IBM TotalStorage FAStT Storage Manager Version 8.4x

IBM

Installation and Support Guide for Intel-based Operating System Environments

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> **Note:**
> Before using this information and the product it supports, be sure to read the general information in "Notices" on page 147.

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About this document

Throughout this document, Storage Manager Version 8.4 refers to all version 8.4 software release levels. References to Storage Manager Version 8.41 refer exclusively to that release.

This document provides information about how to plan, install, configure, and work with IBM® TotalStorage® Fibre Array Storage Technology (FAStT) Storage Manager Version 8.4 in each of the following Intel® processor-based operating systems:

- Microsoft® Windows NT®4.0
- Windows® 2000
- Windows Server 2003
- Novell NetWare 6.0 and 6.5
- Red Hat Enterprise Linux Advanced Server 2.1 (formerly Red Hat Linux Advanced Server 2.1)
- United Linux 1.0 IA-64
- United Linux 1.0
    - SuSE Linux Enterprise Server 8 (SLES 8)
    - Turbolinux Enterprise Server 8 (TLES 8)
    - Conectiva Linux Enterprise Edition Powered by United Linux
- VMware ESX Server 2.0

This document also provides information about how to plan, install, configure, and work with IBM TotalStorage FAStT Storage Manager Version 8.41 in each of the following Intel processor-based operating systems:

- Windows 2000
- Red Hat Enterprise Linux Advanced Server 2.1 (formerly Red Hat Linux Advanced Server 2.1)
- United Linux 1.0
    - SuSE Linux Enterprise Server 8 (SLES 8)
    - Turbolinux Enterprise Server 8 (TLES 8)
    - Conectiva Linux Enterprise Edition Powered by United Linux
    - IA-64

Use this document to perform the following tasks:

- 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.

Notes:

1. The controller firmware and NVSRAM that ship with the IBM FAStT Storage Manager Version 8.4 support only the following FAStT storage servers:
    - FAStT600; Machine Type 1722; Model Number 60U
    - FAStT600; Machine Type 1722; Model Number 60X
    - FAStT700; Machine Type 1742; Model Number 1RU
    - FAStT700; Machine Type 1742; Model Number 1RX

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- FAStT900; Machine Type 1742; Model Number 90U
- FAStT900; Machine Type 1742; Model Number 90X
2. The controller firmware and NVSRAM that ship with the IBM FAStT Storage Manager Version 8.41 support only the following FAStT storage servers:
   - FAStT600; Machine Type 1722; Model Number 60U
   - FAStT600; Machine Type 1722; Model Number 60X
   - FAStT900; Machine Type 1742; Model Number 90U
   - FAStT900; Machine Type 1742; Model Number 90X

Who should read this document

This document is intended for system and storage administrators who are responsible for installing software. Readers should have knowledge of Redundant Array of Independent Disks (RAID), Small Computer System Interface (SCSI), and Fibre Channel technology, They should also have working knowledge of the applicable operating systems that are used with the management software.

FAStT installation process overview

Figure 1 gives an overview of the FAStT hardware and the FAStT Storage Manager software installation process. Lined arrows in the flow chart indicate consecutive hardware and software installation process steps. Labeled arrows indicate which document provides detailed information about a step.

Install Process	Documentation		
Plan Installation	* FC Planning and Integration: User's Guide and Svc Info FAStT Storage Manager Concepts Guide	**Connect Power and Start Server**	**FAStT Storage Server Installation Guides** **Fibre Channel Hardware Maintenance and Problem Determination Guide**
Install Storage Server/RAID Controller Enclosure(s) in Rack	**FAStT Storage Svr Installation Guide** **FAStT RAID Controller Enclosure Unit Install and User's Guide**	**Verify Server operation w/ LEDs**	
Install Storage Expansion Unit(s)	**FAStT Storage Exp Units Install and User's Guides**	**Prepare for Installation of SM Software**	**FAStT Storage Manager Installation and Support OS Guides** **FAStT Storage Manager Copy Services User's Guide**
Make FC Connections		**Install and Verify SM SW on Host and Workstation**	
Set Link Speed (1 Gb only)	**FAStT and HBA Install and User's Guides** **FAStT Fibre Channel Storage Server Installation Guides** **Fibre Channel Cabling Instructions**	**Complete SM SW Installation**	
Determine Management Method Out-of-Band In-Band		**Configure Storage Hardware**	**Online Help**
Install Network Hardware; Prepare Network Connection		**Configure Storage Subsystems on Host**	
* For pSeries Server and 6227 or 6228 HBA use only			

Figure 1. Installation process flow by current publications

FAStT Storage Manager Version 8.4 library

Table 1 presents an overview of FAStT Storage Manager product library documents by the common tasks that they address. Click on active links in the tables to access those documents currently available on the Internet. You can access documentation for the other FAStT products at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Table 1. TotalStorage FAStT Storage Manager Version 8.4 titles by user tasks

Title	User tasks					
	Planning	Hardware installation	Software installation	Configuration	Operation and administration	Diagnosis and maintenance
IBM TotalStorage FAStT Storage Manager 8.4x Installation and Support Guide for Intel-based Operating System Environments, GC26-7621	✔		✔	✔		
IBM TotalStorage FAStT Storage Manager 8.4x Installation and Support Guide for AIX, UNIX, and Solaris, GC26-7622	✔		✔	✔		
IBM TotalStorage FAStT Storage Manager Copy Services User's Guide, GC26-7561	✔		✔	✔	✔	
IBM FAStT Storage Manager Script Commands (see product CD)				✔		
IBM TotalStorage FAStT Storage Manager Concepts Guide, GC26-7560	✔	✔	✔	✔	✔	✔

How this document is organized

Chapter 1, "Introduction," on page 1 provides an overview of IBM FAStT Storage Manager Version 8.4 and describes storage subsystem management methods, configuration types, types of installations, and installation requirements.

Chapter 2, "Preparing for installation," on page 31 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, Windows Server 2003, NetWare, Linux, and UNIX® platforms. It also describes other setup tasks.

Chapter 3, "Installing Storage Manager software in a standard Windows configuration," on page 55 provides installation instructions for Windows NT, Windows 2000, and Windows 2000 Server software components in a standard (noncluster) environment.

Chapter 4, "Installing Storage Manager software in a Windows cluster server environment," on page 65 provides installation instructions for Windows NT, Windows 2000, and Windows 2000 Server software in a cluster server environment.

Chapter 5, "Installing Storage Manager software in a standard NetWare configuration," on page 89 provides installation instructions for the storage management software in standard (noncluster) and cluster server configurations in the NetWare 6.0 operating system environment.

Chapter 6, "Installing Storage Manager software in a Linux configuration," on page 95 provides installation instructions for the storage management software in a Linux operating system environment.

Chapter 7, "Installing Storage Manager software in a VMware ESX Server configuration," on page 101 provides installation instructions for the storage management software in a VMware ESX Server operating system environment.

Chapter 8, "Completing Storage Manager 8.4 installation," on page 103 discusses completion of Storage Manager software on Windows NT, Windows 2000, Windows 2000 Server, NetWare, and Linux platforms. It provides details on starting the Enterprise Management window, performing an automatic discovery of storage subsystems, adding devices, setting up alert notifications, downloading firmware and nonvolatile storage random access memory (NVSRAM), creating arrays and logical drives, and other storage subsystem management tasks.

Chapter 9, "Using the storage management software for Windows and NetWare," on page 115 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 in Windows NT, Windows 2000, Windows 2000 Server, and NetWare operating system environments.

Appendix A, "Windows operating system limitations," on page 127 discusses Windows NT, Windows 2000, and Windows Server 2003 operating system limitations and other operating system issues.

Appendix B, "NetWare operating system limitations," on page 133 discusses NetWare operating system limitations and other related operating system issues.

Appendix C, "Linux operating system limitations," on page 135 discusses Linux operating system limitations and other related operating system issues.

Appendix D, "VMware ESX Server operating system limitations," on page 137 discusses VMware ESX Server operating system limitations and other related operating system issues.

Appendix E, "Storage subsystem and controller information record," on page 139 provides a data sheet template that you can use to create a controller information record.

Appendix F, "Additional FAStT documentation," on page 141 provides an overview of the FAStT900, FAStT700, and FAStT600 Fibre Channel Storage Server product libraries, as well as other related documents.

Notices that this document uses

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.

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 IBM @server 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:

  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 @server 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 the Web site at:

www.ibm.com/pc/support/

and follow the instructions. Also, to order publications through the IBM Publications Ordering System, go to the Web site at:

www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi/

Web sites

Locate up-to-date information about FAStT Fibre Channel Storage Servers and FAStT Storage Manager 8.4, including documentation and the most recent software, firmware, and NVSRAM downloads at the following Web sites.

IBM xSeries servers
For IBM xSeries information, go to the Web site at:

www.ibm.com/eserver/xseries/

IBM IntelliStation
For IBM IntelliStation information, go to the Web site at:

www.ibm.com/pc/intellistation/

FAStT Fibre Channel Storage Servers
Find the latest information about all of the IBM FAStT Fibre Channel Storage Servers at:

www.ibm.com/storage/disk/fastt/

IBM TotalStorage products
Find information about all IBM TotalStorage products at:

www.ibm.com/storage

TotalStorage FAStT interoperability matrix
Find the latest information about operating system and host bus adapter (HBA) support, clustering support, storage area network (SAN) fabric support, and Storage Manager feature support at:

www.ibm.com/storage/disk/fastt/supserver.htm/

IBM Service
For service information for your IBM products, including supported options, go to the Web site at:

www.ibm.com/pc/support/

FAStT technical support

Find FAStT software downloads, hints and tips, documentation, parts information, HBA and fibre channel support at:

www-1.ibm.com/servers/storage/support/fastt/index.html

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.

Premium feature activation

Enable a premium feature on a FAStT600 or FAStT900 by using the online tool at:

www.storage.ibm.com/pfeatures.html

IBM Publications Center

Order IBM publications at:

www.ibm.com/shop/publications/order/

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 the Web site at:

www.ibm.com/services/sl/products/

For more information about Support Line and other IBM services, go to the Web site at:

www.ibm.com/services/

or, for support telephone numbers, go to the Web site at:

www.ibm.com/planetwide/

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. For support telephone numbers, go to the Web site at:

www.ibm.com/planetwide/

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

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Your feedback is important to help us provide the highest quality of information. If you have any comments about this document, please either fill out the Readers' comments form (RCF) at the back of this document and give it to an IBM representative, or submit it in one of the following ways:

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    STARPUBS at SJEVM5
  - Submit your comments over IBMLink from Canada to:

    STARPUBS at TORIBM
  - Submit your comments over IBM Mail Exchange to:

    USIB3WD at IBMMAIL

  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 or table number.

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  Tucson, Arizona 85744-0001
  U.S.A.

Chapter 1. Introduction

IBM FAStT Storage Manager version 8.4x host software supports new features incorporated into the latest release of controller firmware version 05.4x.xx.xx. This version of FAStT Storage Manager also manages FAStT storage servers with all general released firmware versions from 04.00.02.xx through 05.3x.xx.xx. The latest controller firmware versions supporting FAStT600 storage servers available free-of-charge are of the 05.34.xx.xx code thread. The latest controller firmware versions supporting FAStT200, FAStT500, FAStT700 and FAStT900 storage servers available free-of-charge are of the 05.30.xx.xx code thread. You can upgrade FAStT600, FAStT700 and FAStT900 storage servers to the 5.4x.xx.xx controller firmware version only by purchase option. New features associated with the 05.4x.xx.xx controller firmware are listed in "New features" on page 2.

This document provides information on how to prepare, install, configure, and start IBM TotalStorage FAStT Storage Manager Version 8.4 in the following operating system environments:

- Windows NT 4.0
- Windows 2000
- Windows Server 2003
- Novell NetWare
- Linux
- VMware ESX Server

This document also provides information on how to prepare, install, configure, and start IBM TotalStorage FAStT Storage Manager Version 8.41 in the following operating system environments:

- Windows 2000
- Linux

Consult your IBM service representative for any future support of additional operating system environments.

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

- readme.txt file

  Read this document first. It supplies information associated with operating systems on which you can install Storage Manager software. A readme file is located in the root directory of each of four installation CDs associated with supported operating systems. For the latest installation and user information, refer to the following IBM Web site:

  www-1.ibm.com/servers/storage/support/fastt/index.html

- *IBM TotalStorage FAStT Storage Manager Concepts Guide*

  Use this document to become familiar with terminology and features of the IBM FAStT Storage Manager software. To download this book, go to the Web site at:

  www-1.ibm.com/servers/storage/support/fastt/index.html

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 8.4 Client. From either an Enterprise Management or Subsystem Management window, click **Help** or press **F1**.

After you install IBM FAStT Storage Manager Version 8.4, consider installing the FAStT Management Suite Java (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 (Windows and Linux), the *IBM FAStT MSJ User's Guide*, and the FAStT MSJ program are located on the IBM FAStT Storage Manager Version 8.4 CD where associated with your particular operating system. For information about how to install and run SANavigator, see the *FAStT Hardware Maintenance Manual and Problem Determination Guide*.

New features

This section describes the standard features that are part of the Storage Manager Version 8.4 software. Your storage subsystem firmware must be version 5.4x.xx.xx if you want to use any of the features listed in this section. If your controller firmware is version 05.3x.xx.xx or earlier, you must purchase a firmware upgrade option.

The following new features and support have been added to the Storage Manager version 8.40 software:

- Support for IBM TotalStorage FAStT600 Turbo Option Fibre Channel Storage Server
- Support for up to 256 logical unit number (LUN) mappings per host server (depending on the operating system)
- Persistent Reservations feature
- VolumeCopy feature

Storage Manager 8.41 supports:

- FAStT EXP100 storage expansion enclosure attachment to FAStT600 and FAStT900 storage servers.
- Serial ATA (SATA) hard drives instead of fibre-channel hard drives
- Firmware version 5.41.xx.xx, which ships as part of the EXP100 expansion enclosure without additional charge.

Restrictions to Storage Manager software Version 8.41 and firmware version level 5.41.xx.xx include:

- No copy services support (Remote Mirroring Option, FlashCopy®, VolumeCopy)
- No support for the simultaneous attachment of the EXP100 expansion enclosure to controllers that are attached to EXP700 or EXP500 expansion enclosures (those using fibre-channel hard drives)
- FAStT storage servers require that you install firmware version 5.41.xx.xx and its associated NVSRAM file for SATA hard drives to be recognized in EXP100 expansion enclosures.

You can either order FAStT storage servers factory-equipped with firmware version 5.41.xx.xx or upgrade your firmware and NVSRAM files using the procedure documented in the *IBM TotalStorage FAStT EXP100 Storage Expansion Unit Installation and User's Guide,* GC26-7601.

- After the upgrade is complete, you cannot downgrade a controller firmware from version 5.41.xx.xx to any previous version.

Premium features

> **FAStT600**
>
> - The Remote Mirror feature is not currently supported on either the FAStT600 or FAStT600 Turbo Option Fibre Channel storage servers.
> - Storage Partitioning is not a standard feature on the FAStT600.

Four premium features can be enabled on all FAStT subsystems by purchasing a premium feature key. These include FlashCopy, Remote Mirror option, VolumeCopy, and Storage Partitioning (standard on all but the FAStT600 and FAStT600 Turbo Option). Each of these features is described in the following section.

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.

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.

VolumeCopy

The VolumeCopy feature is a firmware-based mechanism for replicating logical drive data within a storage array. This feature is designed as a system management tool for tasks such as relocating data to other drives for hardware upgrades or performance management, data backup, or restoring FlashCopy logical drive data. Users submit VolumeCopy requests by specifying two compatible drives. One drive is designated as the Source and the other as the Target. The VolumeCopy request is persistent so that any relevant result of the copy process can be communicated to the user.

Storage Partitioning

Storage Partitioning allows the user to present all storage volumes to a SAN through several different partitions by *mapping* storage volumes to a LUN number, each partition presenting LUNs 0 - 255. This volume/LUN mapping applies only to the host port or ports that have been configured to

access that LUN. A given storage volume can have only one Host/LUN mapping. This feature allows the total number of configurable storage volumes supported by the array to be much greater than the number of addressable storage devices.

This feature also allows the support of multiple hosts using different operating systems and their own unique disk storage subsystem settings to be connected to the same FAStT Storage Serverat the same time (heterogeneous host environment).

Storage Manager 8.4 limitations

Because there is no Storage Manager 8.4-level firmware and NVSRAM for FAStT200 (3542-1RU) and FAStT500 (3552-1RU), Storage Manager 8.4 features are unavailable for these products. However, IBM recommends that you use Storage Manager 8.4 host software to manage these FAStT Storage Servers.

Supported machine types

Table 2 provides a list of machine types and supported storage management software.

Table 2. Machine types and supported storage management software

Product name	Machine type	Model	Firmware version	Supported storage management software version
IBM 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, 8.41
IBM FAStT200 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, 8.41
IBM FAStT200 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, 8.41
IBM Netfinity FAStT500 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, 8.41
IBM TotalStorage FAStT700 Fibre Channel Storage Server	1742	1RU 1RX	5.00.xx.xx 5.20.xx.xx 5.21.xx.xx 5.30.xx.xx 5.40.xx.xx	8.0, 8.2, 8.21, 8.3, 8.41
IBM TotalStorage FAStT900 Fibre Channel Storage Server	1742	90X 90U	5.30.xx.xx 5.40.xx.xx 5.41.xx.xx (supports EXP100 only)	8.3, 8.4, 8.41

Product name	Machine type	Model	Firmware version	Supported storage management software version
IBM TotalStorage FAStT600 Fibre Channel Storage Server	1722	6LU 6LX	5.34.xx.xx	8.41.xx.03 or later
		60U 60X	5.33.xx.xx 5.34.xx.xx 5.40.xx.xx 5.41.xx.xx (supports EXP100 only)	8.3, 8.4, 8.41

Notes:

1. Firmware level 5.41.xx.xx provides EXP100 expansion enclosure support only.

2. Firmware level 5.40.xx.xx and earlier provide support for EXP500 and EXP700 expansion enclosures only.

3. Controller firmware versions regulate the function of any given Storage Manager client code version release. You might need to purchase the appropriate firmware upgrade option to enable the function of your particular Storage Manager client code version release. 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, 8.3, 8.4 or 8.41.

4. This table associates all compatible controller firmware and management software versions for the various FAStT Storage Server products. To ensure the highest level of compatibility and error-free operation, the controller firmware for all FAStT Storage Server products should be 05.3x.xx.xx-level (except for machine type 3526, for which the latest available firmware level is 04.01.xx.xx.) and the management software version should be 08.4x.xx.xx-level or higher.

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 3 provides a list of some of the changed terms. For further information on terminology, see the Help section of the Storage Manager Enterprise Management window, the Storage Subsystem Management window, or the glossary on page 149.

Table 3. New terminology

Term used in previous versions	New term
RAID module	Storage subsystem
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. You can attach it to the storage subsystem in either of 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 document.
2. A host computer can also function as a management station.

IBM FAStT Storage Manager Version 8.4 software for Windows

Storage Manager Version 8.4 contains the following software components for Windows NT 4.0, Windows 2000, and Windows Server 2003:

- The following component installs on both the host and management station:
  - Storage Manager 8.4 Client (SMclient)
- The following components install only on the host:
  - Redundant Disk Array Controller (RDAC)
  - Storage Manager 8.4 Agent (SMagent)
  - Storage Manager 8.4 Utility (SMutil)

Microsoft Virtual Machine

Systems running Windows NT 4.0 and Storage Manager 8.4 do not require the Microsoft Virtual Machine to support the following components or options:

- SMagent
- Event Monitor option of the SMclient

Storage Manager 8.4 Client

The Storage Manager 8.4 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 8.4 Agent

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

Storage Manager 8.4 Utility

The Storage Manager 8.4 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 120.
*   **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 120.
*   **SMrepassist utility**. The SMrepassist utility enables you to perform the following tasks:
    *   Flush cached data before creating a FlashCopy or VolumeCopy.
    *   Resolve duplicate logical drive signatures between the base logical drives and a FlashCopy logical drive or between target and source logical drives in a VolumeCopy logical drive pair (Windows NT 4.0 only).

    For more information, see "Using the SMrepassist utility" on page 121.

IBM FAStT Storage Manager Version 8.4 software for NetWare

Storage Manager Version 8.4 contains the following software components for NetWare:

*   The following components install on both the host and management station:
    *   Storage Manager 8.4 Client (SMclient)
*   The following components install only on the host:
    *   Storage Manager 8.4 Agent (SMagent)
    *   Storage Manager 8.4 Utility (SMutil)
        *   hot_add
        *   SMdevices
    *   LSIMPE.CDM

        Download this software component from the following Web site:

        support.novell.com

IBM FAStT Storage Manager Version 8.4 software for Linux

Storage Manager Version 8.4 contains the following software components for Linux:

- The following components install on both the host and management station:
  - Storage Manager 8.4 Client (SMclient)
  - Storage Manager 8.4 Runtime (SMruntime)
- The following components install only on the host:
  - Storage Manager 8.4 Utility (SMutil)
  - IBM FAStT MSJ QLremote agent
  - FAStT Management Suite Java™ (FAStT MSJ)

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

Unless you are using Windows NT, you must make direct (out-of-band) connection to the FAStT Storage Server in order to obtain the correct host type. The correct host type will allow the FAStT Storage Server to configure itself properly for the operating system of the host server. After you do so, and depending on your particular site requirements, you can use either or both management methods. The management methods you select will determine where you will need to install the software components.

Note: Storage Manager 8.4 supports only the out-of-band management method for use with the Linux operating system.

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 9.

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

- Ethernet cables do not need to be run to the controllers.
- A Dynamic Host Configuration Protocol/Bootstrap Protocol (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 31, 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 28.

Running the
host-agent software

Host computer

Fibre Channel
I/O path

Network

Controller
Controller

Controller
Controller

Storage subsystems

Note: The host can
act as a management
station also.

Management station
(one or more)

SJ000879
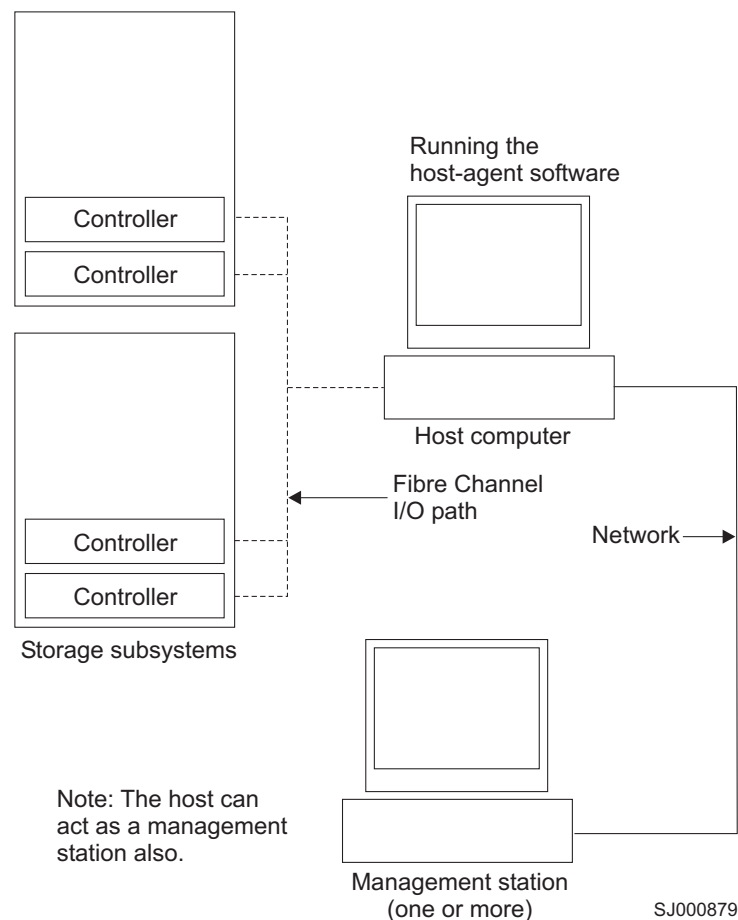
Figure 2. Host-agent (in-band) managed storage subsystems

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 11.

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 Storage Manager 8.4 supports.
- 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.
- You 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 Chapter 2, "Preparing for installation," on page 31.

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/pc/support/

  Refer to Retain Tip #H171389 Unable To Setup Networking Without DHCP/BOOTP.
- Storage subsystem controllers with firmware version 05.00.xx. or higher have the following default settings.

Controller	IP address	Subnet mask
A	192.168.128.101	255.255.255.0
B	192.168.128.102	255.255.255.0

Notes:
1. If the storage subsystem controllers have firmware version `05.4x.xx.xx` or higher, use the Storage Manager Client Program to change the default IP address.
2. You must make a direct management connection to the storage server using the default IP addresses before you can change them.

Figure 3 on page 11 shows a system in which storage subsystems are managed by using the direct-management (out-of-band) method.

