, “Preparing for installation”, on page 21 to manage the subsystem directly.
3. Open the Storage Manager 8 Enterprise Management window. Click **Edit** → **Add** device.
4. Enter the IP address for the first controller and click **Add**.

5. Repeat to add the IP address of the additional controllers.
6. Click **Close**.
7. Right-click the newly added storage subsystem and select **Manage Device**. The Subsystem Management window for the storage subsystem opens. Proceed with the storage subsystem management tasks.

## SMAgent workaround for defining additional Access LUN mapping

Perform the following steps to define additional Access LUN mapping for Storage Manager 8.3 Agent:

1. Go to a different computer that has management access to the storage subsystem, or establish a direct management connection to the storage subsystem from the current host.
2. Start the IBM FAStT Storage Manager 8.3 Client and open the Subsystem Management window for the storage subsystem.
3. Click the **Mappings View** tab.
4. Right-click the **Default Group** and select **Define Additional mappings**.
5. Select **Access**.
6. From the LUN drop-down menu, select Logical Unit Number (LUN) 31.
7. Click **Add** to define the access LUN.
8. Click **Close**. In the Define Mapping pane, a LUN with the Access name is displayed.
9. Close the window and restart the host. When the host restarts, the SMAgent service starts.

## SMAgent workaround for changing existing Access LUN mapping

Perform the following steps to change existing Access LUN mapping:

1. Go to a different computer that has management access to the storage subsystem, or establish a direct management connection to the storage subsystem from the current host.
2. Start the IBM FAStT Storage Manager 8.3 Client and open the Subsystem Management window for the storage subsystem.
3. Click the **Mappings View** tab.
4. From the topology pane, select the **Default Group** or the corresponding host partition.
5. Right-click **Access** and select **Change Mapping**. A Change Mapping window opens.
6. From the LUN drop-down menu, select the LUN that your operating system supports. If it is not available, you must remove one of the existing storage partitioning mappings.
7. Click **OK**.
8. Close the window and restart the host. When the host restarts, the SMAgent service starts.





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## Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory may require replacement of the standard memory with an optional memory module.

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## Glossary

This glossary provides definitions for the terminology used for the IBM TotalStorage FAStT. This glossary also provides definitions for the terminology used for the IBM TotalStorage FAStT Storage Manager.

This glossary defines technical terms and abbreviations used in this document. If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at [www.ibm.com/networking/nsg/nsgmain.htm](http://www.ibm.com/networking/nsg/nsgmain.htm)

This glossary also includes terms and definitions from:

- *Information Technology Vocabulary* by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- *IBM Glossary of Computing Terms*. New York: McGraw-Hill, 1994.

The following cross-reference conventions are used in this glossary:

**See** Refers you to (a) a term that is the expanded form of an abbreviation or acronym, or (b) a synonym or more preferred term.

### See also

Refers you to a related term.

**Abstract Windowing Toolkit (AWT).** A Java graphical user interface (GUI).

**accelerated graphics port (AGP).** A bus specification that gives low-cost 3D graphics cards faster access to main memory on personal computers than the usual PCI bus. AGP reduces the overall cost of creating high-end graphics subsystems by using existing system memory.

**access volume.** A special logical drive that allows the host-agent to communicate with the controllers in the storage subsystem.

**adapter.** A printed circuit assembly that transmits user data (I/Os) between the internal bus of the host system and the external Fibre Channel link and vice versa. Also called an I/O adapter, host adapter, or FC adapter.

**advanced technology (AT) bus architecture.** A bus standard for IBM compatibles. It extends the XT bus architecture to 16 bits and also allows for bus mastering, although only the first 16 MB of main memory are available for direct access.

**agent.** A server program that receives virtual connections from the network manager (the client program) in an SNMP-TCP/IP network-managing environment.

**AGP.** See *accelerated graphics port*.

**AL\_PA.** See *arbitrated loop physical address*.

**arbitrated loop.** A shared 100 MBps Fibre Channel transport structured as a loop and supporting up to 126 devices and one fabric attachment. A port must successfully arbitrate before a circuit can be established.

**arbitrated loop physical address (AL\_PA).** One of three existing Fibre Channel topologies, in which two to 126 ports are interconnected serially in a single loop circuit. Access to the FC-AL is controlled by an arbitration scheme. The FC-AL topology supports all classes of service and guarantees in-order delivery of FC frames when the originator and responder are on the same FC-AL. The default topology for the disk array is arbitrated loop. An arbitrated loop is sometimes referred to as Stealth Mode.

