

IBM TotalStorage FAStT Storage Manager  
Version 8.3



# Installation and Support Guide for Linux



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Version 8.3



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**Note**

Before using this information and the product it supports, read the general information in "Notices" on page 55.

**Second Edition (April 2003)**

This edition applies to the IBM TotalStorage FASTT Storage Manager Version 8.3 for Linux and replaces GC26-7519-00.

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## About this document

This document provides information about how to set up, install, configure, and work with IBM TotalStorage™ Fibre Array Storage Technology (FAStT) Storage Manager Version 8.3. The following operating system environments are supported:

- Red Hat Advanced Server 2.1
- SuSE Linux Enterprise Server 8 (powered by United Linux 1.0)

Use this document to:

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

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

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## Who should read this document

This *Installation and Support Guide* is for system administrators and storage administrators who are responsible for installing software. Readers should have knowledge of RAID, SCSI, and fibre-channel technology, and should also have working knowledge of the applicable operating systems that are used with the management software.

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## How this document is organized

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

Chapter 2, “Planning and preparing for installation”, on page 17 explains how you plan and prepare for a network installation, including how to set up a Dynamic Host Configuration Protocol/Boot Protocol (DHCP/BOOTP) server, UNIX® Boot Protocol (BOOTP) server, or a Novell NetWare server.

Chapter 3, “Installing the storage management software”, on page 35 provides procedures to install the software in a standard (noncluster) environment.

Chapter 4, “Completing the installation”, on page 41 explains how you start the Enterprise Management window, download firmware, apply NVSRAM, add devices, and perform subsystem management tasks.

Appendix A, “Linux operating system limitations”, on page 51 explains Linux operating system limitations.

Appendix B, “Storage Subsystem and Controller information record”, on page 53 provides a data sheet template that you can use to create a controller information record.