Controller

Controller

Controller

Controller

Storage subsystems

Host computer

Fibre Channel
I/O path

Ethernet

Management station
(one or more)   SJ000864
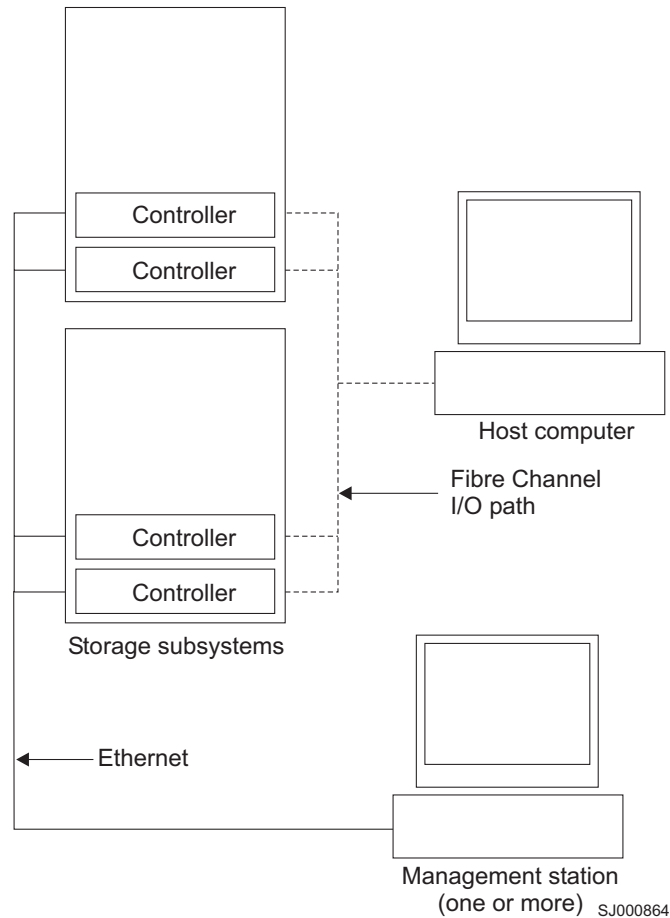
Figure 3. Direct-management (out-of-band) storage subsystems

Reviewing a sample network

Figure 4 on page 12 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
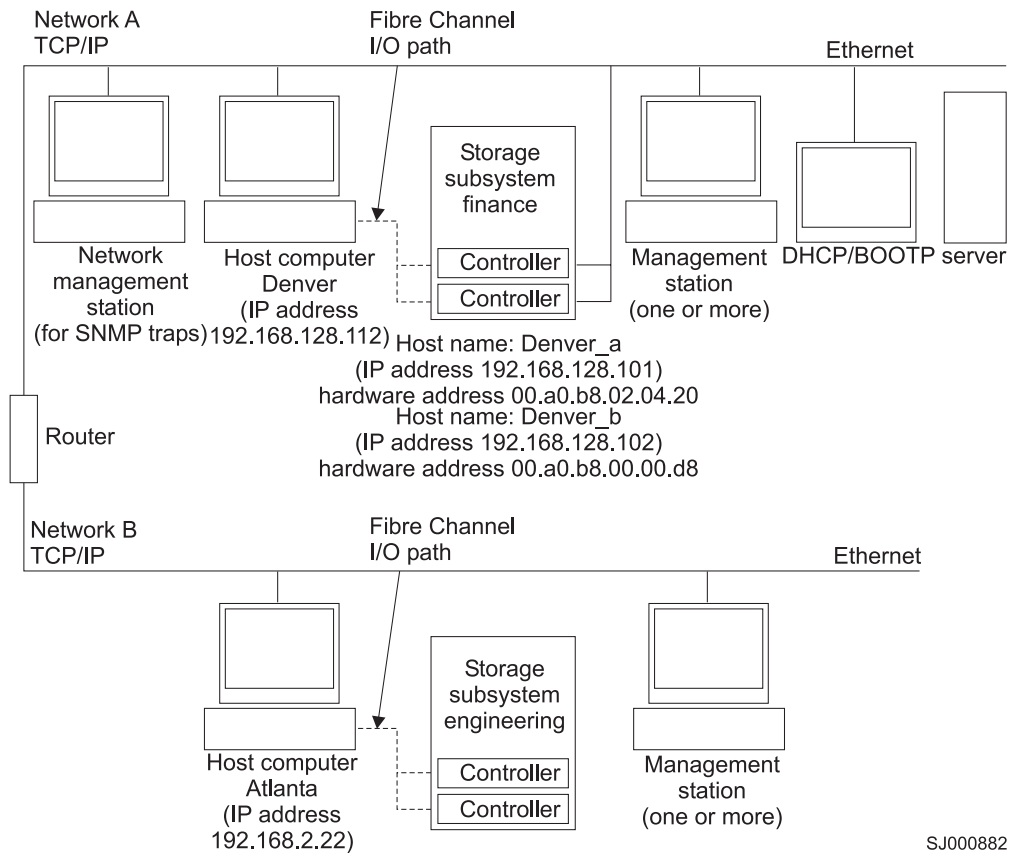
Figure 4. Sample network using directly-managed and host-agent managed storage subsystems

Where to install 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:

- SMclient
- SMruntime (for Linux only)

Host computers

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

- RDAC (for Linux, Windows NT, Windows 2000, and Windows Server 2003 only)
- SMutil
- LSIMPE.com (for NetWare only)
- IBM FAStT MSJ and QLRemote agent (for Linux only if Linux RDAC is not installed)

Note: See the Linux RDAC README in the IBM FAStT Storage Manager for x86 Linux software package for detailed Linux RDAC installation instructions.

Depending on how you intend to manage the storage subsystems, you might need to install the following software components:
- SMagent (for Windows NT, Windows 2000, Windows Server 2003, and NetWare only)
- SMclient
- SMruntime (for Linux only)

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 8.4 in either of the two following configurations:
- Standard (noncluster) configuration
- Cluster server configuration
  - Although there is currently no support for Linux cluster server configurations, you can contact IBM for updates regarding availability of such support in the future.
  - Illustrations of cluster server configurations that follow do not pertain to NetWare.

Standard (noncluster) configuration

Figure 5 shows a sample standard (noncluster) configuration.
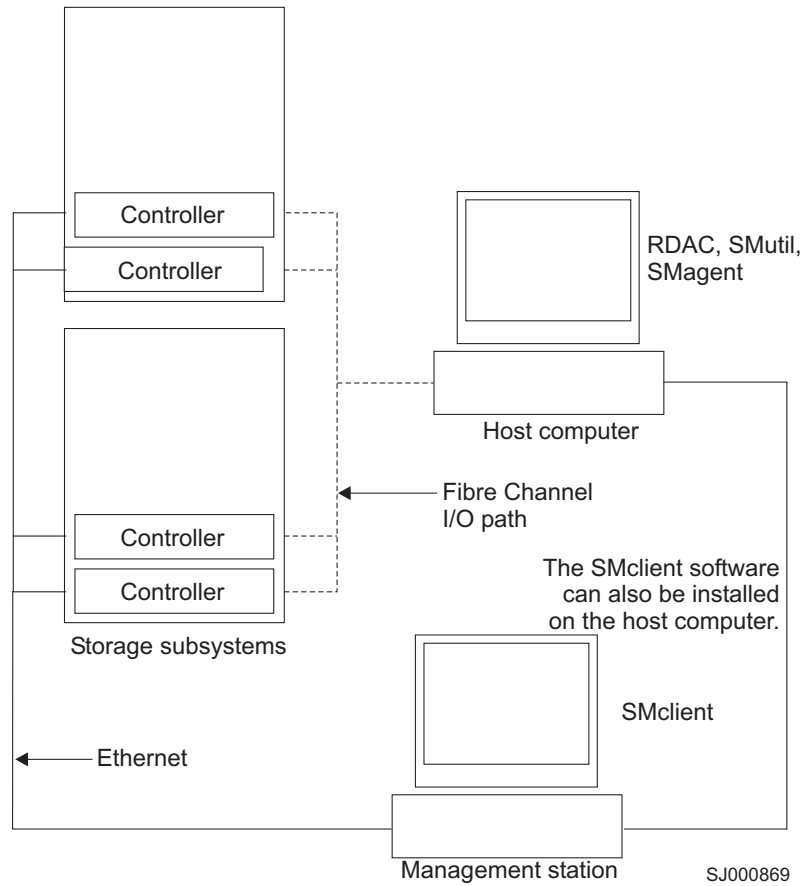
Figure 5. Sample standard (noncluster) configuration

Cluster server configuration for Windows and NetWare

Figure 6 shows a sample cluster server configuration.
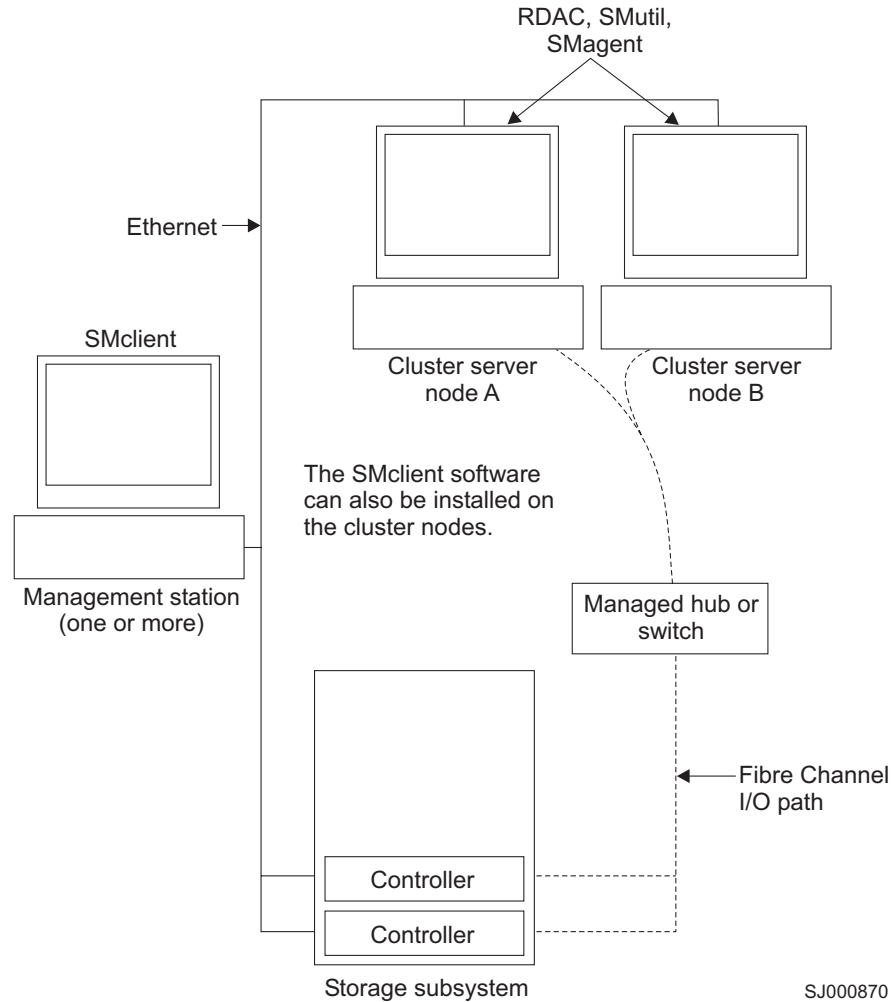
Figure 6. Sample cluster server configuration

Installation types

You can install the storage management software in either of the following types of hardware environments:

- **New storage subsystem environment**. Use this hardware environment if you are installing the IBM TotalStorage FAStT Fibre Channel Storage Server using firmware 05.4x.xx.xx and you will manage storage subsystems using Storage Manager 8.4.

- **Existing storage subsystem environment**. If you are installing the storage management software in an environment with existing storage subsystems, see Table 4 on page 16 for your installation options.

Notes:

1. Where you are instructed in the following table to uninstall Storage Manager software (for Windows operating systems only), be sure to uninstall the management software on all management systems or hosts that have access to the storage subsystem that has firmware 5.4x.xx.xx. The Storage Manager 8.4

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, install the Storage Manager 8.4 RDAC on all host computers that have disks defined on storage subsystems that have firmware level 5.4x.xx.xx

2. Because uninstallation and installation of RDAC require a system reboot, it is possible to install all other components of Storage Manager 8.4, except RDAC, so that you can download the new firmware version (05.4x.xx.xx) to the storage subsystem and manage it. Schedule an RDAC installation as soon as possible to ensure error-free operation and the highest level of compatibility.

Table 4. Configurations for existing storage subsystems

Current environment	Planned environment	Action
(Machine type 1742) Existing storage subsystems with controllers that have firmware versions 05.00.xx.xx, 05.2x.xx.xx or 05.3x.xx.xx (Machine type 1722) Existing storage subsystems with controllers that have firmware version 05.3x.xx.xx	Firmware version 5.40.xx.xx Storage Manager 8.4x. **Note:** Firmware version 05.40.xx.xx supports EXP500 and EXP700 expansion enclosures only.	1. Purchase option. 2. Uninstall Storage Manager 8.3x. See "Uninstalling storage management software components" on page 122 for more information. 3. Install Storage Manager 8.4. See "New installation process" on page 55 for more information. 4. Discover the storage subsystems. See "Performing an initial automatic discovery of storage subsystems" on page 104 for more information. 5. Download firmware and NVSRAM version 5.4x.xx.xx. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information. **Note:** Upgrade the controller firmware using the version supplied on the FAStT Storage Manager 8.40 Upgrade CD before downloading controller firmware from the Web. Only after you have done so, access the Web to download controller firmware version 5.40.xx.xx.

Table 4. Configurations for existing storage subsystems (continued)

Current environment	Planned environment	Action
(Machine type 1742) Existing storage subsystems with controllers that have firmware versions 05.00.xx.xx, 05.2x.xx.xx or 05.3x.xx.xx (Machine type 1722) Existing storage subsystems with controllers that have firmware version 05.3x.xx.xx	Firmware version 5.41.xx.xx Storage Manager 8.4x. **Notes:** 1. Perform upgrade of machine types 1742 and 1722 to firmware level 05.41.xx.xx only when you no longer plan to use these storage servers to manage EXP500 and EXP700 storage expansion enclosures equipped with fibre-channel drives. Perform this upgrade only when you plan to use these FAStT storage servers only to manage EXP100 expansion enclosures. 2. Firmware version 05.41.xx.xx supports EXP100 expansion enclosures only.	1. This firmware ships as part of the FAStT Storage Manager 8.41 Support for FAStT EXP100 SATA Storage Expansion Unit CD. 2. Uninstall Storage Manager 8.3x. See "Uninstalling storage management software components" on page 122 for more information. 3. Install Storage Manager 8.4. See "New installation process" on page 55 for more information. Follow the instructions to upgrade the controller firmware in the *IBM TotalStorage FAStT EXP100 Installation and User's Guide.* **Note:** Upgrade the controller firmware using the version supplied on the FAStT Storage Manager 8.41 Support for FAStT EXP100 SATA Storage Expansion Unit CD before downloading controller firmware from the Web. Only after you have done so, access the Web to download controller firmware version 5.41.xx.xx.

Table 4. Configurations for existing storage subsystems (continued)

Current environment	Planned environment	Action
(Machine type 3552) Existing storage subsystems with controllers that have firmware version levels 04.00.xx.xx through 05.3x.xx.xx	Firmware version level 05.3x.xx.xx Storage Manager 8.4x. **Note:** Firmware version level 05.4x.xx.xx does not support machine type 3552.	1. Uninstall previous Storage Manager version. See "Uninstalling storage management software components" on page 122 for more information. 2. Install Storage Manager 8.4. See "New installation process" on page 55 for more information. 3. Discover the storage subsystems. See "Performing an initial automatic discovery of storage subsystems" on page 104 for more information. If the current controller firmware version number starts with "4.", go to the FAStT technical support Web site listed on page xix to download firmware level 04.01.02.30 or higher and its matching NVSRAM. **Important:** The storage subsystem controllers must be at firmware level 04.01.02.30 or higher before you download firmware level 05.3x.xx.xx and NVSRAM to the controllers. 4. If the current controller firmware version number starts with ″4.″, download firmware level 04.01.02.30 or higher and its associated NVSRAM. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information. 5. Download the latest firmware and NVSRAM version 5.3x.xx.xx from the IBM Web site. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information.

Table 4. 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 05.3x.xx.xx	Firmware version 5.3x.xx.xx Storage Manager 8.4x. **Note:** Firmware version 05.4x.xx.xx does not support machine type 3542.	1. Uninstall the previous Storage Manager software. See "Uninstalling storage management software components" on page 122 for more information. 2. Install Storage Manager 8.4. See "New installation process" on page 55. 3. Discover storage subsystems. See "Performing an initial automatic discovery of storage subsystems" on page 104 for more information. If the current controller firmware version number starts with "4." , go to the FAStT technical support Web site listed on page xix to download the level 04.01.02.30 or higher firmware and matching NVSRAM. **Important:** The storage subsystem controllers must be at firmware level 04.01.02.30 or higher before you download firmware level 05.3x.xx.xx and NVSRAM to the controllers. 4. Download firmware level 04.01.02.30 or higher and its associated NVSRAM. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information. 5. Download firmware and NVSRAM version 5.3x.xx.xx. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information.

Table 4. Configurations for existing storage subsystems (continued)

Current environment	Planned environment	Action
(Machine types 3526, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.xx.xx through 04.00.01.xx	Firmware version 04.01.xx.xx for machine type 3526 Firmware version 05.3x.xx.xx for machine type 3552 Storage Manager 8.4 **Note:** Firmware version 05.3x.xx.xx does not support machine type 3526. Firmware version 05.4x.xx.xx does not support machine type 3552.	1. Uninstall Storage Manager Version 7.x. See "Uninstalling storage management software components" on page 122 for more information. 2. Install Storage Manager 8.4. See "New installation process" on page 55 for more information. 3. Discover the storage subsystems. See "Performing an initial automatic discovery of storage subsystems" on page 104 for more information. If the current controller firmware version number starts with "4.", go to the FAStT technical support Web site listed on page xix to download the level 04.01.02.30 or higher firmware and matching NVSRAM. **Important:** The storage subsystem controllers must be at firmware level 04.01.02.30 or higher before you download firmware level 05.3x.xx.xx and NVSRAM to the controllers. 4. If the current controller firmware version number starts with "4.", download firmware level 04.01.02.30 or higher and its associated NVSRAM. See "Downloading controller and NVSRAM ESM firmware" on page 109 for more information.
(Machine types 3526, 3542, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.02.xx through 04.01.xx.xx	Existing firmware versions Storage Manager 8.4	1. Uninstall Storage Manager Version 7.x. See "Uninstalling storage management software components" on page 122 for more information. 2. Install Storage Manager 8.4. See "New installation process" on page 55 for more information. 3. Discover the storage subsystems. See "Performing an initial automatic discovery of storage subsystems" on page 104 for more information.
(Machine types 3526, 3552) Existing storage subsystems with controllers that have firmware versions 04.00.xx.xx through 4.00.01.xx	Existing firmware versions 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 level 05.4x.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 version levels 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 version levels 04.00.02.xx through 05.3x.xx.xx, which is managed with Storage Manager 8.4

Important: The common host must have the latest level (8.4) of RDAC and SMagent installed. Upgrade all storage subsystems running firmware at or below level 05.2x.xx.xx to the current code level. The latest 05.3x.xx.xx firmware is available free of charge for download with all fixes and software patches from the following IBM support Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

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

Version 8.4 of the storage-management software must be installed on either a management station or host.

Important: In a co-existing situation, the common host must have Storage Manager Version 8.4 RDAC and SMagent installed.

Management station

Firmware version 4.x (minimum)

Controller

Controller

Host-agent

Host computer

Firmware version 5.x

Controller

Controller

Fibre Channel I/O path

Ethernet

Storage subsystems

Client software

Version 7.10 of the storage-management software must be installed on a management station.*

*Only to manage existing storage subsystems with firmware version 4.00.xx.xx to 4.00.01.xx.

Management station

SJ001058

Figure 7. Sample coexisting storage subsystems

System requirements

This section provides detailed information about the hardware, software, and operating system requirements for Storage Manager 8.4.

Hardware requirements

Table 5 lists the hardware required for installing Storage Manager 8.4.

Table 5. Hardware requirements for Storage Manager 8.4 software

Hardware component	Requirements	Software tested
A DHCP/BOOTP server (only for directly managed storage subsystems) **Note:** If the controllers static IP addresses or default IP addresses are used, you do not need to set up the DHCP/BOOTP server.	One of the following BOOTP or BOOTP-compatible servers: • Microsoft BOOTP-compatible DHCP server for Windows NT • Microsoft BOOTP-compatible DHCP server for Windows 2000 • Microsoft BOOTP-compatible DHCP server for Windows Server 2003 • UNIX BOOTP server • NetWare DHCP server	
Storage subsystems (one or more)	Storage subsystems with controllers running firmware version levels 04.00.02.xx through 05.4x.xx.xx	
Fibre Channel (FC) host adapters		The following fibre-channel host adapters were tested with the storage management software: • IBM FAStT host adapter (part number: 00N6881) • An IBM FAStT FC2 Host Bus Adapter (part number 19K1246) or IBM FAStT single port FC2-133 Host Bus Adapter (part number 24P0960) For information about specific host adapter requirements: • Refer to the readme file in the `\Host_Adapter` directory on the installation CD. • Read the host adapter documentation. • Go to the Web site at: www.ibm.com/pc/support/

Table 5. Hardware requirements for Storage Manager 8.4 software (continued)

Hardware component	Requirements	Software tested
Fibre-channel (FC) fabric switches (if needed for the desired configuration)		The following fibre-channel fabric switches were tested with the storage management software: • IBM 8-port fibre-channel switch (machine type 2109 S08) • IBM 16-port fibre-channel switch (machine type 2109 S16) • IBM 16-port 2 Gbps fibre-channel switch (machine type 2019 F16) • IBM 8-port 2 Gbps fibre-channel switch (machine type 3534 F08) • IBM 32-port 2 Gbps fibre-channel switch (machine type 2109 F32) • INRANGE IN-VSN FC/9000 2 Gbps fibre-channel directors (machine types 2042-01 and 2042-128) • McDATA 4500 Sphereon 2 Gbps 16-, 24-, and 32-port fibre-channel switch (machine types 2031-216, 2031-224, and 2032-232) • McDATA Intrepid 6140 2 Gbps directors (machine type 2032-140) • CISCO MDS 9209 2 Gbps multilayer director (machine types 2062-D07 and 2062-T07) • CISCO MDS 9216 2 Gbps multilayer fabric switch (machine type 2062-D01) For specific fibre-channel switch setup requirements: • Read the switch documentation. • Go to the Web site at: www.ibm.com/storage/fcswitch/

Table 5. Hardware requirements for Storage Manager 8.4 software (continued)

Hardware component	Requirements	Software tested

Management station (for client software)	Your management station computer requires:
	• Intel Pentium® or Pentium-equivalent microprocessor (450 MHz or faster)
	• CD-ROM drive
	• Mouse or similar pointing device
	• System memory:
	  – For Windows NT 4.0: A minimum of 64 MB (128 MB recommended)
	  – For Windows 2000: A minimum of 128 MB (256 MB recommended)
	  – For Windows Server 2003, NetWare, and Linux: A minimum of 256 MB (512 MB recommended)
	• Ethernet network interface adapter
	• AGP or PCI video adapter (AGP preferred); ISA adapters are not supported
	• 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.
	• Hardware-based Windows acceleration. Desktop computers that use system memory for video memory are not preferred for use with the storage management software.
	
	Important: 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.	

Note: For more information about host adapters, fabric switches, and managed hubs, go to the following ServerProven™ Web sites at:

www.ibm.com/pc/us/compat/

www.ibm.com/storage/disk/fastt/supserver.htm

Firmware requirements

To use all of the features of Storage Manager 8.4, your storage subsystem must contain controllers with firmware version 5.4x.xx.xx for machine types 1722 and 1742. To manage storage subsystems with Storage Manager 8.4, your storage subsystems must contain controllers with firmware versions 04.00.02.xx or higher.

You cannot upgrade your firmware from versions 04.xx.xx.xx through 05.3x.xx.xx to 5.4x.xx.xx for machine types 3552 and 3542. For more information about this subject, contact your IBM reseller or IBM marketing representative.

Storage Manager 8.4 also supports four premium feature options:
- Storage Partitioning
- FlashCopy
- VolumeCopy
- Remote Mirroring

Windows software requirements

Table 6 lists the disk space and administrator privileges that are required to install version 8.4 of the storage management software in a Windows environment.

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 120 MB of free disk space.

Table 6. Installation requirements for Windows by software package

Package	Disk space requirement (Windows NT / Windows 2000)	Administrator privilege (Windows NT / Windows 2000)
SMclient	80 MB	Not required / Not required
RDAC	2 MB / 2 MB	Required
SMagent	1 MB / 1 MB if SMclient is installed. 40 MB / 40 MB if SMclient is not installed.	Required
SMutil	2 MB / 2 MB	Required

Windows operating system requirements

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

Management stations
- 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 4
- Windows 2000 Professional with Service Pack 4
- Windows 2000 Advanced Server with Service Pack 4
- Windows XP, Professional Edition
- Windows Server 2003, Web Edition

- Windows Server 2003, Standard Edition
- Windows Server 2003, Enterprise Edition

Host computers
- 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 4
- Windows 2000 Professional with Service Pack 4
- Windows 2000 Advanced Server with Service Pack 4
- Windows Server 2003, Web Edition
- Windows Server 2003, Standard Edition
- Windows Server 2003, Enterprise Edition

Cluster nodes
- Windows NT 4.0 Enterprise Edition with Service Pack 6a
- Windows 2000 Advanced Server with Service Pack 4
- Windows 2000 Datacenter
- Windows Server 2003, Enterprise Edition

NetWare software requirements

Table 7 lists the disk space that is required for installing the Storage Manager 8.4 software in a NetWare environment.