**auto volume transfer/auto disk transfer (AVT/ADT).** A function that provides automatic failover in case of controller failure on a storage subsystem.

**AVT/ADT.** See *auto volume transfer/auto disk transfer*.

**AWT.** See *Abstract Windowing Toolkit*.

**basic input/output system (BIOS).** Code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

**BIOS.** See *basic input/output system*.

**BOOTP.** See *bootstrap protocol*.

**bootstrap protocol (BOOTP).** A Transmission Control Protocol/Internet Protocol (TCP/IP) protocol that a diskless workstation or network computer uses to obtain its IP address and other network information such as server address and default gateway.

**bridge.** A SAN device that provides physical and transport conversion, such as Fibre Channel to SCSI bridge.

**bridge group.** A bridge and the collection of devices connected to it. Bridge Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**broadcast.** A method of sending an SNMP request for information to all the devices on a subnet that use a single special request. Because of its efficiency, the SANavigator tool sets its default method of discovery to broadcast. However, a network administrator might disable this method on the network router.

**cathode ray tube (CRT).** An electrical device for displaying images by exciting phosphor dots with a scanned electron beam. CRTs are found in computer VDUs and monitors, televisions, and oscilloscopes.

**CDPD.** See *cellular digital packet data*.

**cellular digital packet data (CDPD).** A wireless standard that provides two-way, 19.2 kbps packet data transmission over existing cellular telephone channels.

**CGA.** See *color graphics adapter*.

**client.** A computer system or process that requests a service of another computer system or process that is typically referred to as a server. Multiple clients can share access to a common server.

**color graphics adapter (CGA).** An early, now obsolete, IBM video display standard for use on IBM PCs. CGA displays 80 x 25 or 40 x 25 text in 16 colors, 640 x 200 pixel graphics in two colors or 320 x 200 pixel graphics in four colors.

**command.** Any selection on a dialog box or elsewhere in the user interface that causes the SANavigator tool to perform a task.

**community strings.** The name of a community contained in each SNMP message. SNMP has no standard mechanisms for verifying that a message was sent by a member of the community, keeping the contents of a message private, or for determining if a message has been changed or replayed.

**CRC.** See *cyclic redundancy check*.

**CRT.** See *cathode ray tube*.

**cyclic redundancy check (CRC).** (1) 1) A redundancy check in which the check key is generated by a cyclic algorithm. (2) 2) An error detection technique performed at both the sending and receiving stations.

**dac.** See *disk array controller*.

**dar.** See *disk array router*.

**DASD.** See *Direct-Access Storage Device*.

**device type.** Identifier used to place devices in the physical map, such as the switch, hub, storage.

**DHCP.** See *Dynamic Host Configuration Protocol*.

**direct access storage device (DASD).** IBM mainframe terminology for a data storage device by which information can be accessed directly, instead of by-passing sequentially through all storage areas. For example, a disk drive is a DASD, in contrast with a tape drive, which stores data as a linear sequence.

**direct memory access (DMA).** The transfer of data between memory and an input/output (I/O) device without processor intervention.

**disk array controller (dac).** A disk array controller device that represents the two controllers of an array. See also *disk array controller*.

**disk array router (dar).** A disk array router that represents an entire array, including current and deferred paths to all logical unit numbers (LUNs) (hdisks on AIX). See also *disk array controller*.

**DMA.** See *direct memory access*.

**domain.** The most significant byte in the N\_Port Identifier for the FC device. It is not used in the FC-SCSI hardware path ID. It is required to be the same for all SCSI targets logically connected to an FC adapter.

**DRAM.** See *dynamic random access memory*.

**dynamic host configuration protocol (DHCP).** A protocol defined by the Internet Engineering Task Force that is used for dynamically assigning IP addresses to computers in a network.

**dynamic random access memory (DRAM).** A storage in which the cells require repetitive application of control signals to retain stored data.