## FASTt installation process overview

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

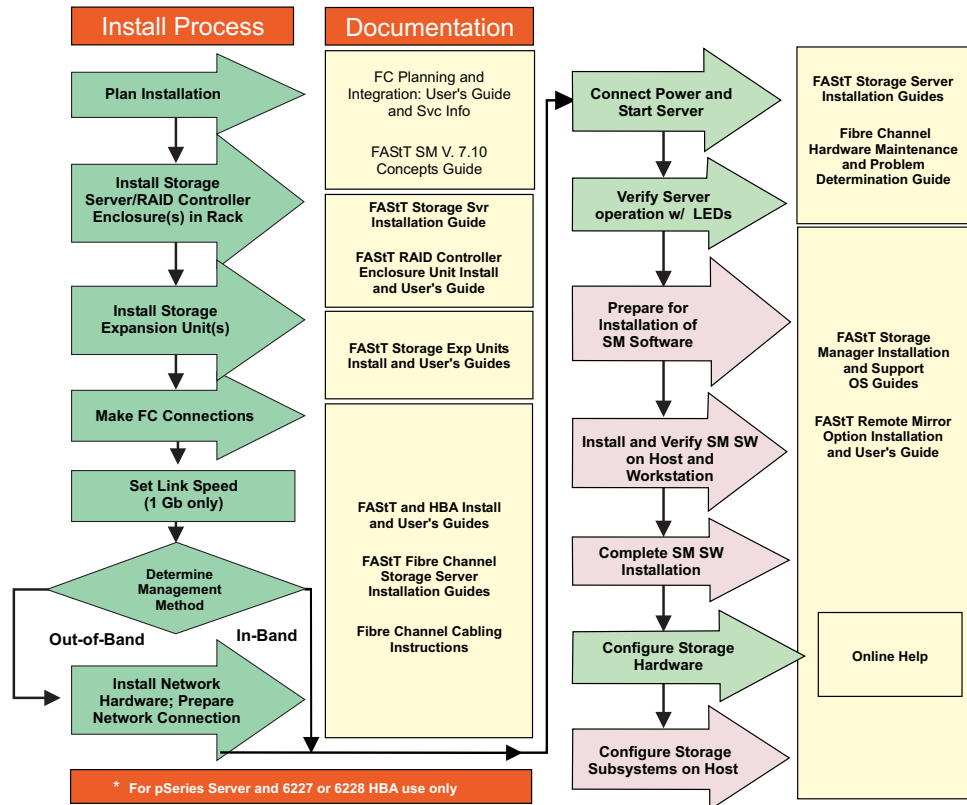


Figure 1. Installation process flow by current publications

## FASTt documentation

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

## FAST Storage Manager Version 8.3 library

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

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

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

## FAST900 Fibre Channel Storage Server library

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

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

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



## FAST700 Fibre Channel Storage Server library

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

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

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

## FAStT600 Fibre Channel Storage Server library

Table 4 associates each document in the FAStT600 Fibre Channel Storage Server library with its related common user tasks.

Table 4. 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	✓	✓				

## FAST500 Fibre Channel Storage Server library

Table 5 associates each document in the FAST500 Fibre Channel Storage Server library with its related common user tasks.

Table 5. TotalStorage FAST500 and FAST High Availability Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM FAST500 RAID Controller Enclosure Unit User's Guide, 48P9847				✓	✓	✓
IBM FAST EXP500 Storage Expansion Unit Installation and User's Guide, 59P5637	✓	✓		✓	✓	✓
IBM FAST500 RAID Controller Enclosure Unit Installation Guide, 59P6244		✓			✓	
IBM FAST FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAST FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FAST Management Suite Java User's Guide, 32P0081					✓	✓
IBM Fibre Channel Hardware Maintenance Manual, 19K6130						✓
IBM Fibre Channel Problem Determination Guide, 48P9804						✓

## FAST200 Fibre Channel Storage Server library

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

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

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

## FASTt related documents

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

Table 7. TotalStorage FASTt related document titles by user tasks

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

## Notices used in this document

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

- **Note:** 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 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 about IBM and IBM products, what to do if you experience a problem with your IBM @server system, and whom to call for service, if it is necessary.

## Before you call

Before you call, make sure that you have taken 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.
- Check for technical information, hints, tips, and new device drivers at the IBM Support Web site:  
[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)
- 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 documents 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 IBM `@server` 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 system and preinstalled software, if any, is available in the documents that come with your system. This includes printed books, 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.

## Web sites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates.

- For FASTT information, go to the Web site at:

[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)

The support page has many sources of information and ways for you to solve problems, including:

- Diagnosing problems, using the IBM Online Assistant
  - Downloading the latest device drivers and updates for your products
  - Viewing frequently asked questions (FAQ)
  - Viewing hints and tips to help you solve problems
  - Participating in IBM discussion forums
  - Setting up e-mail notification of technical updates about your products
- For the latest information about operating system and HBA support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage FASTT Interoperability Matrix at the following Web site:

[www.storage.ibm.com/disk/fastt/pdf/0217-03.pdf](http://www.storage.ibm.com/disk/fastt/pdf/0217-03.pdf)

- You can order publications through the IBM Publications Ordering System at:  
[www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi](http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi)
- For the latest information about IBM products, services, and support go to the Web site at:  
[www.ibm.com/eserver/](http://www.ibm.com/eserver/)

## Software service and support

Through 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 following Web site :

[www.ibm.com/services/sl/products](http://www.ibm.com/services/sl/products)

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

- [www.ibm.com/services](http://www.ibm.com/services)
- [www.ibm.com/planetwide](http://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 number, go to the following Web site:

[www.ibm.com/planetwide](http://www.ibm.com/planetwide)

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

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## How to send your comments

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

- E-mail

Submit your comments electronically to:

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

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

- Mail or fax

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

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## Chapter 1. Introduction

This installation and support guide provides information about how to prepare, install, configure, and start the IBM TotalStorage FAStT Storage Manager Version 8.3 program. The following operating systems are supported:

- Red Hat Advanced Server 2.1
- SuSE Linux Enterprise Server 8 (powered by United Linux 1.0)

Before you begin to install this product, first consult the readme.txt file. The readme file is located in the root directory of the installation CD. For the latest installation and user information about the storage-management software and hardware components, go to the following Web site:

[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)

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 Storage Manager 8.3 Client. From either an Enterprise Management or Subsystem Management window, click **Help** or press F1.