Table 7. Installation requirements for NetWare by software package

Package	Disk space requirement
Storage Manager 8.4 Client (SMclient)	35 MB
Storage Manager 8.4 Agent (SMagent)	1 MB
Storage Manager 8.4 Utility (SMutil)	22 MB
LSIMPE.CDM driver	1 MB
IBM FAStT Management Suite Java (FAStT MSJ)	1 MB
IBM HA device driver	1 MB
Java Virtual Machine	37 MB

NetWare operating system requirements

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

Management stations
- 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 4
- Windows 2000 Professional with Service Pack 4
- Windows 2000 Advanced Server with Service Pack 4

- Red Hat Enterprise Linux AS 2.1
- United Linux 1.0
  - SuSE Linux Enterprise Server 8 (SLES 8)
  - Turbolinux Enterprise Server 8 (TLES 8) -
  - Conectiva Linux Enterprise Edition Powered by United Linux

Host computers
- Novell NetWare 6.0 with Service Pack 3

Cluster nodes
- Novell NetWare 6.0 with Service Pack 3

Linux software requirements

Table 8 lists the disk space that is required for installing Storage Manager 8.4 in a Linux environment.

Table 8. Installation requirements for Linux by software package

Package	Disk space requirement
Storage Manager 8.4 Client (SMclient)	15 MB on /opt, 2 MB on /tmp
IBM FAStT Management Suite Java (FAStT MSJ)	35 MB
Storage Manager 8.4 Utility (SMutil)	7 MB on /opt
IBM Host Adapter device driver	1 MB
Storage Manager 8.4 run time (SMruntime)	42 MB on /opt, 1 MB on /var

Linux operating system requirements

Table 9 lists the minimum operating system and kernel levels required by each management station or host computer.

Table 9. Management station or host computer by minimum operating system and kernel levels

Operating system	Kernel
Red Hat Advanced Server 2.1	2.4.9-e.27 or higher
SuSE Linux Enterprise Server Version 8 (SLES 8)	2.4.21 or higher

Notes:
1. Red Hat Enterprise Linux Advanced Server 2.1 supports a maximum of 128 logical drives per storage partition.
2. SuSE Linux Enterprise Server 8 supports a maximum of 256 logical drives with 32 LUNs per storage partition.

Number of supported logical drives

With controller firmware 05.40.xx.xx and higher, the supported logical drive limits for NetWare 6.0, Linux, Windows NT 4.0, Windows 2000, and Windows Server 2003 are as follows:

- NetWare 6.0 with SP3 or higher supports up to 256 logical drives per storage subsystem (LUNs 0-255) when you use IBM-approved FAStT adapters and their supported device drivers.

- Linux supports up to 256 logical drives per storage subsystem (LUNs 0 through 255) when you use IBM-approved FAStT adapters and their supported device drivers.

  Check your Linux kernel documentation for the maximum total number of logical drives supported in the host sever and the maximum number of logical drives that can be mapped from a storage subsystem.
- Windows NT 4.0 with Service Pack 6a 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.
- Windows 2000 supports up to 64 logical drives per storage subsystem (LUNs 0 through 63) when you use IBM-approved FAStT adapters and their supported device drivers.
- Windows Server 2003 supports a maximum of 255 LUNs (LUNs 0 through 254) 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 05.4x.xx.xx depends on the model of the FAStT storage subsystem. See Table 10.

Table 10. Maximum number of logical drives per storage server

Model Type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum FlashCopy logical drives
1742	2048 (See notes 3 and 5)	256 (See notes 4 and 6)	1024 (See note 2)
1722	1024 (See notes 1 and 5)	256 (See notes 4 and 6)	512 (See note 2)

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

Notes:

1. When you use firmware version 5.xx.xx.xx, the firmware reserves one logical drive for use by the system.
2. Maximum of four FlashCopy logical drives for each standard logical drive.
3. Maximum of 32 remote mirror pairs.
4. 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.
5. For firmware version levels 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.
6. For firmware version level 05.4x.xx.xx, the default host type limit is the maximum LUN value allowed in the default partition. If the default host type has the restriction option enabled, the default partition allows only 32 LUNs; otherwise, it allows 256 LUNs.

Important:

- The FlashCopy drive can not be added or mapped to the same server that has the base logical drive of the FlashCopy logical drive in a Windows 2000, Windows Server 2003, or NetWare environment. You must map the FlashCopy logical drive to another server.

- For firmware version 05.3x.xx.xx and earlier, the maximum number of logical drives that can be mapped to a host server from each storage subsystem is 32.

Chapter 2. Preparing for installation

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

The installation procedure for Storage Manager 8.41 components is identical to the Storage Manager 8.4 installation procedure. See the appropriate sections of this document to install either Storage Manager 8.4 or 8.41 host software for a particular operating system. When you have completed Storage Manager 8.4 or 8.41 software component installation procedures, perform the procedures in Chapter 8, "Completing Storage Manager 8.4 installation," on page 103 and Chapter 9, "Using the storage management software for Windows and NetWare," on page 115.

See the *FAStT Storage Manager 8.41 Support for FAStT EXP100 SATA Storage Expansion Unit CD* for additional information as well as firmware associated with FAStT EXP100 Storage Expansion Unit.

Planning and preparing for Windows installation

Table 11 contains information about where you need to install the Storage Manager software components.

Table 11. Software component installation in a Windows environment

System type	Software installation sequence
Management station	SMclient

Host computer and cluster node	1. SMclient
	  • Optional component
	  • Necessary if you intend to manage the storage subsystem from the host computer.
	  • See "Storage Manager 8.4 Client" on page 56.
	2. RDAC
	  • Required component
	  • 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).
	  • See "RDAC" on page 58.
	3. SMagent
	  • Optional component
	  • Necessary if you intend to use the host-agent management method.
	  • See "Storage Manager 8.4 Agent" on page 61
	4. SMutil
	  • Required component
	  • Contains the hot_add, SMdevices, and SMrepassist utilities
	  • See "Storage Manager 8.4 Utility" on page 63.

Planning and preparing for NetWare installation

Table 12 shows the installation sequence for Storage Manager software components and provides information to help you plan for the installation of the storage management software.

Table 12. Software component installation sequence in a Novell NetWare 6.0 environment

System type	Software installation sequence
Management station	Storage Manager 8.4 Client (SMclient).
Host computer and cluster node	1. Storage Manager 8.4 Client (SMclient) This optional component is necessary if you intend to manage the storage subsystem from a host computer. See "Storage Manager 8.4 Client" on page 90. 2. Storage Manager 8.4 Agent (SMagent) This optional component is necessary if you intend to use the host-agent management method. See "Storage Manager 8.4 Agent" on page 91. 3. Storage Manager 8.4 Utility (SMutil) This required component contains the hot_add, SMdevices, and SMrepassist utilities. See "Storage Manager 8.4 Utility" on page 91. 4. `LSIMPE.CDM` driver See "Installing the LSIMPE driver" on page 92. 5. IBM Host Adapter device driver (`QL2x00`) See "Installing the IBM fibre-channel host bus adapter device driver" on page 93.

Planning and preparing for Linux installation

Table 13 shows the installation sequence for Storage Manager software components and provides information to help you plan for the installation of the storage management software for Linux.

Table 13. Software component installation sequence in a Linux environment

System type	Software installation sequence
Management station	Storage Manager 8.4 Client (SMclient) See "Installing the Storage Manager 8.4 Client (SMclient)" on page 97.

Table 13. Software component installation sequence in a Linux environment (continued)

System type	Software installation sequence
Host computer and cluster node	1. Storage Manager 8.4 Client (SMclient) This optional component is necessary if you intend to manage the storage subsystem from a host computer. See "Installing the Storage Manager 8.4 Client (SMclient)" on page 97. 2. Storage Manager 8.4 Runtime (SMruntime) This required component contains the software Java Runtime for the SMclient and SMutil packages. See "Installing Storage Manager 8.4 Runtime (SMruntime)" on page 97 3. Storage Manager 8.4 Utility (SMutil) This required component contains the hot_add, SMdevices, and SMrepassist utilities. See "Installing the Storage Manager 8.4 Utility (SMutil)" on page 98. 4. IBM FAStT Management Suite Java (FAStT MSJ) This required component configures the path information for the Linux Host Adapter failover device drivers. See "Installing IBM FAStT Management Suite Java" on page 99. 5. IBM Host Adapter failover device drivers (`QLA2200.o` and `QLA2300.o`) These required components enable your computer to communicate with the host adapter and to provide logical drive failover/failback support. See "Installing the IBM fibre-channel host bus adapter device driver" on page 99.

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. See "Step 1: Naming the storage subsystems" on page 34 for more information.

3. Record the storage subsystem names and management types in Appendix E, "Storage subsystem and controller information record," on page 139. An example of a completed information record is shown in Table 14 on page 35.

   Note: Throughout the remaining steps, you will need to return to Appendix E, "Storage subsystem and controller information record," on page 139 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. See "Step 3: Identifying the hardware Ethernet MAC address for each controller" on page 35 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. See "Step 4: Assigning IP addresses to hosts and controllers" on page 37.

   (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. See "Step 4: Assigning IP addresses to hosts and controllers" on page 37.

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 "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

8. (For a directly-managed system only) Set up the host or domain name server (DNS) table. For more information, see "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

9. Power on the devices that are connected to the network.

Step 1: 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 display as `<unnamed>`. Use the Subsystem Management window to rename the individual storage subsystems.

Consider the following factors when you name 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`

Step 2: Recording the subsystem names

After you decide on a naming scheme, record the storage subsystem names in the blank information record form provided in Appendix E, "Storage subsystem and controller information record," on page 139).

Table 14 on page 35 shows a sample information record for the network shown in Figure 4 on page 12. This network contains storage subsystems that are managed by using both the direct-management and host-agent-management method.

Table 14. 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

If you plan to manage your storage subsystem using the direct-management method, go to "Step 3: 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 "Step 4: Assigning IP addresses to hosts and controllers" on page 37.

Step 3: 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 control (MAC) address for each controller.

To identify the hardware Ethernet MAC address for machine types 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 36. 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 (Appendix E, "Storage subsystem and controller information record," on page 139).

Hardware Ethernet
address label

SJ000866
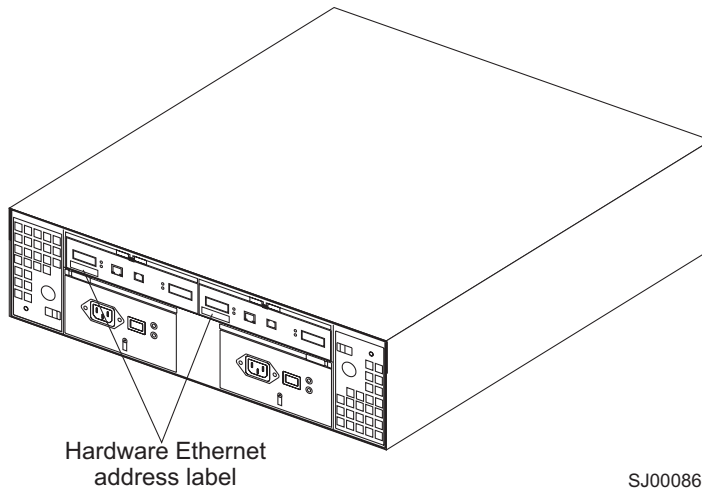
Figure 8. Locating the Ethernet MAC address (machine types 3542 and 1722)

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** .

SJ000865
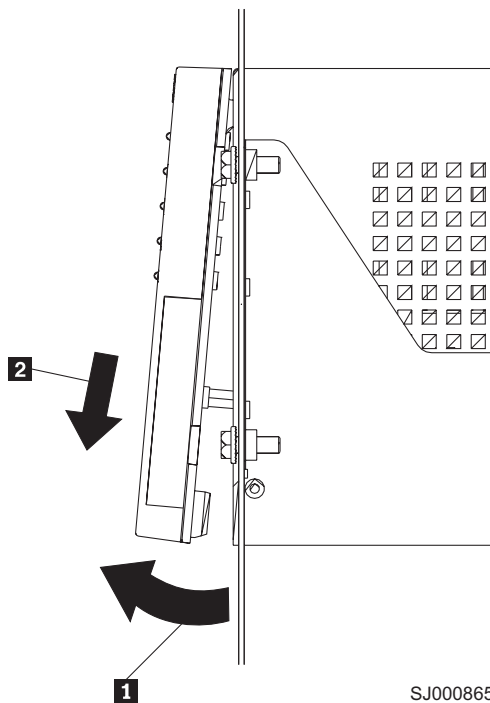
Figure 9. Removing the controller-unit bezel (machine types 3552 and 1742)

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 (Appendix E, "Storage subsystem and controller information record," on page 139).

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.

SJ000867
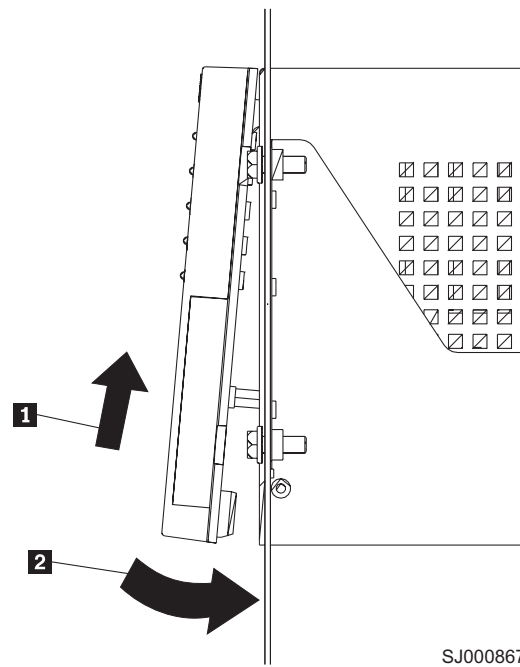
Figure 10. Replacing the controller-unit bezel (machine types 3552 and 1742)

5. Continue with "Step 4: Assigning IP addresses to hosts and controllers."

Step 4: 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 (Appendix E, "Storage subsystem and controller information record," on page 139). Then, go to "Step 5: Setting up the DHCP or BOOTP-compatible server" on page 38.

Note: If you want to assign static IP addresses for the controllers, refer to Retain Tip #H171389 *Unable to setup networking without DHCP/BOOTP* at the IBM support Web site at:

www.ibm.com/support

Then go to "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

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 (Appendix E, "Storage subsystem and controller information record," on page 139). Then, go to "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

Step 5: 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 to set up a DHCP server on Windows NT 4.0, Windows 2000, Windows Server 2003, and Novell NetWare, as well as instructions to set 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 for Storage Manager 8.4.

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
Perform the following steps 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. Proceed 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
Perform the following steps and use the information you recorded in Appendix E, "Storage subsystem and controller information record," on page 139, 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 as shown in Figure 11.

Create Scope - (Local)	☒

IP Address Pool

Excluded Addresses:

Start Address: `153.79.144.1`

End Address: `153.79.144.50`

Subnet Mask `255.255.248.0`

Exclusion Range:

Start Address: `. . .` Add ->

End Address: `. . .` <- Remove

Lease Duration

◉ Unlimited

○ Limited To: `3` ▲▼ Day(s) `00` ▲▼ Hour(s) `00` ▲▼ Minute(s)

Name: _____

Comment: _____

OK   Cancel   Help

SJ000859
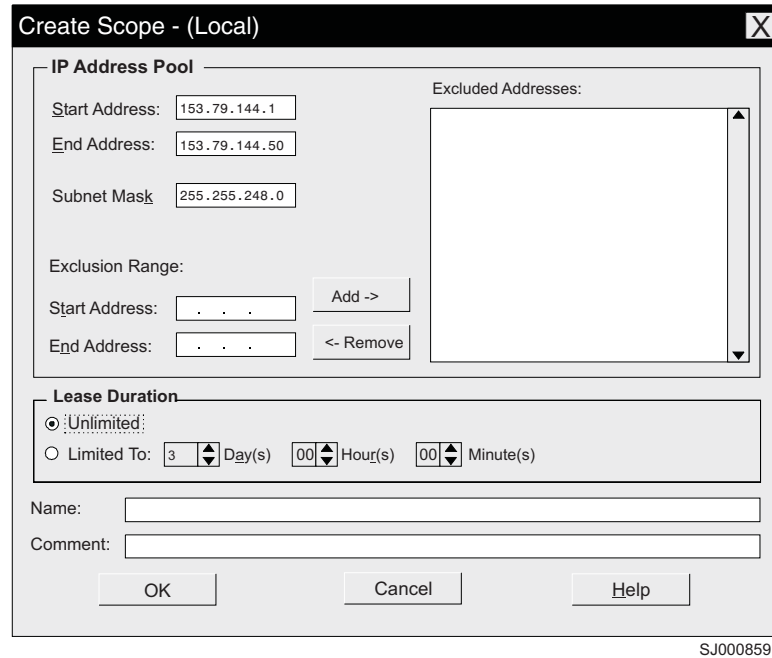
Figure 11. Create Scope - (Local) window

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 15 shows the global options that you need to set.

Table 15. 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

Table 15. Global options for a Windows NT 4.0 DHCP server (continued)

Number	Description	Notes
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 41.

   a. Click **DHCP Options → Global**. The DHCP Options: Global window opens, as shown in Figure 12.
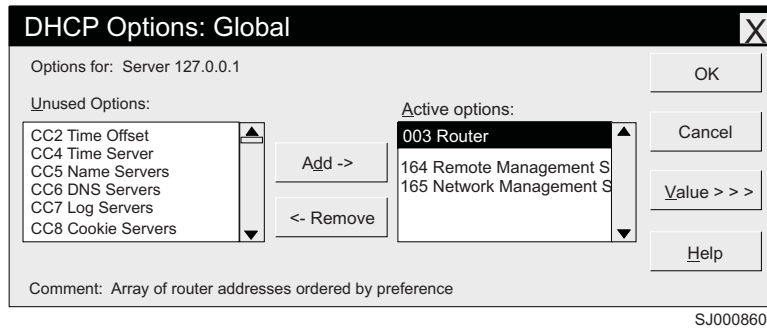
Figure 12. DHCP Options: Global window

   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, as shown in Figure 13.
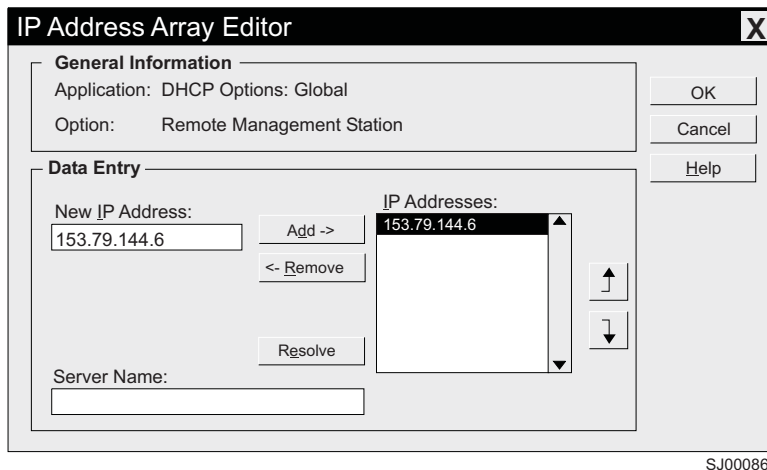
Figure 13. IP Address Array Editor window

          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 steps 3b through 3c on page 40 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 (Appendix E, "Storage subsystem and controller information record," on page 139) 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 steps 4b on page 41 through 4e on page 41 for each controller that is listed on the information record (Appendix E, "Storage subsystem and controller information record," on page 139).

  g. When you finish adding the information for all of the controllers, click **Close** to return 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: When you set an option to **Global Scope**, it will apply to every controller in the group. You will not need to add it again.

  a. Click **Scope → Active Leases**. The Active Leases window opens, as shown in Figure 14.

Active Leases - [153.79.144.0]	X
Total Addresses in Scope: 50	OK
Active/Excluded: 6 (12%)	Cancel
Available: 44 (88%)	Help

Client
| 159.79.144.13 | denver_a | Reservation |
| 159.79.144.14 | denver_b | Reservation |

Properties   Delete   Reconcile   Refresh

Sort Order
○ Sort leases by IP Addresses
◉ Sort leases by Name

☐ Show Reservations Only
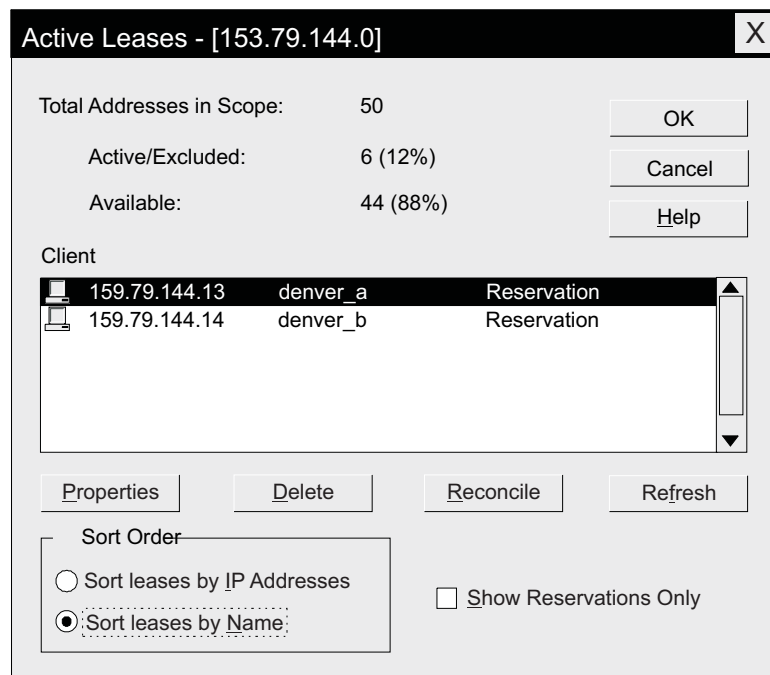
SJ000862

Figure 14. Active Leases window

b. Select a controller in the list.

c. Click **Properties**. The Add Option Type window opens, as shown in Figure 15. The Unique Identifier is the hardware Ethernet address from step 4c.

```
┌─────────────────────────────────────────────────────────┐
│ Add Option Type                                    [X]   │
│                                                          │
│  IP Address:          ┌──────────────────┐               │
│                       │ 153.79.144.13    │               │
│                       └──────────────────┘               │
│  Unique Identifier:   ┌──────────────────────┐           │
│                       │ 00a0b8020420         │           │
│                       └──────────────────────┘           │
│  Client Name:         ┌──────────────────────┐           │
│                       │ denver_a             │           │
│                       └──────────────────────┘           │
│  Client Comment:      ┌──────────────────────────────┐   │
│                       │                              │   │
│                       └──────────────────────────────┘   │
│  Lease Expires:       N/A                                │
│   ┌────────┐  ┌────────┐  ┌────────┐  ┌───────────┐      │
│   │   OK   │  │ Cancel │  │  Help  │  │ Options...│      │
│   └────────┘  └────────┘  └────────┘  └───────────┘      │
└─────────────────────────────────────────────────────────┘
                                                SJ000863
```

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 (Appendix E, "Storage subsystem and controller information record," on page 139) in the String field. Click **Edit** if the value that you need to add is an IP address for a router.

h. Repeat steps 5e through 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 steps 5b through 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 "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

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 43.

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 (Appendix E, "Storage subsystem and controller information record," on page 139). 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, as shown in Figure 16 on page 44.
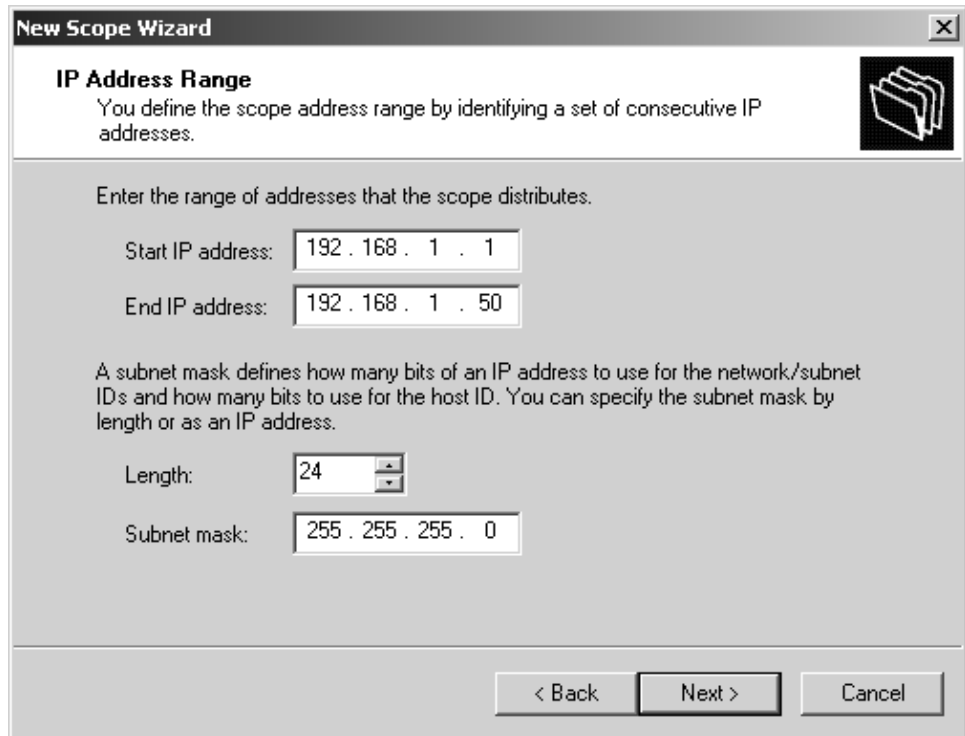
SJ000868

Figure 16. New Scope Wizard: IP Address Range window

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

   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 opens.