**E\_Port.** An expansion port that connects the switches for two fabrics (also used for McData ES-1000 B ports).

**ECC.** See *error correction coding*.

**EEPROM.** See *Electrically Erasable Programmable Read-Only Memory*.

**EGA.** See *enhanced graphics adapter*.

**electrically eErasable programmable read-only memory (EEPROM).** A type of non-volatile storage device that can be erased with an electrical signal. Writing to EEPROM takes much longer than reading. It also can only be reprogrammed a limited number of times before it wears out. Therefore, it is appropriate for storing small amounts of data that are changed infrequently.

**electrostatic discharge (ESD).** The flow of current that results when objects that have a static charge come into close enough proximity to discharge.

**enhanced graphics adapter (EGA).** An IBM video display standard that provides text and graphics with a resolution of 640 x 350 pixels of 16 colors. It emulates the Color/Graphics Adapter (CGA) and the Monochrome Display Adapter (MDA) and was superseded by the Video Graphics Display (VGA).

**enhanced small disk interface (ESDI).** A hard disk controller standard that allows disks to communicate with computers at high speeds. ESDI drives typically transfer data at about 10 megabits per second, although they are capable of doubling that speed.

**error correction coding (ECC).** A method for encoding data so that transmission errors can be detected and corrected by examination of the data on the receiving end. Most ECCs are characterized by the maximum number of errors they can detect and correct.

**error detection coding.** A method for encoding data so that errors that occur during storage or transmission can be detected. Most error detection codes are characterized by the maximum number of errors they can detect. The simplest form of error detection is by using a single added parity bit or a cyclic redundancy check. Adding multiple parity bits can detect not only that an error has occurred, but also which bits have been inverted, thereby indicating which bits should be re-inverted to restore the original data.

**ESD.** See *electrostatic discharge*.

**ESDI.** See *enhanced small disk interface*.

**eXtended graphics array (XGA).** An IBM advanced standard for graphics controller and display mode design introduced in 1990. XGA, used mostly on workstation-level systems, supports a resolution of 1024 x 768 pixels with a palette of 256 colors, or 640 x 480 with high color (16 bits per pixel). XGA-2 added 1024 x 768 support for high color and higher refresh rates, improved performance, and supports 1360 x 1024 in 16 colors.

**F\_Port.** A port that supports an N\_Port on a Fibre Channel switch.

**fabric group.** A collection of interconnected SAN devices discovered by the SANavigator tool and displayed with a blue background on the Physical and Data Path Maps.

**Fibre Channel.** A bi-directional, full-duplex, point-to-point, serial data channel structured for high performance capability. Physically, Fibre Channel interconnects devices, such as host systems and servers, FC hubs and disk arrays, through ports, called N\_Ports, in one of three topologies: a point-to-point link, an arbitrated loop, or a cross point switched network,

which is called a fabric. FC can interconnect two devices in a point-to-point topology, from two to 126 devices in an arbitrated loop. FC is a generalized transport mechanism that can transport any existing protocol, such as SCSI, in FC frames.

**Fibre Channel Protocol for SCSI (FCP).** A high-level Fibre Channel mapping layer (FC-4) that uses lower-level Fibre Channel (FC-PH) services to transmit SCSI command, data, and status information between a SCSI initiator and a SCSI target across the FC link by using FC frame and sequence formats.

**field replaceable unit (FRU).** An assembly that is replaced in its entirety when any one of its components fails. In some cases, a FRU might contain other field replaceable units.

**FRU.** See *field replaceable unit*.

**general purpose interface bus (GPIB).** An 8-bit parallel bus developed for the exchange of information between computers and industrial automation equipment.

**GPIB.** See *general purpose interface bus*.

**graphical user interface (GUI).** A type of computer interface that presents a visual metaphor of a real-world scene, often of a desktop, by combining high-resolution graphics, pointing devices, menu bars and other menus, overlapping windows, icons, and the object-action relationship.

**GUI.** See *graphical user interface*.

**HBA.** See *host bus adapter*.

**hdisk.** An AIX term representing a logical unit number (LUN) on an array.

**host.** A system that is directly attached to the storage subsystem through a fibre-channel I/O path. This system is used to serve data (typically in the form of files) from the storage subsystem. A system can be both a storage management station and a host simultaneously.

**host bus adapter (HBA).** An interface between the Fibre Channel network and a workstation or server.

**host computer.** See *host*.

**host group.** The collection of HBAs and NASs in a fabric discovered by the SANavigator tool and displayed with a yellow background on the Physical and Data Path Maps.