After installing IBM FAStT Storage Manager Version 8.3, consider installing the FAStT Management Suite Java™ (MSJ) and SANavigator diagnostic programs. You can use these programs to verify the status of the fibre-channel connections before using the storage subsystem. The SANavigator program, the *IBM FAStT MSJ User's Guide* and FAStT MSJ program are located on the IBM FAStT Storage Manager Version 8.3 CD. For information about how to install and run SANavigator, see the *FAStT Hardware Maintenance Manual and Problem Determination Guide*.

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## Features

The IBM FAStT Storage Manager Version 8.3 software has standard and premium features. Each category of features is described in this section.

### Standard features

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

FAStT Storage Manager Version 8.3 software has these new features:

- Support for the IBM TotalStorage FAStT900 Fibre Channel Storage Server.
- Support for the IBM TotalStorage FAStT600 Fibre Channel Storage Server.

- Support for online Environmental Services Monitor (ESM) card firmware download. ESM cards are components in the FAStT expansion units. ESM firmware can be updated while the storage subsystem receives input/output (I/O) from the servers.
- Support for offline fibre-channel hard drive firmware and mode page download. I/O from the servers must be suspended during hard disk drive and mode page downloads.
- Support for Media Scan without parity repairs.
- Forcibly disable fibre-channel drive-level write caching.
- Support for the controller state dump function for diagnostics.

The storage management software includes the following standard features:

#### **EXP700 support**

Support for the IBM TotalStorage FAStT EXP700 Storage Expansion Unit.

#### **Dynamic logical-drive expansion**

This feature enables you to increase the capacity of an existing logical drive. You can use the free capacity of a logical drive on an existing array, or add unconfigured capacity (new or unassigned drives) to that array. You can expand a logical drive dynamically without losing access to it, or to any other logical drives.

#### **2048 logical drive support**

This feature enables you to increase the number of defined logical drives up to 2048 for each storage subsystem. The maximum number of logical drives is dependent upon your controller model. For more information see “Number of supported logical drives” on page 14.

#### **Storage partitioning**

This feature gives you support for up to 64 storage partitions. Specifically, there is support for up to two host ports in each host and up to eight ports in each host group (supporting a four-way host group of dual-adapter hosts).

#### **Script engine and command-line interface (CLI) language**

##### **FAStT600**

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

This feature expands support offered in the previous version to include:

- Creating and deleting a FlashCopy™ logical drive.
- Setting FlashCopy logical drive attributes.
- Supporting dynamic logical drive expansion for standard or repository logical drives.
- Disabling or recreating a FlashCopy.
- Creating or deleting logical drive-to-LUN mappings.
- Uploading Read Link Status data from a storage subsystem to a comma delimited file on a management station.
- Downloading a feature key file to a storage subsystem to enable a premium feature.

### **Read link status (RLS) diagnostic**

This feature enhances controller diagnostics, enabling you to isolate the source of link problems on a fibre-channel loop. During communication between devices, RLS error counts are detected within the traffic flow of the loop. Error count information is accumulated for every component and device on the loop. The baseline is automatically set by the controller; however, a new baseline is set manually through the Read Link Status Diagnostics window.

### **Redesigned user interface**

This feature supports a more integrated process of creating logical drives and then mapping them to hosts or host groups and logical unit numbers to create storage partitions. The previous Storage Partitions window is now a Mappings View that you can switch to from the Logical/Physical view.