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 steps 5 through 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. Proceed to "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

Setting up a Windows Server 2003 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 already installed on the system, see "Creating a scope and setting up a DHCP server."

Installing the DHCP Manager

To install the DHCP Manager, perform the following steps:

1. Click **Start → Control Panel → Add or Remove Programs**. The Add or Remove Programs window opens.

2. In the left pane, click **Add/Remove Windows Components**. The Windows Components Wizard window opens.

3. 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.

4. In the **Subcomponents of Networking Services** field, select **Dynamic Host Configuration Protocol (DHCP)**. Click **OK**. The Networking Services window closes.

5. In the Windows Components Wizard window, click **Next** to start the installation process.

6. If prompted, type the full path to the Windows Server 2003 distribution files and click **Continue**.

7. When the installation has successfully completed, the Windows Components Wizard window opens. Click **Finish** to close the Windows Components Wizard window.

8. Close the Add or Remove Programs window. You are now ready to perform the tasks in "Creating a scope and setting up a DHCP server."

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

Perform the following steps 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. See Appendix E, "Storage subsystem and controller information record," on page 139. Before you begin, read through the instructions to determine what information is required. Then request the information from your network administrator.

1. Click **Start → Administrative Tools → DHCP**. The DHCP window opens.

2. In the Console tree, right-click the server you want to configure, then 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:
   - Scope name and description

- IP address range for the subnet mask, and the controllers that you are configuring
- IP addresses that you want to exclude from the IP address range
- IP address lease duration
- Common DHCP options:
  - IP address for a router
  - Domain name and DNS servers or Windows Internet Naming Service (WINS) servers

4. When you have defined the scope, click **Yes, I want to activate this scope now**. The New Scope Wizard window opens.
5. Click **Finish**. The New Scope Wizard window closes and the DHCP window opens.
6. In the Console tree, expand the Scope folder.
7. Right-click **Reservations**. Then select **New Reservations**. The New Reservations window opens.
8. To define the IP address reservation, type the following information:
   - Reservation name
   - IP address
   - Ethernet hardware MAC address
   - Description
9. In the **Supported Type** field, select **Both (DHCP and BOOTP)**.
10. Click **Add**.
11. Repeat steps 7 through 10 for each controller in the network.
12. Restart the DHCP server and then restart the storage subsystem so that all the modifications are applied.
13. Proceed to "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table" on page 50.

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.

Perform the following steps to set up a Novell NetWare DHCP server:

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 DHCP 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, type 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 displays with a red line through it, indicating 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 steps 3 through 10 for each controller.

Starting the DHCP server

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

```
LOAD DHCPSRVR
```

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 DHCPSRVR command in the `SYS:\SYSTEM\AUTOEXEC.NCF` directory.

2. For additional information about setting up, configuring, or using Novell DNS/DHCP Services, refer either to the Novell Documentation CD or to the following Web site:

   www.novell.com/documentation/

Setting up a UNIX BOOTP server

To use a UNIX BOOTP server, you must set up a BOOTP table. Table 16 and the information record (Appendix E, "Storage subsystem and controller information record," on page 139) provide the necessary information.

Table 16. 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 (see Table 24 on page 139)	host name (`Denver_a`)
IP address	IP address of the controller (see Table 24 on page 139)	dot notation (`ip=192.168.128.101`)
Ethernet address	The Ethernet address of the controller hardware (see Table 24 on page 139)	hexadecimal notation (`ha=00a0b8020420`)

Perform the following steps to set up a UNIX BOOTP server:

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 12 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.

```
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:
```

2. If the storage subsystem is running, shut down and then restart the subsystem. This ensures that the parameters in the BOOTP table take effect.

3. Continue with "Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table."

Step 6 (Windows): Verifying the TCP/IP protocol and setting up the host or DNS table

Install the TCP/IP networking stack to enable SMclient functions. Perform the following two tasks by using the procedure that follows them:

- Verify that the TCP/IP protocol software is installed on the management station or the host server on which you will install and from which will run SMclient.

- Set up the host or DNS table.

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

Windows NT 4.0

Perform the following steps for Windows NT 4.0:

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 12.

```
# 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.

Windows 2000

Perform the following steps for Windows 2000:

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 12:

```
# 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.

Windows Server 2003

Perform the following steps for Windows Server 2003:

1. Open the Windows Explorer window.
2. Right-click the My Network Places folder and select **Properties** from the pull-down menu. The Network Connections window opens.
3. Right-click a defined network connection and select **Properties** from the pull-down menu.
4. A network_name Properties window opens. Make sure that the Internet Protocol TCP/IP box under "The Connection Uses The Following Items" window pane is selected. If not, select it and click **OK** to close the network_name Properties window.
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 12.

```
# 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) may 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      localhost

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.

Step 6 (NetWare): Verifying the TCP/IP protocol and setting up the host or DNS table

The normal default installation process will install the TCP/IP software package.

Perform the following steps to set up the host or DNS table. Make sure that the host names for the controller match the IP addresses for the controllers.

1. Update either the host table or the DNS table to specify a host name to associate with an IP address. If you do not have a DNS table, edit the two host tables that are found in the sys:etc\hosts directories. (Your directory will be different if the operating system is not installed on the root.)

   To set up the host tables for the controllers, open the hosts file that is located in the \etc\ directory. Use a text editor to update the host file to create the following IP address and controller name entries. For example:

   Mappings of host names and host aliases to IP addresses

   127.0.0.1 loopback lb local host loopback address

   Examples from a fictitious network:

```
129.47.4.2 ta tahiti ta.some.com loghost
129.47.6.40 osd-frog
129.47.6.144 sj-in5 in5
197.67.172.71 sj-in1 in1
```

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

Step 6 (Linux): Verifying the TCP/IP protocol and setting up the host or DNS table

The normal default installation process will install the TCP/IP software package.

Perform the following steps to set up the host or DNS table. Make sure that the host names for the controller match the IP addresses for the controllers.

1. Update either the host table or the DNS table to specify a host name to associate with an IP address. If you do not have a DNS table, edit the host table that is found in the /etc/hosts directory. Your directory might be different if the operating system is not installed on the root.

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

The following sample shows a Linux host file. Do not remove the following line, or various programs that require network functionality will fail.