**hub.** In a network, a point at which circuits are either connected or switched. For example, in a star network, the hub is the central node; in a star/ring network, it is the location of wiring concentrators.

**IC.** See *integrated circuit*.

**IDE.** See *integrated drive electronics*.

**In-band.** Transmission of management protocol over the Fibre Channel transport.

**Industry Standard Architecture (ISA).** A bus standard for IBM compatibles that allows components to be added as cards plugged into standard expansion slots. ISA was originally introduced in the IBM PC/XT with an 8-bit data path. It was later expanded to permit a 16-bit data path when IBM introduced the PC/AT.

**initial program load (IPL).** The part of the boot sequence during which a computer system copies the operating system kernel into main memory and runs it.

**integrated circuit (IC).** Also known as a *chip*. A microelectronic semiconductor device that consists of many interconnected transistors and other components. ICs are constructed on a small rectangle cut from a silicon crystal or other semiconductor material. The small size of these circuits allows high speed, low power dissipation, and reduced manufacturing cost compared with board-level integration.

**integrated drive electronics (IDE).** Also known as an Advanced Technology Attachment Interface (ATA). A disk drive interface based on the 16-bit IBM PC ISA in which the controller electronics reside on the drive itself, eliminating the need for a separate adapter card.

**integrated services digital network (ISDN).** A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data. ISDNs are used in public and private network architectures.

**interrupt request (IRQ).** A type of input found on many processors that causes the processor to suspend normal instruction execution temporarily and start executing an interrupt handler routine. Some processors have several interrupt request inputs that allow different priority interrupts.

**Internet Protocol address.** The unique 32-bit address that specifies the location of each device or workstation on the Internet. For example, 9.67.97.103 is an IP address.

**IP address.** See *Internet Protocol address*.

**IPL.** See *initial program Load*.

**IRQ.** See *interrupt request*.

**ISA.** See *Industry Standard Architecture*.

**ISDN.** See *Integrated Services Digital Network*.

**isolated group.** A collection of isolated devices not connected to the SAN but discovered by the SANavigator tool. The Isolated Group displays with a gray background near the bottom of the Physical and Data Path Maps.

**Java Runtime Environment (JRE).** A subset of the Java Development Kit (JDK) for end users and developers who want to redistribute the Java Runtime Environment (JRE). The JRE consists of the Java virtual machine, the Java Core Classes, and supporting files.

**JRE.** See *Java Runtime Environment*.

**label.** A discovered or user entered property value that is displayed underneath each device in the Physical and Data Path Maps.

**LAN.** See *local area network*.

**LBA.** See *logical block addressing*.

**local area network (LAN).** A computer network located on a user's premises within a limited geographic area.

**logical block addressing (LBA).** A hard disk sector addressing scheme in which the addressing conversion is performed by the hard disk firmware. LBA is used on all SCSI hard disks and on ATA-2 conforming IDE hard disks.

**logical unit number (LUN).** An identifier used on a small computer systems interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

**loop address.** The unique ID of a node in Fibre Channel loop topology sometimes referred to as a Loop ID.

**loop group.** A collection of SAN devices that are interconnected serially in a single loop circuit. Loop Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**loop port (FL\_Port).** An N-Port or F-Port that supports arbitrated loop functions associated with an arbitrated loop topology.

**LUN.** See *logical unit number*.

**MAC.** See *medium access control*.

**medium access control (MAC).** In LANs, the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

**man pages.** In UNIX-based operating systems, online documentation for operating-system commands, subroutines, system calls, file formats, special files, stand-alone utilities, and miscellaneous facilities. Invoked by the **man** command.

**management information base (MIB).** The information that is on an agent. It is an abstraction of configuration and status information.

**MCA.** See *micro channel architecture*.

**MIB.** See *management information base*.

**micro channel architecture (MCA).** IBM's proprietary bus that is used in high-end PS/2 personal computers. Micro Channel is designed for multiprocessing and functions as either a 16-bit or 32-bit bus. It eliminates potential conflicts that arise when installing new peripheral devices.

**MIDI.** See *musical instrument digital interface*.

**model.** The model identification assigned to a device by its manufacturer.

**musical instrument digital interface (MIDI).** A protocol that allows a synthesizer to send signals to another synthesizer or to a computer, or a computer to a musical instrument, or a computer to another computer.