In the Subsystem Management window, the Mappings view displays storage partition topology such as the default and defined host groups, hosts, host ports in a tree, and FlashCopy logical drives.

### **Controller default IP address**

Unless a static IP address is assigned to the controller by the administrator, controllers A and B are automatically assigned the following IP addresses:

- Controller A (192.168.128.101)
- Controller B (192.168.128.102)

The subnet mask for the default IP address is 255.255.255.0.

## **Premium features**

### **FAST600**

The FlashCopy and Remote Mirror option features are not supported on the FAST600 Fibre Channel Storage Server.

There are two premium features that can be enabled by purchasing a premium feature key. Descriptions of these premium features are as follows:

### **FlashCopy**

This feature allows you to create and manage FlashCopy logical drives. A FlashCopy logical drive is a logical point-in-time image of another logical drive, called a base logical drive, 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 FlashCopy logical drives that are allowed is one half of the total logical drives supported by your controller model.

### **Remote Mirror option**

This feature 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 I/O operations. When you enable the Remote

Mirror option, the maximum number of logical drives per storage subsystem is reduced. For more information, see “Number of supported logical drives” on page 14.

## FAST600 restrictions

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

- FlashCopy
- Remote Mirror option

## Supported machine types

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

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

Product name	Machine type	Model	Product release and firmware version	Supported storage-management software version
IBM FAST200 Storage Server	3542	1RX 1RU	4.x, 5.20.xx.xx 5.3x.xx.xx	7.10, 8.0, 8.2, 8.21, 8.3
IBM FAST200 High Availability Storage Server	3542	2RX 2RU	4.x, 5.20.xx.xx 5.3x.xx.xx	7.10, 8.0, 8.2, 8.21, 8.3
IBM FAST500 RAID Controller Enclosure Unit	3552	1RX 1RU	4.x, 5.00.xx.xx 5.20.xx.xx 5.21.xx.xx 5.3x.xx.xx	7.10, 8.0, 8.2, 8.21, 8.3
IBM TotalStorage FAST600 Fibre Channel Storage Server	1722	60X 60U	5.33.xx.xx	8.3
IBM TotalStorage FAST700 Fibre Channel Storage Server	1742	1RX 1RU	5.00.xx.xx 5.20.xx.xx 5.21.xx.xx 5.3x.xx.xx	8.0, 8.2, 8.21, 8.3
IBM TotalStorage FAST900 Fibre Channel Storage Server	1742	90X 90U	5.21.xx.xx 5.3x.xx.xx	8.3

**Note:** Storage subsystem firmware must be at version 04.01.02.30 or later to be managed with Storage Manager 8.3.

## Terms to know

If you are upgrading from a previous version of the IBM FAST Storage Manager software, you might find that some of the terms you are familiar with have changed. It is important that you familiarize yourself with the new terminology. Table 9 provides some of the old and new terms.

*Table 9. New terminology*

Term used in previous versions	New term
RAID module	Storage subsystem
Drive group	Array

Table 9. New terminology (continued)

Term used in previous versions	New term
Volume	Logical drive

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

#### **Management station**

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

- Through a Transmission Control Protocol/Internet Protocol (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 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 do the following:

- 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. All Linux operating systems are referred to in this book as Linux unless otherwise noted for installation procedures that might be operating system specific.
2. The terms *host* and *host computer* are used interchangeably throughout this document.
3. A host computer can also function as a management station.

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

Storage Manager Version 8.3 contains the following software components for Linux environments:

- Storage Manager 8.3 Client (SMclient)
- Storage Manager 8.3 Runtime (SMruntime)
- Storage Manager 8.3 Utility software (SMutil)
- IBM FAStT Management Suite Java (FAStT MSJ)
- IBM Host Adapter device drivers (qla2200.o and qla2300.o)

### **Storage Manager Version 8.3 Client**

The Storage Manager Version 8.3 Client (SMclient) provides the graphical user interface (GUI) for managing storage subsystems through the Ethernet network or from the host. 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.