```
127.0.0.1 rh71_8500 localhost.localdomain
localhost 102.54.94.97 rhino.acme.com x.acme.com
```

Chapter 3. Installing Storage Manager software in a standard Windows configuration

This chapter describes how to install the storage management software for Windows NT, Windows 2000, and Windows Server 2003 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 Storage Manager software in a Windows cluster server environment," on page 65.
- If you have existing storage systems, see "Installation types" on page 15 and "Managing coexisting storage subsystems" on page 20.
- To ensure proper installation, make sure that you have completed all preparation tasks described in Chapter 2, "Preparing for installation," on page 31.

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 can install the Storage Manager 8.4 software components on host computers only or 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 the following storage management software on a management station:

- SMclient

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. SMclient
2. RDAC
3. SMagent
4. SMutil

To begin the installation on your management station, see "Storage Manager 8.4 Client" on page 56.

To begin installation on a host, see "Installing the IBM fibre-channel host bus adapter device driver."

Installing the IBM fibre-channel host bus adapter device driver

An IBM fibre-channel host bus adapter (HBA) provides the interface between a host server and an FAStT storage server. IBM FAStT fibre-channel HBAs are high-performance, direct memory access, bus-master, host adapters that are designed for high-end systems. These HBAs support all fibre-channel peripheral devices that support private-loop direct-attach and fabric-loop attachment. The IBM Host Adapter device driver enables your operating system to communicate with the fibre-channel HBA. See the readme file included in the driver package for installation instructions associated with your operating system. For more information, see the Installation and User's Guide for your particular fibre-channel HBA model. The current readme file and latest multipath I/O device driver are available at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Storage Manager 8.4 Client

This section describes how to install SMclient on management stations and host computers that run Windows operating systems.

Before you install the software, make sure that the management station or host computer has at least 80 MB of available disk space.

Important: When you install SMclient 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 SMclient

To install SMclient on Windows operating systems, perform the following steps:

1. Insert the IBM FAStT Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0 or Windows 2000	\Win32\SMclient
Windows Server 2003	\WS03_32bit\SMClient

   Click **Open**.
6. Select the displayed .exe file. Click **Open**. The InstallShield Wizard window opens; then, the Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.
8. Perform the following procedures depending on your operating system:

   For Windows NT 4.0 and Windows 2000:

   a. Read the license agreement and click **Yes**. The Event monitor window opens.

b. At the prompt, click **Yes** if you want to install the Event Monitor. The Choose Destination Location window opens.

c. Click **Browse** to change the destination location.

d. Click **Next** to start the installation. When the installation is complete, the Operation Complete window opens.

e. Click **Finish**.

f. Continue with "Verifying the SMclient installation" on page 71.

For Windows Server 2003:

a. Read the license agreement and click **Yes**. The Choose Destination Location window opens.

b. Click **Browse** to change the destination location. Click **Next** to continue with the installation.

c. The Event monitor window opens. Click **Yes** if you want to install the Event Monitor. Otherwise, click **No**.

d. The Setup Status window opens showing the installation progress. When the installation is complete, the Operation Complete window opens.

e. Click **Finish**.

f. Continue with "Verifying the SMclient installation."

Verifying the SMclient installation

To verify that you installed SMclient correctly on Windows operating systems, perform the following steps:

1. Perform one of the following steps depending on your operating system:
   - For Windows NT 4.0 and Windows 2000, click **Start → Programs**.
   - For Windows Server 2003, click **Start → All Programs**.

2. Verify that `IBM FAStT Storage Manager 8 Client` displays in the Program list. If the appropriate software version displays, go to step 3.

   Otherwise, repeat "Installing SMclient" on page 56. If the appropriate software version associated with your operating system still does not display, 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 SMclient on a host computer, go to "RDAC" on page 58. Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Verifying the Event Monitor installation

This section describes how to verify that you installed the Event Monitor service correctly on Windows operating systems.

Windows NT 4.0

To verify that you installed the Event Monitor service 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 displays with the status `Started`. If it does not display, click **Start**. If the service does not start, reinstall the SMclient. 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 "RDAC." Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows 2000

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

1. Click **Start → Programs → Administrative Tools → Services**. The Services window opens.
2. Verify that the IBM FAStT Storage Manager 8 Event Monitor service displays with the startup type Automatic and status Started. If it does not display, click **Start**. If it does not start, reinstall the SMclient. 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 "RDAC." Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows Server 2003

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

1. Click **Start → Administrative Tools → Services**. The Services window opens.
2. Verify that the IBM FAStT Storage Manager 8 Event Monitor service displays with the startup type `Automatic` and status `Started`. If it does not display, click **Start**. If it displays but does not start, reinstall the SMclient. 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 "RDAC." Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

RDAC

This section describes how to install RDAC on Windows operating systems. You must install RDAC 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 2 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 or Windows Server 2003, continue with "Installing the RDAC" on page 59.

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.

Perform the following steps to manually assign static drive letters on host computers that run 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 RDAC." 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 RDAC."

Installing the RDAC

To install RDAC on Windows operating systems, perform the following steps:

1. Insert the IBM FAStT Storage Manager Version 8.4 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 directory that is associated with your operating system.

Operating System	Directory
Windows NT 4.0	\Win32\SMrdac\NT
Windows 2000 Server or Professional	\Win32\SMrdac\W2K
Windows Server 2003 for 32-bit processors	\WS03_32bit\SMrdac
Windows Server 2003 for 64-bit processors	\WS03_64bit\SMrdac

6. Select the displayed .exe file. Click **Open**. The InstallShield Wizard window opens; then, the Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.
8. Click **Yes** to start the installation. Perform the following steps depending on your operating system:
   - For Windows NT 4.0 and Windows 2000, after you install RDAC, the InstallShield Wizard Complete window opens. Continue with step 10 on page 60.

- For Windows Server 2003, the Installation/Removal status window opens displaying the RDAC installation progress. Continue with step 9.
9. After the installation is complete, the Operation Complete window opens.
10. Select **Yes I want to restart my computer now**. Click **Finish**.
11. Continue with "Verifying the RDAC installation."

Verifying the RDAC installation

This section describes how to verify that you installed RDAC correctly on Windows operating systems.

Windows NT 4.0

To verify that you 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` displays with a device status of `Started`, go to step 4.
   - If `symarray` does not display, an error might have occurred. Repeat the procedure in "Installing the RDAC" on page 59. 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 8.4 Agent" on page 61.
   - If you are managing your storage subsystems directly, go to "Storage Manager 8.4 Utility" on page 63.

Windows 2000

To verify that you 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\System Information\Software environment\drivers` directory.
2. Scroll through the list and select one of the following device drivers:
   - rdacbus
   - rdacdisk

   The `rdacbus` option always displays. The `rdacdisk` option displays only when you have disks.
3. Verify that either `rdacbus` or `rdacdisk` displays with the state type `Running` and status `OK`. If neither does, repeat the procedure in "Installing the RDAC" on page 59. If the failure persists, call your IBM technical support representative. Otherwise, continue as follows:
   - If you are managing the storage subsystems using the host-agent method, continue with "Storage Manager 8.4 Agent" on page 61.
   - If you are managing your storage subsystems using the direct-management method, go to "Storage Manager 8.4 Utility" on page 63.

Windows Server 2003

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

1. Click **Start → All Programs → Accessories → System Tools → System information**. The System Information window opens. Go to the `\System Summary\Software Environment\System Drivers` list.
2. Scroll through the list and select one of the following device drivers:
   - rdacbus
   - rdacdisk

   `rdacbus` is always shown. `rdacdisk` displays only when you have disks.
3. Verify that either `rdacbus` or `rdacdisk` displays with the state type `Running` and status `OK`. If it does not display, repeat the procedure in "Installing the RDAC" on page 59. If the failure persists, call your IBM technical support representative. Otherwise, continue as follows:
   - If you are managing the storage subsystems using the host-agent method, continue with "Storage Manager 8.4 Agent."
   - If you are managing your storage subsystems using the direct-management method, go to "Storage Manager 8.4 Utility" on page 63.

Storage Manager 8.4 Agent

This section describes how to install SMagent software on Windows operating systems. You *must* install the SMagent 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 if the SMclient is installed with the Event Monitoring service.
- The host computer has at least 40 MB of available disk space if the SMclient program is not installed with the Event Monitoring service.
- RDAC is installed on each host computer. If not, see "RDAC" on page 58.
- All storage subsystems are connected to the host computer and are powered on.

Installing SMagent

To install SMagent on Windows operating systems, perform the following steps:
1. Close all programs.
2. Insert the IBM FAStT Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0 and Windows 2000	\Win32\SMagent
Windows Server 2003	\WS03_32bit\SMAgent

   Then, click **Open**.
7. Select the displayed .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 SMagent installation."

Verifying the SMagent installation

This section provides instructions on how to verify that you installed SMagent correctly on Windows operating systems.

Windows NT 4.0

To verify that you installed the SMagent 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 displays with a startup type of `Started`, close the Services window and continue to step 4.

   - If IBM FAStT Storage Manager 8 Agent does not display with a startup type of `Started`, click **Start**. If the status changes to `Started`, go to step 4. If not, see Table 21 on page 133 for a possible cause. Otherwise, reinstall IBM FAStT Storage Manager 8.4 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 8.4 Utility" on page 63.

   - 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 → 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 8.4 Utility" on page 63.

Windows 2000

To verify that you installed the SMagent 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 display with a startup type of `Started`, click **Start**. If the status changes to `Started`, go to step 4. If not, see Table 21 on page 133 for a possible cause. Otherwise, reinstall IBM FAStT Storage Manager 8.4 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 8.4 Utility" on page 63.

- 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 8.4 Utility."

Windows Server 2003

To verify that you installed the SMagent 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 → 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 display with a startup type of Started, click **Start**. If the status changes to Started, go to step 4. If not, see Table 21 on page 133 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, see "Storage Manager 8.4 Utility."
   - 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 → 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** from the pull-down menu. The IBM FAStT Storage Manager 8 Agent Properties window opens.
     e. In the Startup Type list, select **Manual**. Click **OK**.
     f. The IBM FAStT Storage Manager 8 Agent Properties window closes.
5. Continue with "Storage Manager 8.4 Utility."

Storage Manager 8.4 Utility

This section describes how to install SMutil on host computers that run both Windows operating systems. This component contains utilities that will register and map new logical drives to the operating systems.

Installing SMutil

To install SMutil on Windows operating systems, perform the following steps:

1. Close all programs and insert the IBM FAStT Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0, Enterprise Edition	\Win32\SMutil
Windows 2000 Advanced Server	\Win32\SMutil
Windows Server 2003 for 32-bit processors	\WS03_32bit\SMUtil
Windows Server 2003 for 64-bit processors	\WS03_64bit\SMUtil

   Then click **Open**.
6. Select the displayed .exe file. Click **Open**. The InstallShield Wizard window opens, displaying the status of the files unpacking. The Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.
8. Click **Yes** to begin the installation. After the installation is complete, the Operation Complete window opens.
9. Click **Finish**.
10. Continue with "Verifying the SMutil installation."

Verifying the SMutil installation

To verify that you installed the SMutil correctly on Windows operating systems, perform the following steps:

1. Go to the following directory:

   installation_directory\IBM_FAStT\Util

   where *installation_directory* is the directory where you installed the SMutil.
2. Verify that the directory contains the following files:
   - hot_add.exe
   - SMdevices.bat
   - SMrepassist.exe

   If it does not, reinstall the SMutil by using the procedure in "Installing SMutil" on page 63. If the problem persists, contact your IBM technical support representative.
3. Go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Additional information

For additional information about installing and using Storage Manager 8.4 for Windows NT, Windows 2000, and Windows Server 2003 in a standard (noncluster) configuration, see Appendix A, "Windows operating system limitations," on page 127.

Chapter 4. Installing Storage Manager software in a Windows cluster server environment

This chapter describes how to install the storage management software in a Windows 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 15 and "Managing coexisting storage subsystems" on page 20.
- 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 79.
- To ensure proper installation, complete all preparation tasks described in Chapter 2, "Preparing for installation," on page 31.

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. Figure 17 on page 66 shows typical direct-attached or fibre-channel switch connection configurations. Both configurations offer full redundancy.

Interlink

Node A
Host adapters

Node B
Host adapters

Fibre Channel connection (direct)

Mini hub 1   Mini hub 2

Storage subsystem

Storage subsystem controllers

Interlink

Node A
Host adapters

Node B
Host adapters

Fibre Channel connection (Fibre Channel switch)

Switch   Switch

Mini hub 1   Mini hub 2

Storage subsystem

Storage subsystem controllers

SJ000871

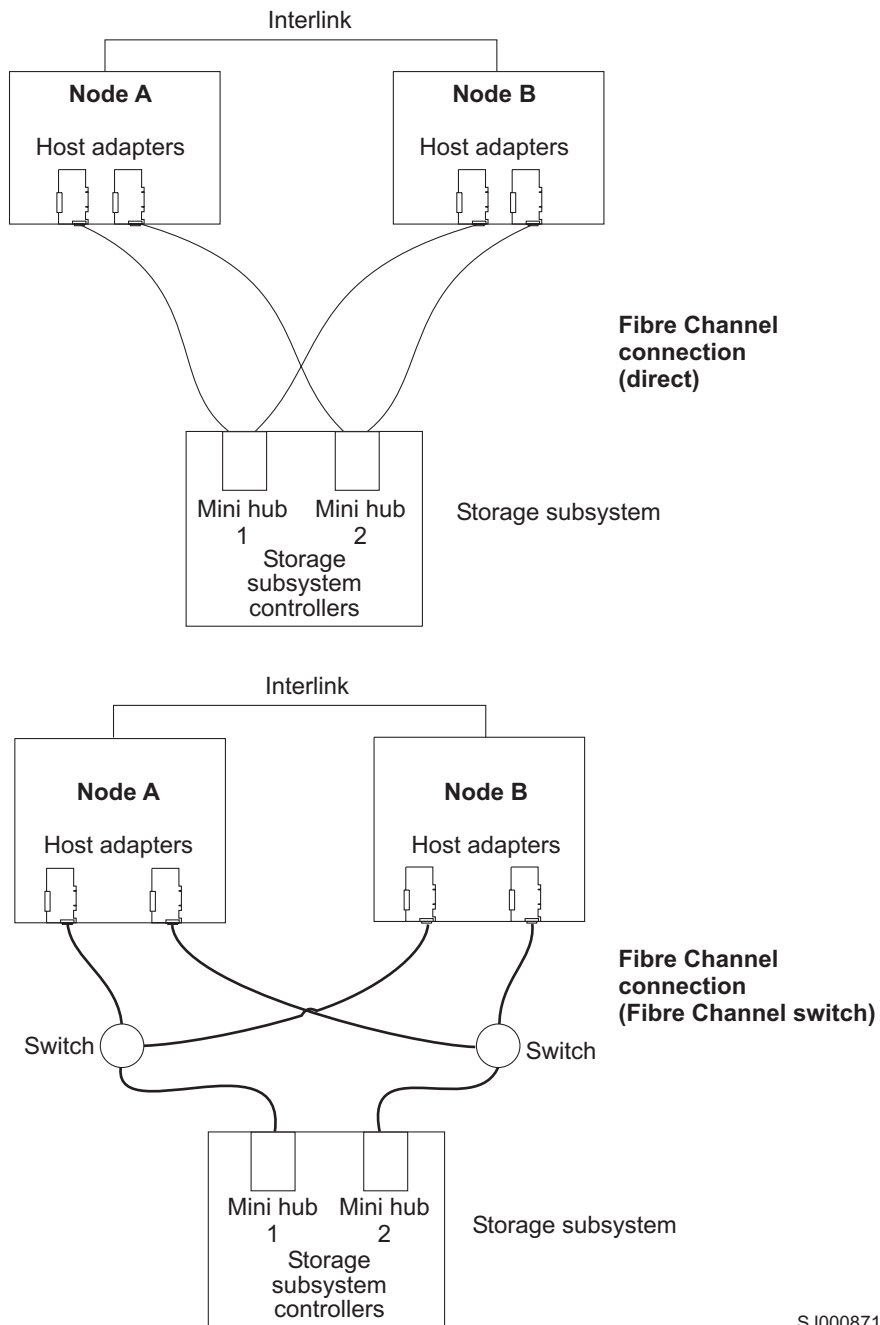*Figure 17. Installing the storage subsystem on a fibre-channel network*

Host adapters

Refer to the appropriate host-adapter 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 is assigned a unique hard ID. For instructions about changing hard IDs, see the documentation provided with your host adapters.
- The correct device driver is installed for the host adapter. See the readme file in the \Host_Adapter directory on the IBM FAStT Storage Manager Version 8.4 CD for information about 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.

Installing the storage management software in a cluster environment

The following procedures describe how to install the storage management software in a cluster environment.

Windows NT 4.0 and Windows 2000

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 HBA and device driver are installed in each cluster node. For information about HBA and device driver installation, see "Installing the IBM fibre-channel host bus adapter device driver" on page 69.
2. Power down node B. Start node A.
3. Install the storage management software on node A. See "Installing the storage management software" on page 69 for instructions.
4. Complete the procedures in Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.
5. Run the hot_add utility on node A. See "Using the hot_add utility" on page 120 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 NT File System (NTFS), 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. See "Installing the storage management software" on page 69 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 display 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. See "Installing the cluster server software" on page 78 for instructions.

13. Go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows Server 2003

Perform the following steps to install the storage management and cluster service software on Windows Server 2003:

1. Make sure that the HBA and device driver are installed in each cluster node. For information about HBA and device driver installation, see "Installing the IBM fibre-channel host bus adapter device driver" on page 69.

2. Install the storage management software on the host server that will be the first node of the cluster. See "Installing the storage management software" on page 69 for instructions.

3. Complete the procedures in Chapter 8, "Completing Storage Manager 8.4 installation," on page 103, specifically to create LUNs that will be used as cluster disks and to make sure that the host type of the host group or host ports that these LUNs are mapped to were set to "Windows 2000/Server 2003..clustered" or "Windows 2000 clustered".

4. Run the hot_add utility on the first node of the cluster. See "Using the hot_add utility" on page 120 for instructions.

   Note: You might have to restart the first node of the cluster in order to see the newly-added logical drives (LUNs).

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

   Important: You must make sure that the permanent (sticky) drive letters that are assigned to LUNs in the first cluster node are available (not used) in the rest of the cluster nodes. In another words, all of the nodes in the cluster 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, which will prevent the cluster disks from operating correctly. Assigning a permanent drive letter ensures that Windows assigns the same drive letter to the partition on all cluster nodes.

6. Install the storage management software on the second node of the cluster.

   Note: You must install the RDAC and SMutil software packages. You do not have to install all of the storage management software packages unless you want to manage the storage subsystem from this cluster node.

7. Run the hot_add utility on the second node of the cluster.

8. Repeat step 6 and step 7 for each additional node of the cluster.

9. Install the cluster server software. See "Installing the cluster server software" on page 78 for instructions.

10. Manually move the cluster disk groups from the first cluster node to each of the nodes in the cluster, making sure that they can be brought online. If they can be brought online with no problems, you are ready to continue with your application software installation. If you experience any problems, call IBM support for assistance.

Installing the IBM fibre-channel host bus adapter device driver

An IBM fibre-channel host bus adapter (HBA) provides the interface between a host server and a FAStT storage server. IBM FAStT fibre-channel HBAs are high-performance, direct memory access, bus-master, host adapters that are designed for high-end systems. These HBAs support all fibre-channel peripheral devices that support private-loop direct-attach and fabric-loop attachment. The IBM Host Adapter device driver enables your operating system to communicate with the fibre-channel HBA. See the readme file included in the driver package for installation instructions associated with your operating system. For more information, see the Installation and User's Guide for your particular fibre-channel HBA model. The current readme file and latest multipath I/O device driver are available at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Installing the storage management software

This section describes how to install the storage management software on Windows operating systems. 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 can install the Storage Manager 8.4 software components on cluster nodes only or cluster nodes and management stations.

Management station: A management station is a system that is used to manage the storage subsystem. You can attach it to the storage subsystem in either of 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 the following storage management software on a management station:
* SMclient

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. SMclient
2. RDAC
3. SMagent

4. SMutil

See "Installing the SMclient" to begin the installation.

Installing the SMclient

This section provides instructions on how to install SMclient on management stations and cluster nodes that run on Windows operating systems.

Before you install the software, make sure that the following conditions are met:
*   The management station or host computer has at least 80 MB of available disk space.
*   All programs are closed.

Important: When you install SMclient 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 SMclient

To install SMclient on Windows operating systems, perform the following steps:
1. Insert the IBM FAStT Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0 or Windows 2000	\Win32\SMclient
Windows Server 2003	\WS03_32bit\SMClient

    Click **Open**.
6. Select the displayed .exe file. Click **Open**. The InstallShield Wizard window opens then the Welcome window opens.
7. Click **Next**. The End User License Agreement window opens.
8. Perform the procedure that is associated with your operating system:

    For Windows NT 4.0 and Windows 2000:

    a. Read the license agreement and click **Yes**. The Event monitor window opens.
    b. At the prompt, click **Yes** if you want to install the Event Monitor. The Choose Destination Location window opens.
    c. Click **Browse** to change the destination location.
    d. Click **Next** to start the installation. When the installation is complete, the Operation Complete window opens.
    e. Click **Finish**.
    f. Continue with "Verifying the SMclient installation" on page 71.

    For Windows Server 2003:

    a. Read the license agreement and click **Yes**. The Choose Destination Location window opens.
    b. Click **Browse** to change the destination location. Click **Next** to continue with the installation.

c. The Event monitor window opens. Click **Yes** if you want to install the Event Monitor. Otherwise, click **No**.

d. The Setup Status window opens showing the installation progress. When the installation is complete, the Operation Complete window opens.

e. Click **Finish**.

f. Continue with "Verifying the SMclient installation."

Verifying the SMclient installation

Perform the following steps to verify that the SMclient software is installed correctly on Windows operating systems:

1. Perform one of the following steps, depending on your operating system:

    *   For Windows NT 4.0 and Windows 2000, click **Start → Programs**.

    *   For Windows Server 2003, click **Start → All Programs**.

2. Verify that `IBM FAStT Storage Manager 8 Client` displays in the Program list. If the appropriate software version displays, go to step 3.

    Otherwise, repeat "Installing SMclient" on page 70. If the appropriate software version associated with your operating system still does not display, 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 with step 4.

4. If you are installing SMclient on a host computer, go to "RDAC" on page 72. Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Verifying the Event Monitor installation

This section describes how to verify that you installed the Event Monitor correctly on Windows operating systems.

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 IBM FAStT Storage Manager 8 Event Monitor service displays with the status `Started`. If it is not, click **Start**. If the service does not start, reinstall the SMclient. 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 "RDAC" on page 72. Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

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 IBM FAStT Storage Manager 8 Event Monitor service displays with the startup type `Automatic` and status `Started`. If it is not, click **Start**. If the service does not start, reinstall the SMclient. 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 "RDAC" on page 72. Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows Server 2003:   To verify that you installed the Event Monitor service correctly on Windows Server 2003, perform the following steps:

1. Click **Start → Administrative Tools → Services**. The Services window opens.
2. Verify that the IBM FAStT Storage Manager 8 Event Monitor service displays with the startup type `Automatic` and status `Started`. If it is not, click **Start**. If it does not start, reinstall the SMclient. If the failure persists, call your IBM technical support representative.
3. If you are installing the storage management software on a host computer, see "RDAC." Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

RDAC

This section describes how to install RDAC on Windows operating systems. You must install RDAC 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 2 MB of available disk space.
- You close all programs.
- The appropriate HBA device 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 or Windows Server 2003, continue with "Installing the RDAC" on page 73.

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 RDAC" on page 73. 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 RDAC."

Installing the RDAC

To install RDAC on Windows operating systems, perform the following steps:

1. Insert the IBM FAStT Storage Manager Version 8.4 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 directory that is associated with your operating system.

Operating System	Directory
Windows NT 4.0	`\Win32\SMrdac\NT`
Windows 2000	`\Win32\SMrdac\W2K`
Windows Server 2003 for 32-bit processors	`\WS03_32bit\SMrdac`
Windows Server 2003 for 64-bit processors	`\WS03_64bit\SMrdac`

6. Select the displayed .exe file; then, click **Open**. The InstallShield window opens, showing the file unpacking. The Welcome window opens.
7. Click **Yes** to start the installation. Perform the following steps, depending on your operating system:
   - For Windows NT 4.0 and Windows 2000, after you install RDAC, the InstallShield Wizard Complete window opens.
   - For Windows Server 2003, the Installation/Removal Status window opens displaying the RDAC installation progress. After the installation is complete, the Operation Complete window opens.
8. Select **Yes, I want to restart my computer now**. Click **Finish**.
9. Continue with "Verifying the RDAC."

Verifying the RDAC

The following section describes how to verify that you installed RDAC correctly on Windows operating systems.

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` displays with a device status of `Started`, continue with step 3 on page 74.

- If `symarray` does not display, an error might have occurred. Repeat the procedure in "Installing the RDAC" on page 73. If the failure persists, call your IBM technical support representative. Otherwise, continue with step 3.
3. Perform one of the following procedures:
   - If you are managing the storage subsystems using the host-agent method, continue with "SMagent" on page 75.
   - If you are managing your storage subsystems directly, continue with "SMutil software" on page 77.

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 and select one of the following device drivers:
   - `rdacbus`
   - `rdacdisk`

   The `rdacbus` option always displays. The `rdacdisk` option displays only when you have disks.
3. Verify that either `rdacbus` or `rdacdisk` displays with the state type `Running` and status `OK`. If neither does, repeat the procedure in "Installing the RDAC" on page 73. If the failure persists, call your IBM technical support representative. Otherwise, proceed to step 4.
4. Perform one of the following procedures:
   - If you are managing the storage subsystems using the host-agent method, continue with "SMagent" on page 75.
   - If you are managing your storage subsystems directly, go to "SMutil software" on page 77.

Windows Server 2003: To verify that you have installed RDAC correctly, perform the following steps:

1. Click **Start → All Programs → Accessories → System Tools → System information**. The System Information window opens. Go to the `\System Summary\Software Environment\System Drivers` list.
2. Scroll through the list and select one of the following device drivers:
   - `rdacbus`
   - `rdacdisk`

   `rdacbus` is always shown. `rdacdisk` displays only when you have disks.
3. Verify that either `rdacbus` or `rdacdisk` displays with the state type `Running` and status `OK`. If it does not, repeat the procedure in "Installing the RDAC" on page 73. If the failure persists, call your IBM technical support representative. Otherwise, continue as follows:
   - If you are managing the storage subsystems using the host-agent method, continue with "SMagent" on page 75.
   - If you are managing your storage subsystems using the direct-management method, go to "SMutil software" on page 77.

SMagent

The following section describes how to install the SMagent software on Windows operating systems. You *must* install the SMagent software if you want to manage the storage subsystem using the host-agent method.

Before you install the software on Windows operating systems, ensure that the following conditions are met:

- You have Administrator privileges on the cluster nodes.
- Each cluster node will have at least 1 MB of available disk space if you install SMclient with the Event Monitoring service.
- The host computer will have at least 40 MB of available disk space if you do not install the SMclient program with the Event Monitoring service.
- You installed RDAC on each cluster node. If you have not done so, refer to "RDAC" on page 72.

Installing SMagent

To install SMagent on Windows operating systems, perform the following steps:

1. Close all programs.
2. Insert the IBM FAStT Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0	\Win32\SMagent
Windows 2000	\Win32\SMagent
Windows Server 2003 for 32-bit processors	\WS03_32bit\SMAgent

   Click **Open**.
7. Select the displayed .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 SMagent."

Verifying the SMagent

The following section describes how to verify that you installed the SMagent correctly on Windows operating systems.

Windows NT 4.0: To verify that you installed the SMagent 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 displays with a startup type of `Started`, close the Services window, and continue to step 4 on page 76.

- If Storage Manager 8 Agent does not display with a startup type of `Started`, click **Start**. If the status changes to `Started`, go to step 4 on page 62. If not, refer to Table 21 on page 133 for a possible cause. Otherwise, reinstall SMagent. 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 "SMutil software" on page 77.
   - 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 "SMutil software" on page 77.

Windows 2000:   To verify that you installed the SMagent 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 display with a startup type of `Started`, click **Start**. If the status changes to `Started`, go to step 4 on page 62. If not, see Table 21 on page 133 for a possible cause. Otherwise, reinstall SMagent. 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 "SMutil software" on page 77.
   - 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 "SMutil software" on page 77.

Windows Server 2003:   To verify that you installed the SMagent correctly, perform the following steps:

1. Click **Start → 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 display with a startup type of `Started`, click **Start**. If the status changes to `Started`, go to 4. If not, see Table 21 on page 133 for a possible cause. Otherwise, reinstall SMagent. 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, see "SMutil software."

   • 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 → 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. Select **Properties** from the pull-down menu. The IBM FAStT Storage Manager 8 Agent Properties window opens.

     e. In the Startup Type list, select **Manual**. Click **OK**.

     f. The IBM FAStT Storage Manager 8 Agent Properties window closes.

5. Continue with "SMutil software."

SMutil software

This section provides instructions regarding SMutil software installation on cluster nodes that run Windows operating systems. This component contains utilities that will register and map new logical drives to the operating systems.

Installing SMutil

To install SMutil on Windows operating systems, perform the following steps:

1. Close all programs and insert the IBM Storage Manager Version 8.4 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 folder that is associated with your operating system.