**NDIS.** See *network device interface specification*.

**network device interface specification (NDIS).** An application programming interface (API) definition that allows DOS or OS/2 systems to support one or more network adapters and protocol stacks. NDIS is a 16-bit, Ring O (for the OS/2 operating system) API that defines a specific way for writing drivers for layers 1 and 2 of the OSI model. NDIS also handles the configuration and binding of these network drivers to multiple protocol stacks.

**network management station (NMS).** In the Simple Network Management Protocol (SNMP), a station that executes management application programs that monitor and control network elements.

**NMI.** See *non-maskable interrupt*.

**NMS.** See *network management station*.

**non-maskable interrupt (NMI).** A hardware interrupt that another service request cannot overrule (mask). An NMI bypasses and takes priority over interrupt requests generated by software, the keyboard, and other such devices and is issued to the microprocessor only in disastrous circumstances, such as severe memory errors or impending power failures.

**N\_Port.** A node port. A Fibre Channel defined hardware entity that performs data communications over the Fibre Channel link. It is identifiable by a unique Worldwide Name. It can act as an originator or a responder.

**node.** A physical device that allows for the transmission of data within a network.

**nonvolatile storage (NVS).** A storage device whose contents are not lost when power is cut off.

**NVS.** See *nonvolatile storage*.

**NVSRAM.** Nonvolatile storage random access memory. See *nonvolatile storage*.

**Object Data Manager (ODM).** An AIX proprietary storage mechanism for ASCII stanza files that are edited as part of configuring a drive into the kernel.

**ODM.** See *Object Data Manager*.

**out-of-band.** Transmission of management protocols outside of the Fibre Channel network, typically over Ethernet.

**PCI local bus.** See *peripheral component interconnect local bus*.

**PDF.** See *portable document format*.

**peripheral component interconnect local bus (PCI local bus).** A standard that Intel Corporation introduced for connecting peripherals. The PCI local bus allows up to 10 PCI-compliant expansion cards to be installed in a computer at a time. Technically, PCI is not a bus but a bridge or mezzanine. It runs at 20 - 33 MHz and carries 32 bits at a time over a 124-pin connector or 64 bits over a 188-pin connector. A PCI controller card must be installed in one of the PCI-compliant slots. The PCI local bus is processor independent and includes buffers to decouple the CPU from relatively slow peripherals, allowing them to operate asynchronously. It also allows for multiplexing, a technique that permits more than one electrical signal to be present on the PCI local bus at a time.

**performance events.** Events related to thresholds set on SAN performance.

**polling delay.** The time in seconds between successive discovery processes during which Discovery is inactive.

**port.** The hardware entity that connects a device to a Fibre Channel topology. A device can contain one or more ports.

**portable document format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**private loop.** A freestanding Arbitrated Loop with no fabric attachment.

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

**PTF.** See *program temporary fix*.

**RAM.** See *random-access memory*.

**random-access memory (RAM).** A temporary storage location in which the central processing unit (CPU) stores and executes its processes.

**RDAC.** See *redundant disk array controller*.

**read-only memory (ROM).** Memory in which the user cannot change stored data except under special conditions.

**recoverable virtual shared disk (RVSD).** A virtual shared disk on a server node configured to provide continuous access to data and file systems in a cluster.

**red, green, blue (RGB).** (1) Color coding in which the brightness of the additive primary colors of light, red, green, and blue are specified as three distinct values of white light. (2) Pertaining to a color display that accepts signals that represent red, green, and blue.

**redundant disk array controller (RDAC).** (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

**RGB.** See *red, green, blue*.

**ROM.** See *read-only memory*.

**router.** A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses.

**RVSD.** See *recoverable virtual shared disk*.

**SAN.** See *storage area network*.

**scope.** Defines a group of controllers by their IP addresses. You must create and configure a scope so that dynamic IP addresses can be assigned to controllers on your network..

**SCSI.** See *small computer system interface*.

**segmented loop ports (SL\_Ports).** SL\_Ports allow you to divide a Fibre Channel Private Loop into multiple segments. Each segment can pass frames around as an independent loop and can connect through the fabric to other segments of the same loop.

**serial storage architecture (SSA).** An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with SCSI devices, allows full-duplex packet multiplexed serial data transfers at rates of 20Mb/sec in each direction.

**server.** A functional hardware and software unit that delivers shared resources to workstation client units on a computer network.