## Storage Manager 8.3 Runtime

The Storage Manager 8.3 Runtime (SMRuntime) contains the software Java Runtime for the SMclient and SMutil packages.

## Storage Manager 8.3 Utility

The Storage Manager 8.3 Utility (SMutil) registers and maps new logical drives to the operating system. You can use the SMdevices utility to associate storage subsystem logical drives with operating system device names.

## IBM FAStT Management Suite Java

The IBM FAStT Management Suite Java (FAStT MSJ) is part of the IBM TotalStorage FAStT Storage Manager software package. It provides multipath I/O device drivers for Linux. Based on a driver that resides on top of the hardware driver, FAStT MSJ can be configured with a preferred and an alternate path for every logical drive. 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. The FAStT MSJ agent (qlremote) is installed on the Linux system, which then can be configured from a management station running FAStT MSJ.

See *IBM FAStT MSJ User's Guide* for the diagnostics installation procedure for Linux.

## IBM FAStT Host Adapter device driver

The IBM FAStT Host Adapter device drivers (qla2200.o and qla2300.o) enable your operating system to communicate with the host adapter. The IBM TotalStorage FAStT FC2-133 Host Bus Adapter is a high-performance, direct memory access (DMA), bus-master, host adapter designed, for high-end systems. The IBM FAStT Host Adapter supports all fibre-channel peripheral devices that support private loop direct attach (PLDA) and fabric loop attach (FLA). See the *IBM TotalStorage FAStT FC2-133 Host Bus Adapter Installation and User's Guide* or, for the current readme file and latest multipath I/O device drivers, go to the following Web site:

[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)

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## Managing the storage subsystem

You must manage storage systems using direct (out-of-band) management. You are then managing storage subsystems directly over the network through an 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 storage subsystem controller must be connected to an Ethernet network by a cable that is attached to the RJ-45 connector on each storage subsystem controller module, as shown in Figure 2 on page 8.

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

- The Ethernet connections to the controllers enable a management station running SMclient to manage storage subsystems that are connected to a host running any of the operating systems that are supported by Storage Manager 8.3.
- You do not need to use an access logical drive 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.

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

- Two Ethernet cables are required to connect the storage subsystem controllers to a network.
- When adding devices, you must specify an IP address or host name for each controller.
- A DHCP/BOOTP server and network preparation tasks are required. For a summary of the preparation tasks, see “Preparing for a network installation — overview” on page 17.

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 addresses, see Retain Tip H171389 “Unable To Setup Networking Without DHCP/BOOTP” at the following Web site:  
[www.ibm.com/pc/support](http://www.ibm.com/pc/support)
- If the storage subsystem controllers have firmware version 05.00.xx. or later, they have the following default settings:

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

Figure 2 on page 8 shows a system in which subsystems are managed using the direct (out-of-band) management method.