Operating System	Folder
Windows NT 4.0 Enterprise Edition	\Win32\SMutil
Windows 2000 Advanced Server	\Win32\SMutil
Windows Server 2003 for 32-bit processors	\WS03_32bit\SMUtil
Windows Server 2003 for 64-bit processors	\WS03_64bit\SMUtil

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**. The End User License Agreement window opens.

8. Click **Yes** to begin the installation. After the installation is complete, the Operation Complete window opens.

9. Click **Finish**.

10. Continue with "Verifying the SMutil installation."

Verifying the SMutil installation

To verify that you installed the SMutil correctly on Windows operating systems, perform the following steps:

1. Go to the following directory:

   installation_directory\IBM_FAStT\Util

   where *installation_directory* is the directory where you installed the SMutil.

2. Verify that the directory contains the following files:

   - hot_add.exe
   - SMdevices.bat
   - SMrepassist.exe

   If it does not, reinstall the SMutil using the procedure in "Installing SMutil" on page 63. If the problem persists, contact your IBM technical support representative.

3. Go to "Installing the storage management software in a cluster environment" on page 67.

Installing the cluster server software

The following sections describe how to install the cluster server software on Windows operating systems.

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 node A and node 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 you install 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 4.

   Note: Refer to Microsoft Knowledge Base article Q174799 for more information regarding service pack installation 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 display on the left side of the Cluster Administrator window, reinstall the cluster server software. If the problem persists, contact your IBM technical support representative.

Windows Server 2003

Important: Do not perform this procedure unless the necessary storage management software components are installed on all cluster nodes.

Perform the following steps to install the cluster server software on cluster nodes:

1. Install the cluster server software on the first node of the cluster. 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.

2. In the Cluster Administrator window, make sure that all of the cluster disk groups can be varied online and offline with no problems.

3. Install the cluster server software on the second node of the cluster. Refer to the appropriate MSCS documentation for the correct procedure to install additional nodes in the cluster server.

   Note: During installation, specify that you want to join the existing cluster. You can add one cluster node at a time or all of the remaining cluster nodes at the same time. You should add cluster nodes one at a time.

4. If all node names do not display on the left side of the Cluster Administrator window, reinstall the cluster server software. If the problem persists, contact your IBM technical support representative.

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. If you choose this upgrade method, it is important that you perform the upgrade during off-peak workload time.

  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 one of the cluster nodes and then in each of the

remaining cluster nodes, one cluster node a time, 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 level to version 05.4x.xx.xx, you will not be able to communicate with the controller until you have upgraded to Storage Manager 8.4 software on your management station and cluster nodes. Previously installed versions of Storage Manager will not recognize controllers running version 05.4x.xx.xx firmware.

Performing a scheduled upgrade

The following sections describe how to perform a scheduled upgrade on Windows operating systems.

Windows NT 4.0 and Windows 2000

To perform a scheduled upgrade from Storage Manager Version 7.xx, 8.0, or 8.2x to Storage Manager 8.4 on machines that are running Windows NT 4.0 and Windows 2000, perform the following procedure:

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

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 122.

   Note: Uninstall the storage management components in the following order:
   a. SMagent
   b. SMutil
   c. RDAC
   d. SMclient

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 SMclient on node A. See "Installing the SMclient" on page 70 for instructions.

6. Install the RDAC on node A. See "RDAC" on page 72 for instructions.

7. Install the SMagent on node A. See "SMagent" on page 75 for instructions.

8. Install the SMutil on node A. See "SMutil software" on page 77 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, see "Uninstalling storage management software components" on page 122.

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 you continue.

13. Install the SMclient on node B. See "Installing the SMclient" on page 70 for instructions.

14. Install the RDAC on node B. See "RDAC" on page 72 for instructions.

15. Install the SMagent on node B. See "SMagent" on page 75 for instructions.

16. Install the SMutil on node B. See "SMutil software" on page 77 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 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows Server 2003

To perform a scheduled upgrade from Storage Manager Version 7.xx, 8.0, or 8.2x to Storage Manager 8.4 on machines that are running Windows Server 2003, perform the following procedure:

1. Before you install the storage management software, perform the following steps in each of the cluster nodes in the cluster:

    a. Click **Start → 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. From each cluster node, uninstall the components from the previous version of the storage management software. See "Uninstalling storage management software components" on page 122 for instructions.

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

    a. SMagent

    b. SMutil

    c. RDAC

    d. SMclient

3. Verify that the IBM host adapter device driver version in each cluster node is 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.

4. Install the new version of the Storage Manager software in each cluster node. See "Installing the storage management software" on page 69 for instructions.

5. Start up one node at a time and complete the following steps for each node:

    a. Click **Start → 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. Manually start the cluster server service.

6. Open Cluster Administrator windows and verify that the cluster groups can be brought online. If not, contact your IBM service representative for support.

Performing a rolling upgrade

This section describes how to perform a rolling upgrade on Windows operating systems.

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.

Windows NT 4.0 and Windows 2000

To perform a rolling upgrade from Storage Manager Version 7.xx, 8.0, or 8.2x to Storage Manager 8.4 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, see "Uninstalling storage management software components" on page 122.

   Note: Uninstall the components in the following order:
   a. SMagent
   b. SMutil
   c. RDAC
   d. SMclient
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 SMclient on node A. See "Installing the SMclient" on page 70 for instructions.
8. Install the RDAC on node A. See "RDAC" on page 72 for instructions.
9. Install the SMagent on node A. See "SMagent" on page 75 for instructions.
10. Install the SMutil on node A. See "SMutil software" on page 77 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, see "Uninstalling storage management software components" on page 122.

17. Verify that the IBM HBA device driver versions are current. If they are not current, see the readme file located in the \Host_Adapter directory on the installation CD and upgrade the device drivers.
18. Install the SMclient on node B. See "Installing the SMclient" on page 70 for instructions.
19. Install the RDAC on node B. See "RDAC" on page 72 for instructions.
20. Install the SMagent on node B. See "SMagent" on page 75 for instructions.
21. Install the SMutil on node B. See "SMutil software" on page 77 for instructions.
22. Run Cluster Administrator. Then click **File → Resume Node** to resume cluster service in node B.
23. Go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Windows Server 2003

To perform a rolling upgrade from Storage Manager Version 7.xx, 8.0, or 8.2x to Storage Manager 8.4 on machines that are running Windows Server 2003, perform the following steps:

1. In the first node of the cluster, open the Cluster Administrator window.
2. Double-click the Active Groups folder in the right pane of the Cluster Administrator window.
3. Select each of the active groups listed in the first cluster node and move them to other nodes in the cluster configuration. Make sure that the cluster groups come online successfully.
4. Select the first node of the cluster in the Cluster Node Tree view and click **File → Pause Node** to pause cluster service in that node.
5. From node A, uninstall the components from the previous version of the software. To uninstall the previous version of Storage Manager software, see "Uninstalling storage management software components" on page 122.

   Note: Uninstall the components in the following order:
   a. SMagent
   b. SMutil
   c. RDAC
   d. SMclient
6. Verify that the IBM HBA device driver versions in the cluster node 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 new version of the Storage Manager software in the first cluster node. See "Installing the storage management software" on page 69 for instructions.
8. In the Cluster Administrator window, select the first node of the cluster and click **File → Resume Node** to resume cluster service in first cluster node.
9. Move all cluster groups that were active in the first cluster node back to it. Make sure that the cluster groups can be brought online in the first cluster node with no problems.
10. Repeat steps 1 through 9 for each of the other nodes in the cluster configuration. Perform all steps for each cluster node, one cluster node at a time.

Upgrading Windows operating systems

The following sections describe how to upgrade from one Windows operating systems to another.

Note: Upgrading from Windows NT 4.0 to Windows Server 2003 in a cluster configuration is not supported. You have to either perform a new installation of the Windows Server 2003 or upgrade to Windows 2000 first and then upgrade to Windows Server 2003. Always perform a full system backup before you perform any upgrade procedure.

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 higher.

Attention: To avoid possible data loss, you must uninstall any previous versions of the storage management software (see "Uninstalling storage management software components" on page 122) before you upgrade 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. See "Uninstalling storage management software components" on page 122.
3. Use the instructions from Microsoft to upgrade to Windows 2000.
4. Reinstall Storage Manager. Either see the instructions in "Installing SMclient" on page 56 or the procedure that came with the version of the storage management software you are currently running.

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, see "Uninstalling storage management software components" on page 122. Uninstall the components in the following order:

   a. SMagent

   b. SMutil

   c. RDAC

   d. SMclient

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 SMclient on node A. See "Installing the SMclient" on page 70 for instructions.

10. Install the RDAC on node A. See "RDAC" on page 72 for instructions.

11. Install the SMagent on node A. See "SMagent" on page 75 for instructions.

12. Install the SMutil on node A. See "SMutil software" on page 77 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, see "Uninstalling storage management software components" on page 122. Uninstall the components in the following order:

   a. SMagent

   b. SMutil

   c. RDAC

   d. SMclient

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 HBA device driver versions are correct. If they are not the certified versions, see 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 SMclient on node B. See "Installing the SMclient" on page 70 for instructions.
23. Install the RDAC on node B. See "RDAC" on page 72 for instructions.
24. Install the SMagent on node B. See "SMagent" on page 75 for instructions.
25. Install the SMutil on node B. See "SMutil software" on page 77 for instructions.
26. Run Cluster Administrator. Then click **File → Resume Node** to resume cluster service in node B.
27. Go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Upgrading from Windows NT 4.0 or Windows 2000 to Windows Server 2003 in a standard configuration

If you have an existing storage subsystem running Windows NT 4.0 or Windows 2000, you can upgrade to Windows Server 2003 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 higher.
- Your other installed application software can be upgraded and the versions are at the upgradable version.

Attention: To avoid possible data loss, you must uninstall any previous versions of the storage management software (see "Uninstalling storage management software components" on page 122) before you upgrade your operating system. All storage management configuration information is deleted during the un-installation process. A complete reinstallation of the storage management software is required.

To upgrade from Windows NT 4.0 or Windows 2000 to Windows Server 2003 in a standard (non-cluster) configuration, perform the following steps:

1. Verify that the storage subsystem contains no system-dependent files or directories, such as paging files.
2. Uninstall the Storage Manager software. See "Uninstalling storage management software components" on page 122.
3. Use the instructions from Microsoft to upgrade to Windows Server 2003.
4. Reinstall Storage Manager. Either see the instructions in "Installing the storage management software" on page 69 or the procedure that came with the version of the storage management software that you are currently running.
5. Go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103. Make sure that the host type of the host or default host group is "Windows 2000/Server 2003 non-clustered".

Upgrading from Windows 2000 to Windows Server 2003 in a cluster configuration

Note: Upgrading from Windows NT 4.0 to Windows Server 2003 in a cluster configuration is not supported. You have to either perform a new installation of the Windows Server 2003 or upgrade to Windows 2000 first and then upgrade to Windows Server 2003. Always perform a full system backup before you perform any upgrade procedure.

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

- Put those applications 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 2000 Advanced Server to Windows Server 2003 Enterprise Edition, perform the following steps:

1. On node A, open the Cluster Administrator window.
2. Double-click the Active Groups folder in the right pane of Cluster Administrator.
3. Move all active cluster groups in node A to node B. Make sure that the cluster groups come online successfully in node B.
4. Select node A. Click **File → Pause Node** to pause cluster service in node A.
5. From node A, uninstall all software components. To uninstall the software, see "Uninstalling storage management software components" on page 122. Uninstall the components in the following order:
   a. SMagent
   b. SMutil
   c. RDAC
   d. SMclient
6. Follow the instructions from Microsoft to upgrade node A from Windows 2000 Advanced Server to Windows Server 2003 Enterprise Edition.

   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 rejoins the cluster and remain paused.

7. Verify that the 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 Server 2003 Enterprise Edition.
9. Install the Storage Management software in node A. See "Installing the storage management software" on page 69.
10. In the Cluster Administrator window, select node A and click **File → Resume Node** to resume cluster service in node A.
11. Move the cluster groups that were active in node A back to node A.
12. On node B, open the Cluster Administrator window.
13. Double-click the Active Groups folder in the right pane of Cluster Administrator.
14. Make sure that all cluster groups failover to node A successfully.
15. Select node B. Click **File → Pause Node** to pause cluster service in node B.
16. From node B, uninstall all software components. To uninstall the software, see "Uninstalling storage management software components" on page 122. Uninstall the components in the following order:
    a. SMagent
    b. SMutil
    c. RDAC

d. SMclient

17. Follow the instructions from Microsoft to upgrade node B from Windows 2000
     Advanced Server to Windows Server 2003 Enterprise Edition.

     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 rejoins the cluster and remain paused.

18. Verify that the 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.

19. Verify that node B was successfully upgraded to Windows Server 2003
     Enterprise Edition.

20. Install the Storage Management software in node B. See "Installing the storage
     management software" on page 69 for instructions.

21. In the Cluster Administrator window, select node B and click **File → Resume
     Node** to resume cluster service in node B.

22. In the Cluster Administrator window, move the cluster groups that were active
     in node B back to node B. Make sure that they come online with no problems.

23. If there are more than two nodes in a cluster, repeat steps 12 on page 87
     through 22 for each of the remaining nodes in a cluster, one cluster node at a
     time.

Additional information

For additional information about installing and using Storage Manager 8.4 in a
Windows cluster server configuration, see Appendix A, "Windows operating system
limitations," on page 127.

Chapter 5. Installing Storage Manager software in a standard NetWare configuration

This chapter describes how to install the storage management software in standard (noncluster) and cluster server configurations in the NetWare 6.0 operating system environment.

If you have existing storage systems, read "Installation types" on page 15 and "Storage subsystem management methods" on page 8.

To ensure proper installation, complete all preparation tasks described in "Planning and preparing for NetWare installation" on page 32.

Important: Always check for a readme file on any installation media. A readme file might contain important information that was not available when this document was prepared.

Installation overview

You must install Storage Manager 8.4 software components on both management stations and host computers.

Table 17 shows the installation sequence for Storage Manager software components.

Table 17. Software component installation sequence in a Novell NetWare 6.0 environment

System type	Software installation sequence
Management station	Storage Manager 8.4 Client (SMclient)
Host computer and cluster node	1. Storage Manager 8.4 Client (SMclient) This optional component is necessary if you intend to manage the storage subsystem from a host computer. 2. Storage Manager 8.4 Agent (SMagent) This optional component is necessary if you intend to use the host-agent management method. 3. Storage Manager 8.4 Utility (SMutil) This required component contains the hot_add, SMdevices, and SMflashcopyassist utilities. 4. `LSIMPE.cdm` driver 5. IBM Host Adapter device driver (`QL2x00`)

Important: Be sure that you install the host bus adapter before you install the storage management software.

To install the storage management software in a NetWare 6.0 operating system environment, you *must* install the software on each host computer in the following order:
1. Storage Manager 8.4 Client
2. Storage Manager 8.4 Agent
3. Storage Manager 8.4 Utility
4. LSIMPE.cdm driver

5. IBM Host Adapter (HA) device driver
6. NetWare Agent component of IBM FAStT Management Suite Java (FAStT MSJ)

Storage Manager 8.4 Client

This section provides instructions for installing Storage Manager 8.4 Client on management stations and host computers.

Before you install the software, make sure that:
- The management station or host computer has at least 60 MB of available disk space.
- All programs are closed.
- The HBA is installed.

Important: When you install Storage Manager 8.4 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 8.4 Client (SMclient)

Perform the following steps to install SMclient:

1. Insert the IBM FAStT Storage Manager installation CD into the CD-ROM drive and type the following command:

   `load cdrom`

2. Mount the volume.
3. Click **Novell** → **Install**.
4. Click **Add** and follow the instructions on the screen.
5. Click the **Directory Tree** button.

   The Directory Tree window opens.
6. Select the CD-ROM volume.
7. Select the `\NetWare\SMclient` folder.
8. Select the program.ni file, and then click **OK**.
9. Click **OK**.

   After the files are copied, the License Agreement window opens.
10. Click **Accept** to continue.

    The Copying Files message window opens.
11. When the installation is complete, click **Finish**.

Verifying the Storage Manager 8.4 Client installation

Perform the following steps to verify that SMclient 8.4 installed correctly:

1. Click **Novell** → **Programs**.
2. Verify that the IBM FAStT Fibre Channel Storage Manager Client displays in the list of programs.

   If the program is not listed, repeat "Installing Storage Manager 8.4 Client (SMclient)." If the IBM FAStT Storage Manager Client still does not display, a failure has occurred. Contact your IBM technical support representative.
3. If you are installing Storage Manager 8.4 Client on a host computer, go to "Storage Manager 8.4 Agent" on page 91. Otherwise, go to Chapter 8, "Completing Storage Manager 8.4 installation," on page 103.

Storage Manager 8.4 Agent

Install the Storage Manager 8.4 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:

- The host computer is configured with Novell NetWare 6.0 and Service Pack 2.
- You have Administrator privileges on the host computer.
- The host computer has at least 20 MB of available disk space.

Installing Storage Manager 8.4 Agent (SMagent)

Perform the following steps to install SMagent:

1. Close all other programs.
2. Insert the IBM FAStT Storage Manager installation CD into the CD-ROM drive and type the following command:

   `load cdrom`
3. Mount the CD volume.
4. Click **Novell → Install**.
5. Click **Add**, and follow the instructions on the screen.
6. Click the **Directory Tree** button.

   The Directory Tree window opens.
7. Select the CD-ROM volume.
8. Select the `\NetWare\SMagent` directory.
9. Select the product.ini file, and then click **OK**.
10. Click **OK**.

    After the files are copied, the License Agreement window opens.
11. Click **Accept** to continue.

    The files are copied.
12. When the installation is complete, click **Finish**.

    Note: Make an `autoexec.ncf` entry to enable SMagent when you start the server.

Verifying the Storage Manager 8.4 Agent installation

Perform the following steps to verify that the SMagent installed correctly:

1. Toggle to the Server Console window and at the command prompt, type:

   `SMagent`

   The agent starts and displays the following message when UTM LUNs are being scanned:

   `Activating`
2. Continue with "Storage Manager 8.4 Utility."

Storage Manager 8.4 Utility

This section provides instruction for installing Storage Manager 8.4 Utility software on host computers. This component contains utilities that register and map new logical drives to the operating systems.

Important: Make sure that you have installed the IBM FAStT MSJ QLRemote agent on the same host where you are installing the Storage Manager 8.4 Utility software. For more information, see "Installing IBM FAStT Management Suite Java" on page 93.

Installing Storage Manager 8.4 Utility (SMutil)

Perform the following steps to install SMutil:

1. Close all programs.
2. Insert the IBM FAStT Storage Manager installation CD into the CD-ROM drive and type the following command:

   `load cdrom`

3. Mount the CD volume.
4. Click **Novell → Install**.
5. Click **Add** and follow the instructions on the screen.
6. Click the **Directory Tree** button.

   The Directory Tree window opens.
7. Select the CD-ROM drive.
8. Click the `\NetWare\SMutil` folder, and then, click **Open**.
9. Select the `product.ni` file, and then, click **Open**.

   The Welcome window opens.
10. Click **Next** to begin the installation.

    After you install the Storage Manager 8.4 Utility software, the Operation Complete window opens. If the system detects the installation of another version of Storage Manager 8.4 Utility, a window opens indicating that the installation will be updated and your personal configuration files will be saved. Click **Yes** to continue.
11. Click **Finish**.

Verifying the Storage Manager 8.4 Utility installation

Perform the following steps to verify that SMutil installed correctly:

1. Go to the following directory:

   `sys:system`

2. Verify that the directory contains the following files:
   - `hot_add.ncf`
   - `SMdevices.ncf`

   If it does not, reinstall the Storage Manager 8.4 Utility using the procedure in "Installing Storage Manager 8.4 Utility (SMutil)."

Installing the LSIMPE driver

The `LSIMPE.CDM` driver is used in a Novell NetWare environment to provide multipath I/O support to the storage server. The `LSIMPE.CDM` driver is a custom driver module that is installed with the IBM FAStT Host Adapter driver. In case of a failure along the I/O path, the driver sends the I/O requests through the alternate path and Auto-Volume Transfer (AVT) moves the logical drive within the FAStT Storage Server.

For the current readme file, `LSIMPE.CDM` driver, and installation instructions, go to the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Continue with "Installing the IBM fibre-channel host bus adapter device driver."

Installing the IBM fibre-channel host bus adapter device driver

An IBM fibre-channel host bus adapter (HBA) provides the interface between a host server and a FAStT storage server. IBM FAStT fibre-channel HBAs are high-performance, direct memory access, bus-master, host adapters that are designed for high-end systems. These HBAs support all fibre-channel peripheral devices that support private-loop direct-attach and fabric-loop attachment. The IBM Host Adapter device driver enables your operating system to communicate with the fibre-channel HBA. See the readme file included in the driver package for installation instructions associated with your operating system. For more information, see the Installation and User's Guide for your particular fibre-channel HBA model. The current readme file and latest multipath I/O device driver are available at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Continue with "Installing IBM FAStT Management Suite Java."

Installing IBM FAStT Management Suite Java

For information about installing and using this software, see the *IBM FAStT MSJ User's Guide* or online Help.

Additional information

For additional information about installing and using Storage Manager 8.4 in a NetWare configuration, see Appendix B, "NetWare operating system limitations," on page 133.

Chapter 6. Installing Storage Manager software in a Linux configuration

This chapter describes how to install the storage management software in a Linux operating system environment.

If you have existing storage systems, make sure that you have read "Installation types" on page 15 and "Managing coexisting storage subsystems" on page 20.

To ensure proper installation, make sure you have completed all preparation tasks described in Chapter 2, "Preparing for installation," on page 31.

Important: Always check for a readme file on any installation media. This readme file might contain important information made available only after completion of this document.

Installation overview

Important: Be sure that you install the HBA and device driver before you install the storage management software.

Linux software requirements

Table 18 lists the disk space that is required for installing Storage Manager 8.4 in a Linux environment.

Note: The SMclient and SMagent software packages are not available for all 64-bit Linux kernels.

Table 18. Installation requirements for Linux by software package

Package	Disk space requirement
Storage Manager 8.4 Client (SMclient)	15 MB on /opt, 2 MB on /tmp
IBM FAStT Management Suite Java (FAStT MSJ)	35 MB
Storage Manager 8.4 Utility (SMutil)	7 MB on /opt
IBM Host Adapter device driver	1 MB
Storage Manager 8.4 runtime (SMruntime)	42 MB on /opt, 1 MB on /var

Linux operating system requirements

Table 19 describes the minimum operating system and kernel level requirements for each management station or host computer. See the readme file for the latest information regarding supported kernel versions.

Table 19. Management station or host computer by minimum operating system and kernel level

Operating system	Kernel
Red Hat Enterprise Linux AS 2.1	2.4.9-e.27
SuSE Linux Enterprise Server Version 8 (SLES 8)	2.4.21

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 that you need for the software to operate. Be sure to install the software on the management stations as well as the attached host computers.

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

1. Uninstall the earlier version Storage Manager.
2. Install Storage Manager 8.4 Runtime.
3. Install Storage Manager Client 8.4 Client.
4. Disable and enable the Event Monitor.
5. Install Storage Manager 8.4 Utility.
6. Uninstall existing IBM FAStT Management Suite Java (use this procedure when installing Storage Manager 8.4 on an existing storage subsystem).
7. Install IBM FAStT Management Suite Java.
8. Install the IBM Host Adapter (HA) device driver (`qla2200.o` or `qla2300.o`).

Uninstalling Storage Manager

Perform the following steps to uninstall an earlier version of Storage Manager.

Note: You do not need to restart your host computer after removing a software component. During the software removal process, the host keeps existing storage subsystem mappings and storage partition configurations, which the new client software will recognize.

1. Be sure that you have root privileges, which are required to uninstall Storage Manager.
2. To begin uninstalling Storage Manager, type the following command:

    `rpm -qa|grep SM`
3. Press **Enter**. The SM packages are listed.
4. At the prompt, type the following command and press **Enter**:

    `rpm -e component-name`

    where *component-name* is the name of the storage management software package that you want to uninstall. The system prompt displays when the software removal completes.
5. Verify that the removal was successful. At the system prompt, type the following command and press **Enter**:

    `rpm -qi component-name`

    where *component-name* is the name of the storage management software package that you want to uninstall. If the uninstallation process was successful, the host displays a message indicating that the software is not installed.
6. Repeat step 2 through step 5 to remove each Storage Manager component and associated directory.
7. Click **Completed** in the Installation Activity panel.
8. Select one of the following options:
    *   If you are installing IBM FAStT Storage Manager Version 8.4 on a management station or a host computer, proceed to "Installing the 8.4 software" on page 97.
    *   If you remove the storage management software and do not plan to reinstall the software on a management station or host computer, you have successfully completed all procedures.

Installing the 8.4 software

Use the procedures in this section to install the Storage Manager on a management station or host computer.

Installing Storage Manager 8.4 Runtime (SMruntime)

Perform the following steps to install SMruntime:

1. Close all open programs.
2. Insert the IBM FAStT Storage Manager Version 8.4 CD into the CD-ROM drive.
3. To mount the CD-ROM, type the following command and press **Enter**:

   `mount /mnt/cdrom`
4. Type the following command and press **Enter**:

   `cd /mnt/cdrom/linux`
5. Type the following command:

   `rpm -ivh SMruntime`
6. Press **Tab**; then, press **Enter**.

Verifying the Storage Manager 8.4 Runtime installation

Perform the following steps to verify that the installation was successful:

1. At the system prompt, type the following command and press **Enter**:

   `rpm -qi SMRuntime`

   The verification process displays a message that describes the SMruntime software, including version numbers, copyright license, installation time, and general software package description.

   If no failure is reported, go to step 2. If the verification reports a failure, repeat steps 1 through 6 of the installation procedure.
2. Continue with "Installing the Storage Manager 8.4 Client (SMclient)."

Installing the Storage Manager 8.4 Client (SMclient)

Perform the following steps to install the SMclient:

1. Close all open programs.
2. Insert the IBM FAStT Storage Manager Version 8.4 CD into the CD-ROM drive.
3. To mount the CD-ROM, type the following command and press **Enter**:

   `mount /mnt/cdrom`
4. Type the following command and press **Enter**:

   `cd /mnt/cdrom/linux`
5. Type the following command:

   `rpm -ivh SMclient`
6. Press **Tab**; then, press **Enter**.

Verifying the Storage Manager 8.4 Client installation

Perform the following steps to verify that the installation was successful:

1. At the system prompt, type the following command and press **Enter**:

   `rpm -qi SMclient`

   The verification process displays a message that describes the SMclient software, including version numbers, copyright license, installation time, and general software package description.

If no failure is reported, go to step 2. If the verification reports a failure, repeat step 1 through step 6 of the installation procedure.

2. Continue the installation with "Installing IBM FAStT Management Suite Java" on page 99 if you are installing a new storage subsystem. If you are installing the storage management software on an existing storage subsystem, continue with "Disabling and enabling the Event Monitor."

Disabling and enabling the Event Monitor

The Event Monitor, which comes with the client software, installs automatically during the client software installation. The Event Monitor handles storage subsystem error notification through e-mail or SNMP traps when the storage management software is not actively running on the management station or host computer.

Important: If you installed the client software on multiple hosts, you might receive duplicate error messages from the same storage subsystem. To avoid receiving duplicate error messages, disable the Event Monitor on all but one system. You must run the Event Monitor on one host that will run continually.

To disable the Event Monitor, type the following command and press **Enter**:

```
/etc/rc.d/init.d/SMmonitor stop
```

To enable the Event Monitor, type the following command and press **Enter**:

```
/etc/rc.d/init.d/SMmonitor start
```

Installing the Storage Manager 8.4 Utility (SMutil)

Perform the following steps to install the SMutil:

1. Close all open programs.
2. Insert the IBM FAStT Storage Manager Version 8.4 CD into the CD-ROM drive.
3. To mount the CD-ROM, type the following command and press **Enter**:
   ```
   mount /mnt/cdrom
   ```
4. Type the following command and press **Enter**:
   ```
   cd /mnt/cdrom/linux
   ```
5. Type the following command:
   ```
   rpm -ivh SMutil
   ```
6. Press **Tab**; then, press **Enter**.

Verifying the Storage Manager 8.4 Utility installation

Perform the following steps to verify that the installation was successful:

1. At the system prompt, type the following command and press **Enter**:
   ```
   rpm -qi SMutility
   ```
   The verification process displays a message that describes the SMutility software.

   If no failure is reported, go to step 2. If the verification reports a failure, repeat steps 1 through 6 of the installation procedure.
2. Continue with "Uninstalling IBM FAStT Management Suite Java" on page 99.

Uninstalling IBM FAStT Management Suite Java

If you are installing Storage Manager 8.4 in an environment with existing storage subsystems, you need to uninstall older versions of IBM FAStT Management Suite Java (MSJ) and then install the version of IBM FAStT MSJ that came on the IBM FAStT Storage Manager Version 8.4 CD.

Perform the following steps to uninstall FAStT MSJ:

1. From a system prompt, type the following command:

   `/usr/FAStT_MSJ_Uninstaller`
2. Press **Tab**; then, press **Enter**.

Installing IBM FAStT Management Suite Java

The IBM FAStT MSJ software includes the FAStT GUI device driver that is required for failover support. You can use the GUI to configure logical drives, storage, and failover.

Note: For additional information, see the online help.

Perform the following steps to install IBM FAStT MSJ:

1. Insert the IBM FAStT Storage Manager Version 8.4 CD into the CD-ROM drive.
2. From the X-windows GUI, open a command window.
3. Type the following command and press **Enter**:

   `cd /mnt/cdrom/FAStT_MSJ/linux`
4. To run the installer for FAStT MSJ, type the following command at a system prompt:

   `sh FAStT`
5. Press **Tab**; then, press **Enter**. The Introduction window opens.
6. Click **Next**.
7. Restart your Linux server.
8. Continue with "Installing the IBM fibre-channel host bus adapter device driver."

For additional configuration information, see the *IBM FAStT MSJ User's Guide*.

Installing the IBM fibre-channel host bus adapter device driver

An IBM fibre-channel host bus adapter (HBA) provides the interface between a host server and a FAStT storage server. IBM FAStT fibre-channel HBAs are high-performance, direct memory access, bus-master, host adapters designed for high-end systems. These HBAs support all fibre-channel peripheral devices that support private-loop direct-attach and fabric-loop attachment. The IBM Host Adapter device driver enables your operating system to communicate with the fibre-channel HBA. See the readme file included in the driver package for installation instructions associated with your operating system. For more information, see the Installation and User's Guide for your particular fibre-channel HBA model. The current readme file and latest multipath I/O device driver are available for download at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Additional information

For additional information about installing and using Storage Manager 8.4 in a Linux configuration, see Appendix C, "Linux operating system limitations," on page 135.

Chapter 7. Installing Storage Manager software in a VMware ESX Server configuration

Install Storage Manager 8.4 on a management workstation separate from that running VMware ESX Server 2.0, preferably on the workstation from which you manage the VMware ESX Server 2.0 . Do not install Storage Manager 8.4 on a server running VMware ESX Server 2.0. Your management station should be using either a Windows or Linux operating system. For instructions associated with your particular platform, see Chapter 3, "Installing Storage Manager software in a standard Windows configuration," on page 55 or Chapter 6, "Installing Storage Manager software in a Linux configuration," on page 95.

Figure 18 shows a sample VMware ESX Server configuration.
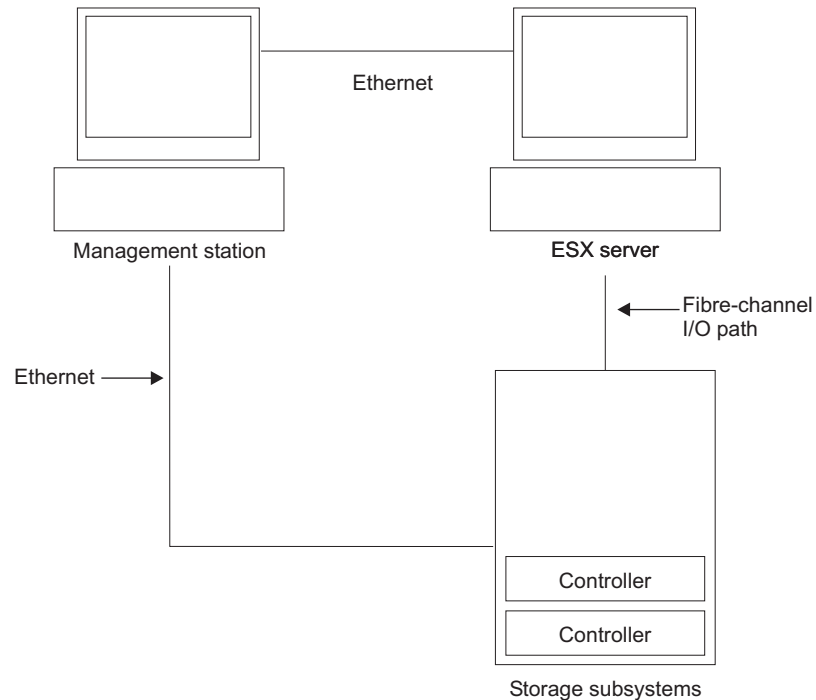
Figure 18. Sample VMware ESX Server configuration

Software requirements

Software requirements for FAStT Storage Manager 8.4 running VMware ESX Server 2.0 are detailed in this section.

Management station

The following software is required for the management station:

1. SM Runtime (Linux only)
2. SMclient

Note: The mapping storage partition host type for VMware is `Linux`.

Host (ESX Server)

The following software is required for the ESX Server:

1. No Storage Manager software
2. VMware-supplied driver for the fibre-channel HBAs
3. QLogic driver failover setup (in VMware ESX Server 2.0)

> **Note:** For the VMware ESX Server 2.0 Administration Guide and additional related information, see the VMware support Web site at:
>
> www.vmware.com/support/esx2/

For more information about installing VMware ESX Server 2.0 on an IBM server, see the IBM support Web site at:

www.ibm.com/pc/us/compat/nos/matrix.shtml

Hardware requirements

For information about the hardware that is supported with VMware ESX Server 2.0, see the IBM support Web site at:

www.ibm.com/storage/disk/fastt/supserver.htm

Additional information

For additional information about installing and using Storage Manager 8.4 in a VMware configuration, see Appendix D, "VMware ESX Server operating system limitations," on page 137.

Chapter 8. Completing Storage Manager 8.4 installation

This chapter contains procedures on how to use Enterprise Management and Subsystem Management to complete Storage Manager 8.4 installation tasks for Windows, NetWare, and Linux operating system environments.

Completing the installation

To complete a Storage Manager 8.4 installation, perform the following tasks:

1. Install SANavigator, if you choose.
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 install 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.ibm.com/pc/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 processor 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 you install IBM FAStT Storage Manager Version 8.4, 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 8.4 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 8 Client**. The client software starts and displays the Enterprise Management window and the Confirm Initial Automatic Discovery window as illustrated in Figure 19 on page 105.
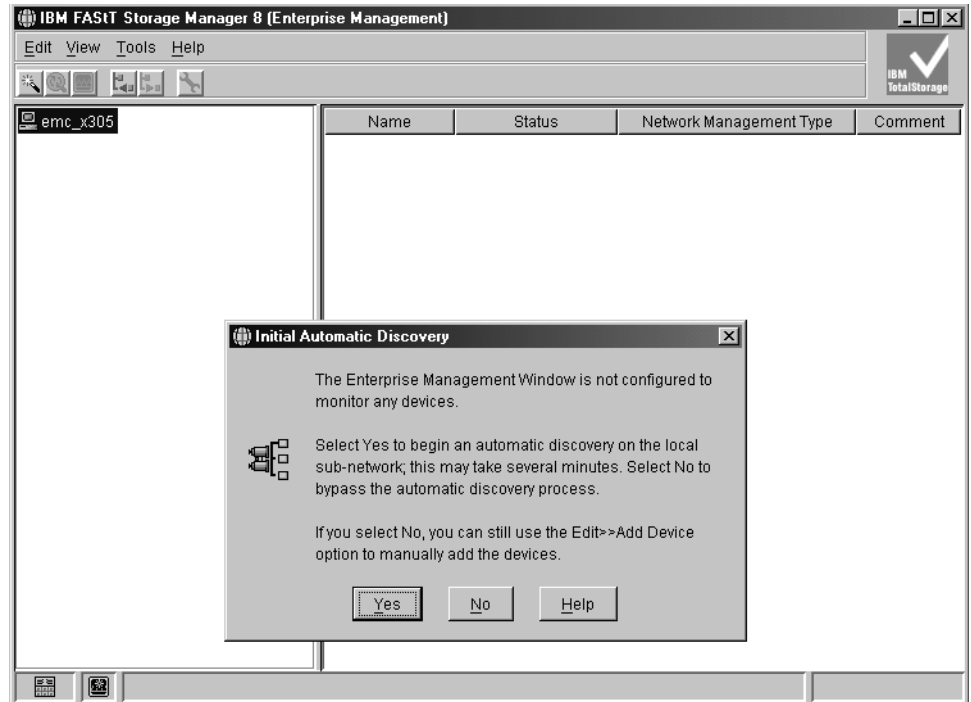
SJ000872

Figure 19. Confirm Initial Automatic Discovery window

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

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.
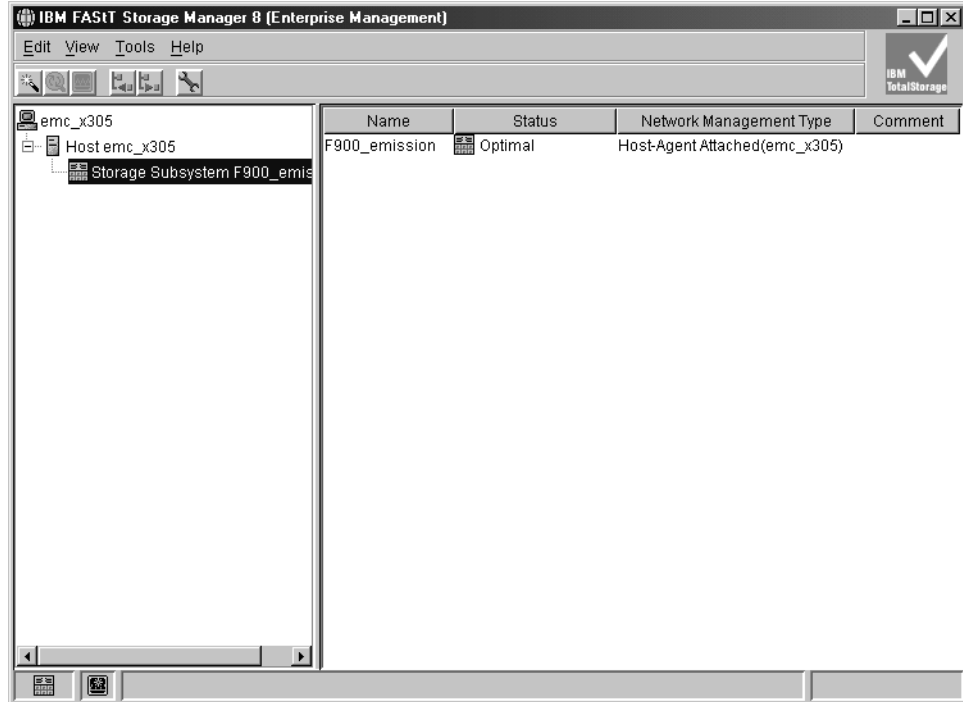
SJ000873

Figure 20. Enterprise Management window

4. Verify that each host and storage subsystem displays 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 31 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 SMagent is installed in the host.

     b. Verify that you have a fibre-channel connection from the storage subsystems to the host that has the SMagent installed.

     c. Verify that all of the preparation steps outlined in Chapter 2, "Preparing for installation," on page 31 are complete. If they are, perform the following steps:

        1) Run the `hot_add` utility.

2) Restart the SMagent using the information in "Stopping and restarting the host-agent software" on page 121.

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 an SMclient. You can also use this option to add additional devices to be managed that were not discovered during the SMclient initial discovery. For more information about this option, see the Enterprise Management window online help.

Important:

- When you add new storage subsystems to the existing storage subsystems in a 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, see "Stopping and restarting the host-agent software" on page 121. 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 8.4 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 your particular storage management product.)

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 21.
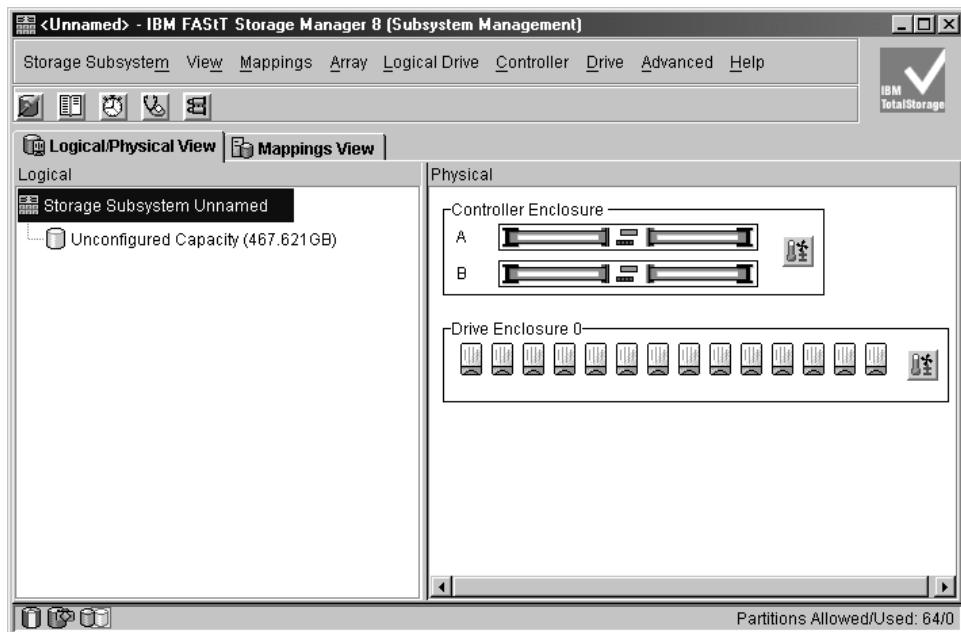
SJ000874

Figure 21. Subsystem Management window

3. Click **Storage Subsystem** → **Rename**. The Rename Storage Subsystem window opens.

4. Type the name of the storage subsystem (see Table 24 on page 139). Then click **OK**.

5. Repeat this procedure for each unnamed storage subsystem. For more information, see the topic on renaming storage subsystems in the Subsystem Management window online help.

6. Proceed to "Downloading controller and NVSRAM ESM firmware" on page 109.

Downloading controller and NVSRAM ESM firmware

Note: Access the latest versions of FAStT storage server controller firmware and NVSRAM and FAStT Storage Expansion Enclosure ESM firmware at the IBM Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

Important: Suspend all I/O activity while downloading firmware and NVSRAM to a FAStT Storage Server with a single controller or you will not have redundant controller connections between the host server and the FAStT Storage Server.

This section provides instructions for downloading FAStT storage server controller firmware and NVSRAM and FAStT Storage Expansion Enclosure ESM firmware. You must download FAStT storage server controller firmware version 05.4x.xx before you download FAStT Storage Expansion Enclosure ESM firmware.

Downloading firmware

To download firmware version 05.4x.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."

Downloading ESM firmware

Perform the following steps to download the ESM firmware:

1. In the FAStT Storage Server Subsystem Management window, select **Advanced** → **Download** → **Environmental (ESM) card firmware**. A download Environmental card firmware window opens.
2. In the window, select the enclosure, provide the filename of the ESM firmware file and click **Start** to begin the ESM firmware download.
3. Click **Cancel** to close the window when the ESM firmware download is complete.

Note: Suspend all I/O activity while ESM firmware downloads if you select multiple enclosures for downloading ESM firmware. If you select only one enclosure for download at a time, you can download ESM firmware while the server conducts I/O activity. However, IBM recommends that you suspend all I/O activity to perform firmware upgrades.

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 you can use 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 level 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 level 04.01.02.34 or higher and install the FAStT Storage Manager Field Tool Version 5.21 program. This program is available at the following Web site:

www-1.ibm.com/servers/storage/support/fastt/index.html

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. For firmware levels 05.3x.xx.xx and lower, the maximum number of hard drives supported for each array is 30 if the hard drive capacities are 73.4 GB or less and 14 if the hard drive capacities are 146 GB. For firmware levels 5.4x.xx.xx and higher, however, the maximum number of drives supported in an array is 30, regardless of the hard drive capacity. Each array can be divided into from 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. Proceed to "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 nodes A and 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.

Note: Windows 2000 and Windows Server 2003 share the following host type options:
- Windows 2000/Server 2003 non-clustered
- Windows 2000/Server 2003 clustered

If these host type entries do not display as options in your host type pull-down menu, use either of the following host types instead:
- Windows 2000 non-clustered
- Windows 2000 clustered

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 FAStT 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 4.0) or variants of the same operating system (for example, Windows NT 4.0 running in a cluster environment or Windows NT 4.0 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" on page 113.

Note: Partitioning is a premium feature. If you disable partitioning, you *must* contact your IBM technical support representative to obtain a key to enable partitioning again. This is not a standard feature with the FAStT600.

Creating a FlashCopy logical drive

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 a host address, so that you can perform backups by 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 both 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 premium feature. Contact your IBM reseller or IBM marketing representative for more information.

Important: The FlashCopy drive cannot be added or mapped to the same server that has the base logical drive of the Flashcopy logical drive in a Windows 2000, Windows Server 2003, or NetWare environment. You must map the Flashcopy logical drive to another server.

Perform the following steps to create a FlashCopy logical drive:

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.
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 VolumeCopy

The VolumeCopy feature is a firmware-based mechanism for replicating logical drive data within a storage array. This feature is designed as a system management tool for tasks such as relocating data to other drives for hardware upgrades or performance management, data backup, or restoring snapshot volume data. Users submit VolumeCopy requests by specifying two compatible drives. One drive is designated as the Source and the other as the Target. The VolumeCopy request is

persistent so that any relevant result of the copy process can be communicated to the user. For more information about this feature, see the *IBM TotalStorage FAStT Storage Manager Copy Services User's Guide*, or contact your IBM reseller or marketing representative.

Using the Remote Mirror option

The Remote Mirror option is a 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, the Remote Mirror option enables you to promote a second storage subsystem to take over responsibility for normal input/output (I/O) operations. For more information about this feature, see the *IBM FAStT Remote Mirror Option Installation and User's Guide*, or contact your IBM reseller or marketing representative.

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.

Chapter 9. Using the storage management software for Windows and NetWare

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 in Windows and NetWare operating system environments. Information regarding the Windows operating system follows. See "Using the storage management software for NetWare" on page 123 for analogous information about the NetWare operating system environment.

Using the storage management software for Windows

This section 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 in a Windows operating system environment.

Adding or deleting logical drives

Use the following procedures to add or delete logical drives in a standard (noncluster) and a cluster 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 4.0 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 120 and "Using the SMdevices utility" on page 120.

Deleting logical drives:

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

Before you delete logical drives with the storage management software or by using **Configuration → Reset**, perform the following steps:

1. Use the Disk Administrator to delete any partitions and to unassign drive letters that are associated with the logical drives.
2. Restart the system to remove the configuration information.

Attention: You must use the Disk Administrator to delete OS partitions and unassigned drive letters before you delete logical drives or reset the configuration in Storage Manager. Take this action to avoid damage to your registry information.

Cluster server configuration for Windows NT 4.0

Use the following procedures to create or delete logical drives in a cluster server environment for Windows NT 4.0.

Creating logical drives: 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 started and that the cluster groups and resources failed back correctly.
8. Stop the cluster server service in node B.
9. Using the procedure outlined in step 3, 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 starts, use Cluster Administrator to create your physical disk resources.
17. Verify that the physical disk resources can be brought online in both nodes.

Deleting logical drives:

Attention: Do not click **Configuration → Reset** in the Storage Manager Client Storage Subsystem management window if you have data or logical drives that you want to keep. 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 **Configuration → Reset** in the Storage Manager Client Storage Subsystem management window, 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 the 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. Take this action to avoid damage to your registry information.

Standard (noncluster) configuration for Windows 2000

Use the following procedures to create or delete logical drives in a standard server environment for Windows 2000.

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

After creating 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 without requiring a system restart. The SMdevices utility identifies the logical drives by their associated operating system device names. For more information, see "Using the hot_add utility" on page 120 or "Using the SMdevices utility" on page 120.

Deleting logical drives:

Attention: Do not click **Configuration → Reset** if you have data or logical drives that you want to keep. 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 **Configuration → Reset**, perform the following steps:

1. Use the Disk Administrator to delete any partitions and to unassign drive letters that are associated with the logical drives.
2. Restart the system to remove the configuration information.

Attention: You must use the Disk Administrator to delete OS partitions and unassigned drive letters before you delete logical drives or reset the configuration in Storage Manager. Take this action to avoid damage to your registry information.

Cluster server configuration for Windows 2000

Use the following procedures to create or delete logical drives in a cluster server environment for Windows 2000.

Creating logical drives: 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.

Deleting logical drives:

Attention: Do not click **Configuration → Reset** in the Storage Manager Client Storage Subsystem management window if you have data or logical drives that you want to keep. 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 **Configuration → Reset** in the Storage Manager Client Storage Subsystem management window, perform the following steps:

1. Use the Cluster Administrator to delete the cluster physical disk resources that own the logical drives that will be deleted.
2. Use the 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 the 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 avoids damage to your registry information.

Standard (non-clustered) configuration for Windows Server 2003

Use the following procedures to create or delete logical drives in a standard environment.

Creating logical drives: When you create logical drives with the storage management software, you must add the new logical drives to the Windows Server 2003 operating system. Each logical drive (not array) is recognized by Windows Server 2003 as a single disk drive.

After creating 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 without requiring a system restart. The SMdevices utility identifies logical drives by their associated operating system device names. For more information, see "Using the hot_add utility" on page 120 or "Using the SMdevices utility" on page 120.

Deleting logical drives:

Attention: Do not click **Configuration** → **Reset** in the Storage Manager Client Storage Subsystem management window if you have data or logical drives that you want to keep. 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 **Configuration** → **Reset** in the Storage Manager Client Storage Subsystem management window, perform the following steps:

1. Use the Disk Administrator to delete any partitions and to unassign drive letters that are associated with the logical drives.
2. If possible, restart the system to remove the configuration information.

Attention: You must use the 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 avoids damage to your registry information.

Cluster server configuration for Windows Server 2003

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

Creating logical drives: To add logical drives in a Windows Server 2003 cluster server environment, perform the following steps:

1. Use the IBM FAStT Storage Manager Client program to create arrays and logical drives and use storage partitioning to assign them to the appropriate cluster host group.
2. Use the hot_add utility to add the new logical drives to the cluster node that is currently owned by the cluster quorum resource.
3. Use the Disk Administrator program to create, format, and assign drive letters to the disk partitions on the new logical drives.
4. In each of the rest of the cluster nodes in the cluster configuration, use the hot_add utility to add the new logical drives to the cluster node.
5. In the first cluster node, use the Cluster Administrator program to create cluster physical disk resources using the new disk partitions on the new logical drives.

   Note: If the new disk does not show up in the available disk pull-down list when you go through the Cluster Administrator program, you might have to reboot the server.
6. Bring the cluster resources online in the first cluster node.
7. Use the Cluster Administrator to move the newly-created cluster physical disk resources to other nodes in the cluster configuration.
8. Verify that the resources come online in other nodes in the cluster configuration.

Deleting logical drives:

Attention: Do not click **Configuration** → **Reset** in the Storage Manager Client Storage Subsystem management window if you have data or logical drives that you want to keep. 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 **Configuration → Reset** in the Storage Manager Client Storage Subsystem management window, perform the following steps:

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

Attention: You must use the 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 avoids damage to your registry 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 SMutil 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_FAStT\Util

   where *installation_directory* is the directory where you installed the SMutil.
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 SMutil 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_FAStT\Util

   where *installation_directory* is the directory where you installed the SMutil.
2. Type:

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

```
\\.\PHYSICALDRIVEx [Storage Subsystem Finance, Logical Drive DEBIT, LUN xx,

WWN <worldwide_name>]
```

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 SMrepassist utility

You can use the SMrepassist 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)

Important: The FlashCopy drive can not be added or mapped to the same server that has the base logical drive of the FlashCopy logical drive in a Windows 2000, Windows Server 2003, or NetWare environment. You must map the FlashCopy logical drive to another server.

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_FAStT\Util

    where *installation_directory* is the directory where you installed the SMutil.

2. Type the following command:

    smrepassist -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:

    smrepassist -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 SAN to which the storage subsystem is connected. 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.

Windows Server 2003

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

1. Click **Start → 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 8.4. 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. SMagent
   b. SMutil
   c. RDAC
   d. SMclient

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**.

Using the storage management software for NetWare

This section provides information on how to add or delete logical drives using the hot_add and SMdevices utilities, start and stop the host-agent software, and uninstall Storage Manager components in a NetWare operating system environment.

Adding or deleting logical drives

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

Creating logical drives

When you create new logical drives with the storage management software, you must add the new logical drives to Novell NetWare. Refer to the Novell NetWare documentation for details about adding a drive. Novell NetWare recognizes each logical drive (not array) as a single drive.

After creating 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, and the SMdevices utility identifies logical drives by their associated operating system device names. For information about how to use these utilities, see "Using the hot_add utility" and "Using the SMdevices utility."

Deleting logical drives

Important: If you have data or logical drives that you want to keep, do not click **Configure → Reset Configure**. This will reset the controller unit and delete *all* previously-configured logical drives.

Before you delete logical drives with the storage management software or use **Configure → Reset Configuration**, stop all input and output activity to the affected storage subsystem. Then dismount any Novell NetWare volumes that are associated with the logical drives.

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 nwconfig to create partitions, add device names, and so on. The hot_add utility is part of the Storage Manager 8.4 Utility package.

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 the Server Console, type:

   ```
   hot_add
   ```

2. Press **Enter**.

   The new logical drives are available through the Disk Administrator.

Using the SMdevices utility

The Storage Manager 8.4 Utility software package 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 drives, volumes, or a combination of both for the logical drive using the `nwconfig` program.

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 the Server Console type:

   `SMdevices`

2. Press **Enter**.

   The software displays device identification information. For example, you might see:

```
V596-A3-D0:0[Storage Subsystem MARKETING, Logical Drive DEBIT,
LUN 0, WWN <600a0b800007545c0000008d3a308b6e>]

V596-A3-D0:1 [Storage Subsystem MARKETING, Logical Drive DEBIT, LUN 1,
WWN <600a0b80000756ec000000a93a307d2a>]

V596-A3-D0:1F [Storage Subsystem MARKETING, Logical Drive Access volume,
LUN 31, WWN <600a0b800007545c0000009000000000>]