**server/device events.** Events that occur on the server or a designated device that meet criteria that the user sets.

**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).

**SL\_Port.** See *segmented loop ports*.

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

**SNMP.** See *Simple Network Management Protocol*.

**SNMPv1.** The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

**SNMP time-out.** The maximum amount of time the SANavigator tool will wait for a device to respond to a request. The specified time applies to one retry only.

**SNMP trap events.** SNMP is based on a manager/agent model. SNMP includes a limited set of management commands and responses. The management system issues messages that tell an agent to retrieve various object variables. The managed agent sends a Response message to the management system. That message is an event notification, called a trap, that identifies conditions, such as thresholds, that exceed a predetermined value.

**SRAM.** See *static random access memory*.

**SSA.** See *serial storage architecture*.

**static random access memory (SRAM).** Random access memory based on the logic circuit known as flip-flop. It is called *static* because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly refreshed. It is however, still volatile, meaning that it can lose its contents when the power is switched off.

**storage area network (SAN).** A network that links servers or workstations to disk arrays, tape backup subsystems, and other devices, typically over Fibre Channel.

**storage management station.** A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel I/O path.

**subnet.** An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

**super video graphics array (SVGA).** A video display standard that Video Electronics Standards Association (VESA) created to provide high resolution color display on IBM PC compatible personal computers. The resolution is 800 x 600 4-bit pixels. Each pixel can therefore be one of 16 colors.

**SVGA.** See *super video graphics array*.

**sweep method.** A method of sending SNMP requests for information to all the devices on a subnet by sending the request to every device on the network. Sweeping an entire network can take a half an hour or more. If broadcast is disabled, the recommended method is to enter the individual IP addresses of the SAN devices into the SANavigator tool. This method produces good results without unnecessarily using time to wait for responses from every IP address in the subnet, especially for IP addresses where no devices are present. There might, however, be times when a full subnet sweep will produce valuable diagnostic information about the network or a device's configuration.

**switch.** A Fibre Channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

**switch group.** A switch and the collection of devices connected to it that are not in other groups. Switch Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**system name.** Device name assigned by the vendor's third-party software.

**TCP.** See *Transmission Control Protocol*.

**TCP/IP.** See *Transmission Control Protocol/Internet Protocol*.

**terminate and stay resident program (TSR program).** A program that installs part of itself as an extension of DOS when it is executed.

**TFT.** See *thin-film transistor*.

**thin-film transistor (TFT).** A transistor created by using thin film methodology.

**topology.** The physical or logical arrangement of devices on a network. The three Fibre Channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

**TL\_Ports.** See *translated loop port*.

**translated loop ports (TL\_Ports).** Each TL\_Port connects to a private loop and allows connectivity between the private loop devices and *off loop* devices (devices not connected to that particular TL\_Port).

**Transmission Control Protocol (TCP).** A communication 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 packed-switched communication 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).** A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

**trap.** In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

**trap recipient.** Receiver of a forwarded SNMP trap. Specifically, a trap receiver is defined by an IP address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

**TSR program.** See *terminate and stay resident program*.

**user action events.** Actions that the user takes, such as changes in the SAN, changed settings, and so on. Each such action is considered a User Action Event.

**vendor.** Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered but will always remain editable.

**VGA.** See *video graphics adapter*.

**video graphics adapter (VGA).** A computer adapter that provides high-resolution graphics and a total of 256 colors.

**video random access memory (VRAM).** A special type of dynamic RAM (DRAM) used in high-speed video applications, designed for storing the image to be displayed on a computer's monitor.

**VRAM.** See *video random access memory*.

**WORM.** See *write-once read-many*.

**Worldwide Name (WWN).** A registered, unique 64-bit identifier assigned to nodes and ports.

**write-once read-many (WORM).** Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered. Typically the storage medium is an optical disk whose surface is permanently etched by using a laser in order to record information. WORM media are high-capacity storage devices and have a significantly longer shelf life than magnetic media.

**WWN.** See *worldwide name*.

**XGA.** See *eXtended graphics array*.

**zoning.** A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.

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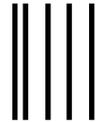
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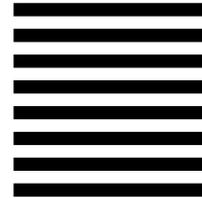
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