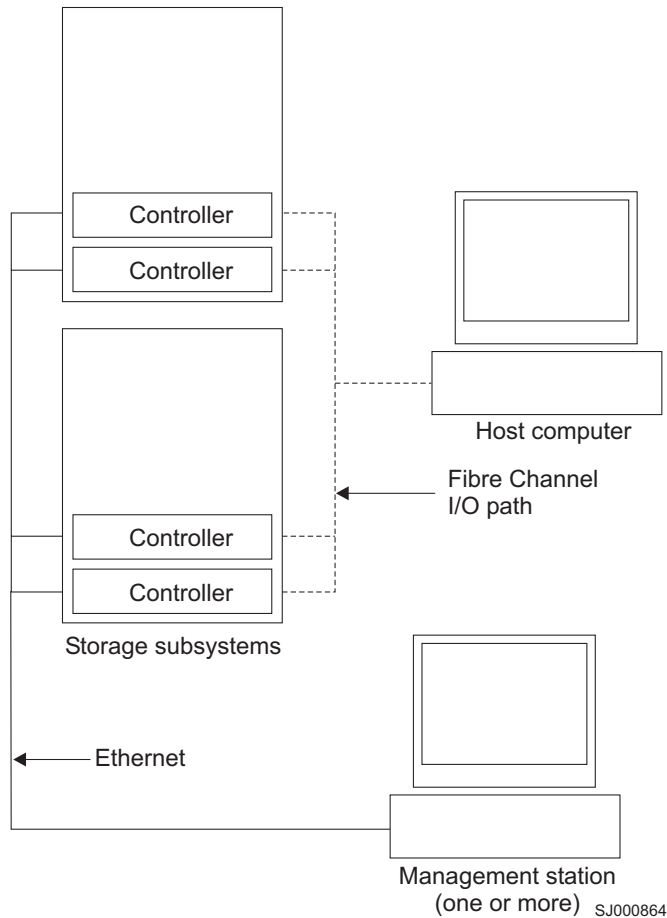


Figure 2. Direct (out-of-band) managed storage subsystems

## Where to install software components

You will need to install the software components on management stations and host computers.

### Management stations

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

- Storage Manager 8.3 Client (SMclient)
- IBM FAStT Management Suite Java (FAStT MSJ)
- Storage Manager 8.3 Runtime (SMRuntime)

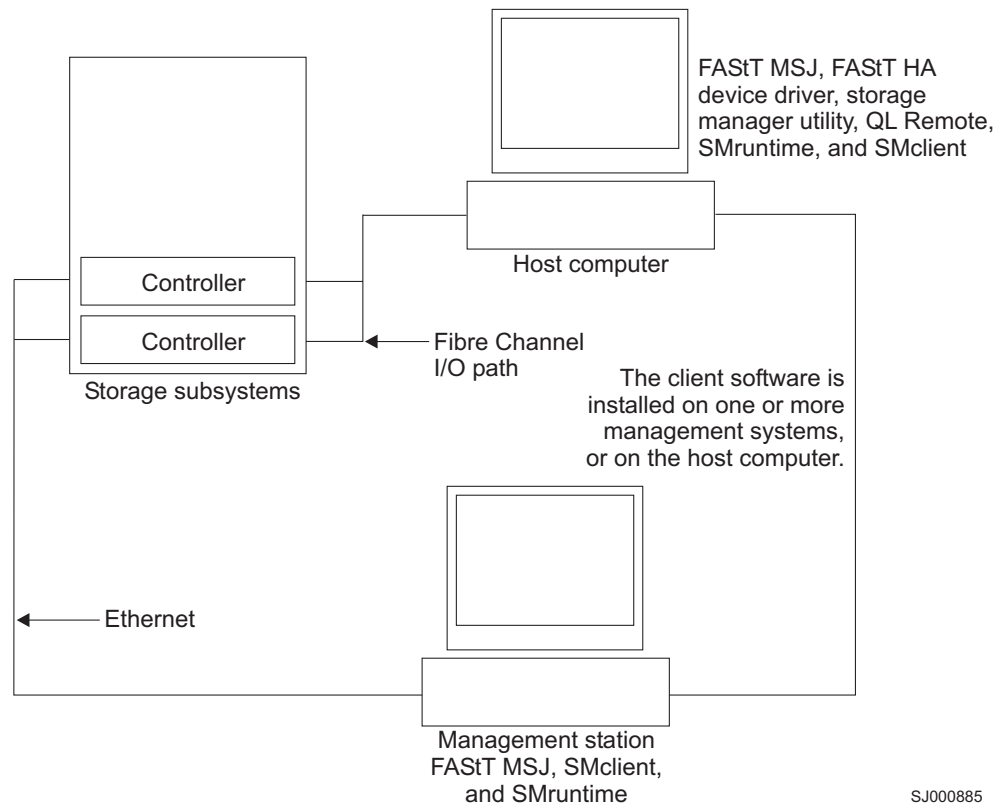
### Host computers

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

- IBM FAStT MSJ
- IBM FAStT Host MSJ agent (qlremote)
- IBM FAStT Host Adapter device driver
- Storage Manager 8.3 Runtime (SMruntime)
- Storage Manager 8.3 (SMclient)
- Storage Manager 8.3 (SMutility)



The SMclient must be installed 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, it must have TCP/IP software installed, and you must assign an IP address to the host. This is illustrated in Figure 3.