Where V596-A3-D0:0;
```

The numbers at the beginning of each line constitute the device name. The device name identifies the adapter or device as follows:

Vendor number [V596]. A unique number specific to the device vendor.

Adapter number [A3]. The instance number of an adapter registered with NWPA. In the example, A3 identifies the first instance of an adapter installed in the server.

Device number [D0]. The number of the disk or other device.

Logical unit number [0,1,1F]. The LUN identifies individual devices when more than one device is attached to one bus.

Storage Subsystem [x]. The storage subsystem name.

Logical Drive [x]. The logical drive name.

LUN [x]. The logical unit number associated with the logical drive.

WWN [x]. The worldwide name for the logical drive.

Stopping and starting the host-agent software

Use the procedures in the following sections to stop and start the host-agent software installed on the host or cluster node.

Note: If an access logical drive is not detected after a restart, the host-agent software will automatically stop running. Restart the host or cluster node so that new host-agent-managed storage subsystems will be discovered.

Stopping the host-agent software

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

Perform the following steps to stop the host-agent software:

1. From the system console, press **Ctrl+Esc**, and then select **System Console**.

2. At the prompt, type:

   ```
   java -show
   ```

   Look for the following line:

   ```
   "devmgr.versioned.agent.AgentServer.............QQQ"
   ```

   where *QQQ* is the process ID.
3. At the prompt type the following:

   ```
   java -killQQQ
   ```

   where *QQQ* is the process ID from the **java -show** command.
4. Press **Enter**.

Starting the host agent manually

To add storage subsystems, start the host-agent software manually either when you start the system or if it is already stopped.

Perform the following steps to start the host agent manually:

1. From the system console, press **Ctrl+Esc**, and then select **System Console**.
2. At the prompt, type:

   ```
   smagent
   ```
3. Press **Enter**.

   The agent will start and display the following message when UTM LUNs are scanned:

   ```
   Activating
   ```
4. Return to ConsoleOne. Press **Ctrl+Esc**, and then click **Xserver → Graphical Console**.

Uninstalling storage-management software components

Use the following procedure to uninstall one or more of the components of Storage Manager 8.4. If you are uninstalling components released with an earlier version of the storage management software, use the procedure that came with the version of the storage management software that you are currently running.

1. From the Xserver Graphical Console, click **Novell → Install**.

   The Installed Products window opens.
2. In the list of currently installed products, select and click **Remove** to uninstall the product/software package.

   The name of the Storage Manager packages are:

   a. Storage Manager 8.4 Agent
   b. Storage Manager 8.4 Utility
   c. Storage Manager 8.4 Client
3. Click **OK** in the Confirm Product Deletion window to proceed with the uninstallation.
4. A Please Wait pop-up window displays while the package uninstalls.
5. The Installed Products window will display again when the uninstallation is complete.

Appendix A. Windows operating system limitations

This appendix contains information about how to operate the storage management software in a Windows NT 4.0, Windows 2000, or Windows Server 2003 environment.

Important: Always check for a readme file on any installation media. This readme file might contain important information that was not available when this document was prepared.

Limitations of Windows operating systems

Table 20 explains limitations that apply when you use the IBM FAStT Storage Manager Version 8.4 with Windows NT 4.0, Windows 2000, and Windows Server 2003.

Table 20. Windows operating system limitations and workarounds

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. Logical drive migration consists of 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.

Table 20. Windows operating system limitations and workarounds (continued)

Limitation	Workaround
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 S08) or the IBM Fibre Channel Switch (machine types 3534 F08 and 2109 F16).	None.
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.	Immediately after you replace the controller, click **Storage subsystem → Redistribute Arrays** in the Subsystem Management window to redistribute arrays back to their preferred controller owners. For more information, refer to the Enterprise Management online help.
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.	Make sure that a single instance of the host-agent software communicates with no more than five clients.
When you connect a FAStT EXP700 Storage Expansion Unit to a FAStT200, you must set the drive speed to 1 Gbps.	None.

Table 20. Windows operating system limitations and workarounds (continued)

Limitation	Workaround

After you install the host-agent software, the host displays the error message `Service Error 100`.	The cause includes:
	• The host-agent software does not find any controllers with firmware version 04.00.02.00 or higher. Upgrade the firmware to the latest firmware level from the IBM support Web site at:
	www.ibm.com/support/
	For more information, see "Direct-management method workaround" on page 131.
	• The access logical drive has been removed from NVSRAM or the storage partition defined for the host. Perform one of the following tasks:
	  – Manage the storage subsystem by using the direct-management method. See "Direct-management method workaround" on page 131.
	  – Define the access logical drive for the host and restart SMagent. See "SMagent workaround for defining additional access LUN mapping" on page 132.
	• 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:
	  – Manage the storage subsystem by using the direct-management method. See "Direct-management method workaround" on page 131.
	  – 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 "SMagent workaround for changing existing access LUN mapping" on page 132.

Auto LUN/Array Transfer is not enabled. If a controller fails over arrays to the alternate controller and the failed controller is replaced and brought back online, the arrays will not automatically transfer to the preferred controller.	Manually select the Redistribute Logical Drives menu option in the IBM FAStT Storage Manager client GUI.
A brownish hash pattern displays in the dialog windows and in online help when operating in 256-color mode.	Run the FAStT Storage Manager 8.4 application in a higher display mode.

Table 20. Windows operating system limitations and workarounds (continued)

Limitation	Workaround
The system might display the FAStT Storage Manager dialog windows as cropped without the vertical and horizontal scroll bars.	Move the mouse pointer over the edge of the window until the mouse pointer changes to a window resize pointer. Left-click your mouse; hold to grip the window's edge and resize the window.

The controller in the IBM FAStT Storage Server with firmware 05.3x.xx.xx is connected to a SAN with more than 64 host connections per controller port that can log into the controllers, exceeding the maximum number of host connections that can be seen and log into the controller.	Either use the switch zoning function or rearrange the SAN connections so that only the following maximum number of host connections can be seen and log into the controller as follows:
	
	• The following FAStT storage subsystems have two ports per controller – one per minihub slot.
	  – FAStT900, Machine Type 1742
	  – FAStT700, Machine Type 1742
	  – FAStT500, Machine Type 3552
	• The FAStT600 (IBM machine type 1722) has two ports per controller.
	• The FAStT200 (IBM machine type 3542) has only one port per controller.

It is possible to circumvent IBM FAStT Storage Server hardware and software designs for redundant pathways from the host system. This is accomplished by connecting a single host adapter from the host system to one of the controller minihubs, and then connecting this minihub to the minihub of the other controller, creating a Fibre Channel-Arbitrated Loop (FC-AL) between the host adapter and the two IBM FAStT Storage Server controllers. This configuration leaves no redundant path to the host system.	When connecting two minihubs together, always connect the IN port of one minihub to the OUT port of the other minihub or vice versa. Do not connect the IN port of one to the IN port of the other minihub or the OUT port of one minihub to the OUT port of the other minihub. Nevertheless, this configuration is not supported by IBM.
If the IBM FAStT Storage Server is connected to a SAN with many other IBM FAStT Storage Servers, there may be ghost LUNs displayed in the Windows NT, Version 4 Disk Administrator.	Use switch zoning to either limit the number of storage servers that the HBAs in the Windows NT Version 4 host server can log into (single or dual HBAs per host server configuration) or create two separate paths from the Windows NT, Version 4 host server to the storage server controllers A and B (dual HBAs per host server configuration.)
When you issue a Subsystem Management command from the IBM FAStT Storage Manager client, the command may be cached. If so, the system will issue the error: `Error 21 – The Operation cannot complete because a... is in progress`. The IBM FAStT Storage Manager client will run such cached commands as soon as the controller resources become available.	Wait for at least ten minutes; then, check to see if the IBM FAStT Storage Manager client has run the command. If it has not, reissue the command.

Limitation	Workaround
You must always uninstall IBM FAStT Storage Manager RDAC before you uninstall the host bus adapter driver. Failure to do so may result in a hung system or blue screen.	None.
When you upgrade the FAStT Storage Subsystem controller firmware from any version 05.00.xx.xx (or earlier) to version 05.2x.xx.xx (or later), the controller returns the first four bytes of the firmware revision to the Product Revision Field of the SCSI LUN inquiry data. Windows 2000 uses this Product Revision data as part of its LUN identification method. In doing so, Windows 2000 incorrectly interpretes your upgrade of the firmware revision level and subsequent Product Revision data change to mean that you have also removed LUNs with the original Product Revision data from the server. When the FAStT Storage Manager hot_add utility later executes the `scan for hardware changes` task, or when you select the **Scan For Hardware Changes** menu option of the Devices folder in the Computer Management window, Windows 2000 displays the `Unsafe Removal of Devices` dialogs for the original LUNs. The devices cited in these dialogs are RDAC Virtual Disks and `xxxx` SCSI devices, where `xxxx` represents either `1722`, `1742`, `3552` or `3542`, depending on the machine type of the FAStT Storage Server from which Windows 2000 had mapped the original LUNs. Under these circumstances, the Windows 2000 server will lose connectivity to the LUNs in the FAStT Storage Subsystem whose controller firmware you updated. This problem will not occur when you upgrade the FAStT Storage Subsystem controller firmware from version 05.20.xx.xx to version 05.3x.xx.xx or later because the Product Revision data field was fixed at `0520`.	After you apply the new FAStT Storage Subsystem controller firmware and NVSRAM, you must perform one of the following procedures reconnect FAStT Storage Servers to their logical drives: • Re-scan the server for hardware changes. • Add the logical drives back to the server. • Reboot all of the Windows 2000 servers that originally had LUNs mapped in the affected FAStT Storage Subsystem.

Direct-management method workaround

Perform the following steps 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 31 to manage the subsystem directly.
3. Open the Storage Manager 8 Enterprise Management window. Click **Edit** → **Add** device.

4. Type 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 SMagent:

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 8.4 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 displays.
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 8.4 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.

Appendix B. NetWare operating system limitations

This appendix contains information about how to operate the storage management software in a NetWare environment.

Important: Always check for a readme file on any installation media. This readme file might contain important information that was not available when this document was prepared.

Table 21 lists the limitations that apply when you use the IBM FAStT Storage Manager Version 8.4 with Novell NetWare.

Table 21. Novell NetWare limitations and workarounds

Limitation	Workaround
If the SMagent is running on the NetWare server and a fiber-optic cable is pulled or a path failure occurs, the NetWare server might end.	Stop the SMagent and manage the FAStT using the direct (out-of-band) method of management. See "Stopping the host-agent software" on page 124 and use the procedure for uninstalling the SMagent software.
Clicking a vertical scroll arrow (either up or down) causes the scroll box to 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 desired position in the Help window.
Logical drive migration (removing a set of drives that are configured with logical drives from one storage subsystem for insertion into another storage subsystem) is not supported because it could cause loss of configuration.	Call for service.
When 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.
The controller firmware does not recognize or communicate with a single controller until slot A is populated. This limitation does not apply to storage subsystems that were originally configured with two controllers.	When you configure a new storage subsystem with a single controller, you must place the controller in slot A.
Public loop configurations (managed hubs that are attached to switches) are not supported.	None.
Multipath failover will work only if the storage controllers are in active/active mode.	When you configure the storage subsystem, change both controllers to active status.
When you remove a fan or power supply field replaceable unit (FRU) from a storage subsystem while the system is running, the storage management software does not report an error message, and the component is not reported as missing. **Note:** Fan and power supply FRU failures are reported.	Replace the missing fan or power supply FRUs immediately to ensure redundancy. Make sure that the fan or power supply FRU is properly seated in the controller unit.
Your windows and online Help displays a brownish hash pattern when you run in 256-color mode.	Run the Storage Manager 8.4 application in a higher display mode.

Table 21. Novell NetWare limitations and workarounds (continued)

Limitation	Workaround
When performing a redundancy check (parity scan) from the storage management application, machine type 3542 can take several minutes longer than machine type 3526 and 3552 controller platforms.	None.
When attempting to manage a storage subsystem where the RAID controller unit does not have access to logical drives, Storage Manager prompts you for a password. This occurs even if no password has been set up. The automatic discovery locates and identifies each storage subsystem as two separate storage subsystems.	Ensure that at least one IBM FAStT EXP700 Storage Expansion Unit with at least one logical drive is properly attached to the IBM FAStT700 RAID controller unit in each storage subsystem being managed. The RAID controller unit should not be powered on until the expansion units are attached and powered on. Power off the RAID controller unit, properly attach all expansion units with the drives installed to the RAID controller unit, and power them on; then, power on the RAID controller unit. At this point, the storage subsystems can be rediscovered and managed by using the FAStT Storage Manager software.
You might not see the maximum number of drives during Automatic Configuration if you are using drives of different capacities.	Use Manual Configuration to select individual drives and select the maximum number of drives allowed.
When you connect an IBM TotalStorage FAStT EXP700 Storage Expansion Unit to a FAStT200, the drive speed must be set to 1 Gbps.	None.
When you issue a Subsystem Management command from the IBM FAStT Storage Manager client, the command may be cached. If so, the system issues the error: `Error 21 - The Operation cannot complete because a... is in progress.` The IBM FAStT Storage Manager client will run such cached commands as soon as the controller resources become available.	Wait for at least ten minutes; then, check to see if the IBM FAStT Storage Manager client has run the command. If it has not, reissue the command.

Appendix C. Linux operating system limitations

This appendix contains information that is specific to operating the storage management software in a Linux environment.

Important: Always check for a readme file on any installation media. This readme file contains information that was not available when this document was prepared.

Table 22 lists the limitations that apply when you use the IBM FAStT Storage Manager Version 8.4 with Linux.

Table 22. Linux limitations and workarounds

Limitations	Workaround
Vixel Rapport 2000 fibre-channel hubs using controllers with firmware version 04.01.02 cause problems, including damage to data, system instability, and disrupted loop activity.	Do not use Vixel Rapport 2000 fibre-channel hubs when your system is operating in a controller or an I/O path fault-tolerant environment.
The maximum number of physical drives allowed in a single RAID 5 logical drive is 29. The maximum number of physical drives allowed in a single RAID 1 logical drive is 28.	None.
After removing all drives from a storage subsystem, you are prompted for a password at software startup or when you perform protected operations, all passwords you enter fail.	Add one of the drives to the storage subsystem and attempt the operation again.
Removing a set of drives that are configured with logical drives from one storage subsystem for insertion into another storage subsystem is not supported because it might cause loss of configuration.	Contact an IBM technical support representative for assistance.
A standard non-network configuration is not supported when the Linux host does not have the TCP/IP software installed.	Install the TCP/IP software on the Linux host computer and assign the host a static IP address.
Multipath failover will work only if the storage controllers are in active/active mode.	When you configure the storage subsystem, change both controllers to active status.
The controller firmware does not 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.	When you configure a new storage subsystem with a single controller, you must place the controller in slot A.
Your windows and online help display a brownish hash pattern when you run in 256-color mode.	Run the Storage Manager 8.4 application in a higher display mode.
When you perform a redundancy check (parity scan) from the storage management application, machine type 3542 can take several minutes longer than machine type 1742 and 3552 controller platforms.	None.
You might not see the maximum number of drives during Automatic Configuration if you are using drives of different capacities.	Use Manual Configuration to select individual drives and select the maximum number of drives allowed.

Table 22. Linux limitations and workarounds (continued)

Limitations	Workaround
When you connect an IBM TotalStorage FAStT EXP700 Storage Expansion Unit to a FAStT200, the drive speed must be set to 1 Gbps.	None.
When you issue a Subsystem Management command from the IBM FAStT Storage Manager client, the command may be cached. If so, the system will issue the error: `Error 21 - The Operation cannot complete because a...` is in progress. The IBM FAStT Storage Manager client will run such cached commands as soon as the controller resources become available.	Wait for at least ten minutes; then, check to see if the IBM FAStT Storage Manager client has run the command. If it has not, re-issue the command.

Appendix D. VMware ESX Server operating system limitations

This appendix contains information about how to operate the storage management software in a VMware ESX Server environment.

Important: Always check for a readme file on any installation media. This readme file might contain important information that was not available when this document was prepared.

Table 23 lists the limitations that apply when you use IBM FAStT Storage Manager Version 8.4 with VMware ESX Server.

Table 23. VMware ESX Server limitations and workarounds

Limitations	Workaround
VMware ESX 2.0 clustering function is not supported. Clustering between guest operating systems is not supported.	None. For information about possible support in future releases, contact your IBM service representative or submit an RPQ.
The maximum number of guest operating systems that are supported on each VMware ESX 2.0 server is 16.	None. For information about possible support in future releases, contact your IBM service representative or submit an RPQ.
New logical volumes cannot be successfully created and assigned to a guest operating system.	Although a guest operating system can scan for new disk volumes dynamically, the guest operating system must be powered off before new logical volumes can be created within VMware ESX Server and assigned to that guest.
When you issue a Subsystem Management command from the IBM FAStT Storage Manager client, the command may be cached. If so, the system will issue the error: `Error 21 - The Operation cannot complete because a... is in progress`. The IBM FAStT Storage Manager client will run such cached commands as soon as the controller resources become available.	Wait for at least ten minutes; then, check to see if the IBM FAStT Storage Manager client has run the command. If it has not, reissue the command.

Appendix E. Storage subsystem and controller information record

Table 24 provides a data sheet for recording storage subsystem names, management types, Ethernet hardware addresses, and IP addresses. Make a copy of this table and complete the information for your storage subsystems and controllers. Use the information to set up the BOOTP table for the network server and the host or Domain Name System (DNS) table. The information is also helpful if you add storage subsystems after initial installation. The column headings show a page reference for detailed instructions about how to obtain the information. For a sample information record, refer to Table 14 on page 35.

Table 24. Storage subsystem and controller information record

Storage subsystem name (page 34)	Management method (page 8)	Controllers-Ethernet and IP addresses, and host name (pages 34 and 37)		Host-IP address and host name (page 37)

Appendix F. Additional FAStT documentation

The following tables present an overview of the FAStT900, FAStT700, and FAStT600 Fibre Channel Storage Server product libraries, as well as other related documents. Each table lists documents that are included in the libraries and what common tasks they address. Click on active links in the tables to access those documents currently available on the Internet. You can access documentation for the other FAStT products at the following Web site:

ssddom02.storage.ibm.com/techsup/webnav.nsf/support/fastt/

FAStT900 Fibre Channel Storage Server library

Table 25 associates each document in the FAStT900 Fibre Channel Storage Server library with its related common user tasks.

Table 25. TotalStorage FAStT900 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 FAStT900 Installation and Support Guide, GC26-7530	✔	✔		✔		
IBM TotalStorage FAStT900 Fibre Channel Cabling Instructions, 24P8135	✔	✔				
IBM TotalStorage FAStT900 Storage Server User's Guide, GC26-7534				✔	✔	✔
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✔			✔	
IBM FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✔			✔	
IBM TotalStorage FAStT900 Rack Mounting Instructions, 19K0900	✔	✔				

Table 25. TotalStorage FAStT900 Fibre Channel Storage Server document titles by user tasks (continued)

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✔	✔			✔	✔
IBM FAStT Management Suite Java User's Guide, 32P0081					✔	✔
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						✔

FAStT700 Fibre Channel Storage Server library

Table 26 associates each document in the FAStT700 Fibre Channel Storage Server library with its related common user tasks.

Table 26. TotalStorage FAStT700 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 FAStT700 Installation and Support Guide, 32P0171	✔	✔		✔		
IBM FAStT700 Fibre Channel Cabling Instructions, 32P0343	✔	✔				
IBM FAStT700 Fibre Channel Storage Server User's Guide, 32P0341				✔	✔	✔
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						✔

FAStT600 Fibre Channel Storage Server library

Table 27 associates each document in the FAStT600 Fibre Channel Storage Server library with its related common user tasks.

Table 27. TotalStorage FAStT600 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 FAStT600 Fibre Channel Storage Server Installation and User's Guide, GC26-7531	✔	✔		✔		
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						✔
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✔			✔	
IBM TotalStorage FAStT600 Rack Mounting Instructions, 24P8125	✔	✔				
IBM TotalStorage FAStT600 Cabling Instructions, 24P8126	✔	✔				

FAStT-related documents

Table 28 associates each of the following documents related to FAStT operations with its related common user tasks.

Table 28. 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 TotalStorage FAStT EXP100 Storage Expansion Unit Release Notes, GC26–7619	✔	✔				
IBM TotalStorage FAStT EXP100 Storage Expansion Unit Installation and Users Guide, GC26–7601	✔	✔		✔	✔	✔
Fibre Channel Solutions - IBM FAStT EXP500 Installation and User's Guide, 59p5637	✔	✔		✔	✔	✔
IBM EXP700 Storage Expansion Unit Installation and User's Guide, 32P0178	✔	✔		✔	✔	✔
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✔				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✔		✔	✔	✔	

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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.

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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

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 peripheral component interconnect (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 input/output (I/O) between the internal bus of the host system and the external fibre-channel (FC) 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 a Simple Network Management Protocol-Transmission Control Protocol/Internet Protocol (SNMP-TCP/IP) network-managing environment.

AGP. See *accelerated graphics port*.

AL_PA. See *arbitrated loop physical address*.

arbitrated loop. One of three existing fibre-channel topologies, in which 2 - 126 ports are interconnected serially in a single loop circuit. Access to the Fibre Channel-Arbitrated Loop (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 a Stealth Mode.

arbitrated loop physical address (AL_PA). An 8-bit value that is used to uniquely identify an individual port within a loop. A loop can have one or more AL_PAs.

array. A set of fibre-channel hard drives that are logically grouped together to form a redundant array of independent disks (RAID) set.

AT. See *advanced technology (AT) bus architecture*.

ATA. See *AT-attached*.

AT-attached. Peripheral devices that are compatible with the original IBM AT computer standard in which signals on a 40-pin AT-attached (ATA) ribbon cable followed the timings and constraints of the Industry Standard Architecture (ISA) system bus on the IBM PC AT computer. Equivalent to integrated drive electronics (IDE).

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).   The personal computer 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).   In Transmission Control Protocol/Internet Protocol (TCP/IP) networking, an alternative protocol by which a diskless machine can obtain its Internet Protocol (IP) address and such configuration information as IP addresses of various servers from a BOOTP server.

bridge.   A storage area network (SAN) device that provides physical and transport conversion, such as fibre channel to small computer system interface (SCSI) bridge.

bridge group.   A bridge and the collection of devices connected to it.

broadcast.   The simultaneous transmission of data to more than one destination.

cathode ray tube (CRT).   A display device in which controlled electron beams are used to display alphanumeric or graphical data on an electroluminescent screen.

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.

command.   A statement used to initiate an action or start a service. A command consists of the command name abbreviation, and its parameters and flags if applicable. A command can be issued by typing it on a command line or selecting it from a menu.

community string.   The name of a community contained in each Simple Network Management Protocol (SNMP) message.

CRC.   See *cyclic redundancy check*.

CRT.   See *cathode ray tube*.

CRU.   See *customer replaceable unit*.

customer replaceable unit (CRU).   An assembly or part that a customer can replace in its entirety when any of its components fail. Contrast with *field replaceable unit (FRU)*.

cyclic redundancy check (CRC).   (1) A redundancy check in which the check key is generated by a cyclic algorithm. (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*.

default host group.   A logical collection of discovered host ports, defined host computers, and defined host groups in the storage-partition topology that fulfill the following requirements:

- Are not involved in specific logical drive-to-LUN mappings
- Share access to logical drives with default logical drive-to-LUN mappings

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

DHCP.   See *Dynamic Host Configuration Protocol*.

direct access storage device (DASD).   A device in which access time is effectively independent of the location of the data. Information is entered and retrieved without reference to previously accessed data. (For example, a disk drive is a DASD, in contrast with a tape drive, which stores data as a linear sequence.) DASDs include both fixed and removable storage devices.

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 router*.

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 node port (N_port) identifier for the fibre-channel (FC) device. It is not used in the fibre channel-small computer system interface (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 Internet Protocol (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.

ECC.   See *error correction coding*.

EEPROM.   See *electrically erasable programmable read-only memory*.

EISA. See *Extended Industry Standard Architecture*.

electrically erasable programmable read-only memory (EEPROM). A type of memory chip which can retain its contents without consistent electrical power. Unlike the PROM which can be programmed only once, the EEPROM can be erased electrically. Because it can only be reprogrammed a limited number of times before it wears out, 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.

environmental services monitor (ESM) canister. A component in a drive enclosure that monitors the environmental condition of the components in that enclosure. Not all storage subsystems have ESM canisters.

E_port. See *expansion port*.

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

ESD. See *electrostatic discharge*.

ESM canister. See *environmental services monitor canister*.

EXP. See *expansion unit*.

expansion port (E_port). A port that connects the switches for two fabrics.

expansion unit (EXP). A feature that can be connected to a system unit to provide additional storage and processing capacity.

Extended Industry Standard Architecture (EISA). A bus standard for IBM compatibles that extends the Industry Standard Architecture (ISA) bus architecture to 32 bits and allows more than one central processing unit (CPU) to share the bus. See also *Industry Standard Architecture*.

fabric. A Fibre Channel entity which interconnects and facilitates logins of N_ports attached to it. The fabric is responsible for routing frames between source and destination N_ports using address information in the frame header. A fabric can be as simple as a point-to-point channel between two N-ports, or as complex as a frame-routing switch that provides multiple and redundant internal pathways within the fabric between F_ports.

fabric port (F_port). In a fabric, an access point for connecting a user's N_port. An F_port facilitates N_port

logins to the fabric from nodes connected to the fabric. An F_port is addressable by the N_port connected to it. See also *fabric*.

FAStT MSJ. See *FAStT Management Suite Java*.

FAStT Management Suite Java (FAStT MSJ). A diagnostic and configuration utility that can be used on Linux, Microsoft Windows, and Novell NetWare host systems. In Linux, it is also used with the QLRemote agent to define preferred and non-preferred paths for logical drives.

FC. See *fibre channel*.

FC-AL. See *arbitrated loop*.

feature enable identifier. A unique identifier for the storage subsystem, which is used in the process of generating a premium feature key. See also *premium feature key*.

fibre channel (FC). A set of standards for a serial input/output (I/O) bus capable of transferring data between two ports at up to 100 Mbps, with standards proposals to go to higher speeds. FC supports point-to-point, arbitrated loop, and switched topologies.

Fibre Channel-Arbitrated Loop (FC-AL). See *arbitrated loop*.

Fibre Channel Protocol (FCP) for small computer system interface (SCSI). A high-level fibre-channel mapping layer (FC-4) that uses lower-level fibre-channel (FC-PH) services to transmit SCSI commands, 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 field replaceable unit might contain other field replaceable units. Contrast with *customer replaceable unit (CRU)*.

FlashCopy. A premium feature for FAStT that can make an instantaneous copy of the data in a volume.

F_port. See *fabric port*.

FRU. See *field replaceable unit*.

GBIC. See *gigabit interface converter*

gigabit interface converter (GBIC). A transceiver that performs serial, optical-to-electrical, and electrical-to-optical signal conversions for high-speed networking. A GBIC can be hot swapped. See also *small form-factor pluggable*.

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 input/output (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. An entity in the storage partition topology that defines a logical collection of host computers that require shared access to one or more logical drives.

host port. Ports that physically reside on the host adapters and are automatically discovered by the FAStT Storage Manager software. To give a host computer access to a partition, its associated host ports must be defined.

hot swap. To replace a hardware component without turning off the system.

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.

IBMSAN driver. The device driver that is used in a Novell NetWare environment to provide multipath input/output (I/O) support to the storage controller.

IC. See *integrated circuit*.

IDE. See *integrated drive electronics*.

in-band. Transmission of management protocol over the fibre-channel transport.

Industry Standard Architecture (ISA). Unofficial name for the bus architecture of the IBM PC/XT personal computer. This bus design included expansion slots for plugging in various adapter boards. Early versions had an 8-bit data path, later expanded to 16 bits. The ″Extended Industry Standard Architecture″ (EISA) further expanded the data path to 32 bits. See also *Extended Industry Standard Architecture*.

initial program load (IPL). The initialization procedure that causes an operating system to commence operation. Also referred to as a system restart, system startup, and boot.

integrated circuit (IC). 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. Also known as a *chip*.

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

Internet Protocol (IP). A protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network.

Internet Protocol (IP) 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.

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

IP. See *Internet Protocol*.

IPL. See *initial program load*.

IRQ. See *interrupt request*.

ISA. See *Industry Standard Architecture*.

isolated group. A collection of isolated devices not connected to the storage area network (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 address*.

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

logical block address (LBA). The address of a logical block. Logical block addresses are typically used in hosts' I/O commands. The SCSI disk command protocol, for example, uses logical block addresses.

logical unit number (LUN). An identifier used on a small computer system 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 storage area network (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. A node port (N_port) or fabric port (F_port) that supports arbitrated loop functions associated with an arbitrated loop topology.

LUN. See *logical unit number*.

MAC. See *medium access control*.

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

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.

MCA. See *micro channel architecture*.

medium access control (MAC). In local area networks (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.

MIB. See *management information base*.

micro channel architecture (MCA). Hardware that is used for PS/2 Model 50 computers and above to provide better growth potential and performance characteristics when compared with the original personal computer design.

Microsoft Cluster Server (MSCS). MSCS, a feature of Windows NT Server (Enterprise Edition), supports the connection of two servers into a cluster for higher availability and easier manageability. MSCS can automatically detect and recover from server or application failures. It can also be used to balance server workload and provide for planned maintenance.

model. The model identification that is assigned to a device by its manufacturer.

MSCS. See *Microsoft Cluster Server*.

network management station (NMS). In the Simple Network Management Protocol (SNMP), a station that runs 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.

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

node port (N_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.

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

N_port. See *node port*.

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*.

performance events. Events related to thresholds set on storage area network (SAN) performance.

peripheral component interconnect local bus (PCI local bus). A local bus for PCs, from Intel, that provides a high-speed data path between the CPU and up to 10 peripherals (video, disk, network, and so on). The PCI bus coexists in the PC with the Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA) bus. ISA and EISA boards plug into an IA or EISA slot, while high-speed PCI controllers plug into a PCI slot. See also *Industry Standard Architecture*, *Extended Industry Standard Architecture*.

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

port. A part of the system unit or remote controller to which cables for external devices (such as display stations, terminals, printers, switches, or external storage units) are attached. The port is an access point for data entry or exit. 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.

premium feature key. A file that the storage subsystem controller uses to enable an authorized premium feature. The file contains the feature enable identifier of the storage subsystem for which the premium feature is authorized, and data about the premium feature. See also *feature enable identifier*.

private loop. A freestanding arbitrated loop with no fabric attachment. See also *arbitrated loop*.

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*.

RAID. See *redundant array of independent disks*.

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. Contrast with *DASD*.

RDAC. See *redundant disk array controller*.

read-only memory (ROM). Memory in which stored data cannot be changed by the user 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.

redundant array of independent disks (RAID). A collection of disk drives that appears as a single volume to the server and are fault tolerant through mirroring or parity checking.

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.

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.*

SAI. See *Storage Array Identifier*.

SA Identifier. See *Storage Array Identifier*.

SAN. See *storage area network*.

SATA. See *serial ATA*.

scope. Defines a group of controllers by their Internet Protocol (IP) addresses. A scope must be created and defined so that dynamic IP addresses can be assigned to controllers on the network.

SCSI. See *small computer system interface*.

segmented loop port (SL_port). A port that allows division of 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.

sense data. (1) Data sent with a negative response, indicating the reason for the response. (2) Data describing an I/O error. Sense data is presented to a host system in response to a sense request command.

serial ATA. The standard for a high-speed alternative to small computer system interface (SCSI) hard drives. The SATA-1 standard is equivalent in performance to a 10 000 RPM SCSI drive.

serial storage architecture (SSA). An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with small computer system interface (SCSI) devices, allows full-duplex packet multiplexed serial data transfers at rates of 20 Mbps 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.

SFP. See *small form-factor pluggable*.

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 port*.

SMagent. The FAStT Storage Manager optional Java-based host-agent software, which can be used on Microsoft Windows, Novell NetWare, HP-UX, and Solaris host systems to manage storage subsystems through the host fibre-channel connection.

SMclient. The FAStT Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and expansion units in a FAStT storage subsystem. SMclient can be used on a host system or on a storage management station.

SMruntime. A Java compiler for the SMclient.

SMutil. The FAStT Storage Manager utility software that is used on Microsoft Windows, HP-UX, and Solaris host systems to register and map new logical drives to the operating system. In Microsoft Windows, it also contains a utility to flush the cached data of the operating system for a particular drive before creating a FlashCopy.

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

small form-factor pluggable (SFP). An optical transceiver that is used to convert signals between optical fiber cables and switches. An SFP is smaller than a gigabit interface converter (GBIC). See also *gigabit interface converter*.

SNMP. See *Simple Network Management Protocol* and *SNMPv1*.

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 event. (1) (2) An event notification sent by the SNMP agent that identifies conditions, such as thresholds, that exceed a predetermined value. See also *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*.

SRAM. See *static random access memory*.

SSA. See *serial storage architecture*.

static random access memory (SRAM). Random access memory based on the logic circuit know 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 turned off.

storage area network (SAN). A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services. See also *fabric*.

Storage Array Identifier (SAI or SA Identifier). The Storage Array Identifier is the identification value used by the FAStT Storage Manager host software (SMClient) to uniquely identify each managed storage server. The FAStT Storage Manager SMClient program maintains Storage Array Identifier records of previously-discovered storage servers in the host resident file, which allows it to retain discovery information in a persistent fashion.

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 input/output (I/O) path.

storage partition. Storage subsystem logical drives that are visible to a host computer or are shared among host computers that are part of a host group.

storage partition topology. In the FAStT Storage Manager client, the Topology view of the Mappings window displays the default host group, the defined host group, the host computer, and host-port nodes. The host port, host computer, and host group topological elements must be defined to grant access to host computers and host groups using logical drive-to-LUN mappings.

subnet. An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

sweep method. A method of sending Simple Network Management Protocol (SNMP) requests for information to all the devices on a subnet by sending the request to every device in the network.

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.

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_port. See *translated loop port*.

transceiver. A device that is used to transmit and receive data. Transceiver is an abbreviation of transmitter-receiver.

translated loop port (TL_port). A port that 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 Simple Network Management Protocol (SNMP) trap.

Specifically, a trap receiver is defined by an Internet Protocol (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*.

uninterruptible power supply. A source of power from a battery that is installed between a computer system and its power source. The uninterruptible power supply keeps the system running if a commercial power failure occurs, until an orderly shutdown of the system can be performed.

user action events. Actions that the user takes, such as changes in the storage area network (SAN), changed settings, and so on.

vendor. Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered, but will always remain editable.

worldwide name (WWN). A unique identifier for a switch on local and global networks.

WORM. See *write-once read-many*.

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.

WWN. See *worldwide name*.

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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