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Figure 3. Sample software installation

## Installation environments

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

### New storage subsystem environment

You are installing the IBM TotalStorage FAST Fibre Channel Storage Server using firmware 5.3x.xx.xx and you plan to manage storage subsystems using Storage Manager 8.3.

### Existing storage subsystem environment

You are installing the storage management software in an environment with existing storage subsystems. See Table 10 on page 10 for your installation options in an environment with existing storage subsystems.

Table 10. Installation options for existing storage subsystems

Existing storage subsystems with:	Options
<p>Machine type 3542, 3552, controllers running firmware version 04.01.02.07 through 04.01.xx.xx.</p> <p><b>Note:</b> If you have a level of firmware that is earlier than 04.01.02.07, you cannot use Red Hat Linux as your operating system.</p>	<p><b>Option 1</b> - Upgrade the controller firmware to version 5.3x.xx.xx and manage the storage subsystems with Storage Manager 8.3. You might need to purchase additional firmware.</p> <p><b>Option 2</b> - Install new storage subsystems and attach them to the same host as the existing storage subsystems. These existing and new storage subsystems are referred to as coexisting storage subsystems. See “Managing coexisting storage subsystems” for more information.</p>

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## Managing coexisting storage subsystems

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

- There are multiple storage subsystems with controllers 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 5.3x.xx.xx, and it is attached to the same host as one or more of the following configurations:

- A storage subsystem with controllers running firmware versions 04.01.02.07 through 04.01.xx.xx, which is managed by a separate management station with Storage Manager 7.02.
- A storage subsystem with controllers running firmware versions 04.01.02.07 through 04.01.xx.xx, which is managed with Storage Manager 8.3.

Figure 4 shows an example of an environment that includes coexisting storage subsystems.

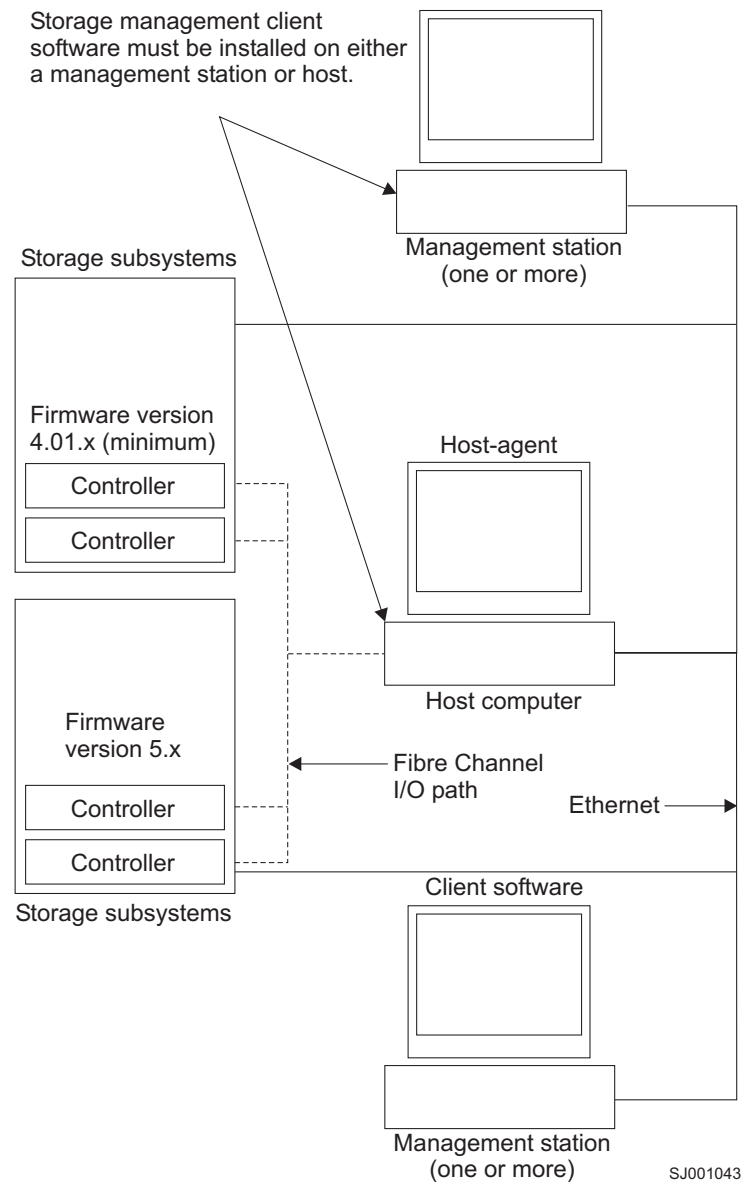


Figure 4. Coexisting storage subsystems

## System requirements

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

### Hardware requirements

Table 11 on page 12 lists the hardware that is required for installing Storage Manager Version 8.3 in a Linux environment. For the latest information about host adapters and host adapter device drivers, see the readme file on the IBM FASTT Storage Manager Version 8.3 installation CD or go to the following Web site:

Table 11. Hardware requirements for Storage Manager 8.3

Hardware component	Requirements
A BOOTP server	<ul style="list-style-type: none"> <li>• UNIX BOOTP server</li> <li>• Microsoft Windows 2000 BOOTP-compatible DHCP server</li> <li>• NetWare DHCP server</li> </ul>
Storage subsystems (one or more)	<p>Storage subsystems with controllers running firmware version 04.01.xx.xx</p> <p><b>Note:</b> Read “Installation environments” on page 9 for information about managing these storage subsystems when existing storage subsystems are physically connected to the same host that you will connect to the new storage subsystems.</p>
Fibre-channel host adapters	<p>The following fibre-channel host adapters are compatible with the storage-management software:</p> <ul style="list-style-type: none"> <li>• IBM FASiT adapter (part number: 00N6881)</li> <li>• IBM FASiT FC-2 host bus adapter (part number: 19K1246)</li> <li>• IBM TotalStorage FASiT FC2-133 host bus adapter (part number: 24P0960)</li> </ul> <p>For information about specific host adapter requirements:</p> <ul style="list-style-type: none"> <li>• See the readme file in the \linux\Host_Adapter directory on the installation CD.</li> <li>• Read the host adapter documentation.</li> <li>• Go to the following Web site: <a href="http://www.ibm.com/storage/techsup.htm">www.ibm.com/storage/techsup.htm</a></li> </ul>
Fibre-channel fabric switches (if needed for your configuration)	<p>The following fibre-channel fabric switches are compatible with the storage management software:</p> <ul style="list-style-type: none"> <li>• IBM 8-port Fibre Channel switch (machine type: 2109-S08)</li> <li>• IBM 16-port Fibre Channel switch (machine type: 2109-S16)</li> <li>• IBM 16-port 2 Gbps Fibre Channel switch (machine type: 2019-F16)</li> <li>• IBM 8-port 2 Gbps Fibre Channel switch (machine type: 3534-F08)</li> </ul> <p>For specific fibre-channel switch setup requirements:</p> <ul style="list-style-type: none"> <li>• Read the switch documentation.</li> <li>• Go to the following Web site: <a href="http://www.ibm.com/storage/fcswitch">www.ibm.com/storage/fcswitch</a></li> </ul>
Fibre-channel managed hub (if needed for your configuration)	<p>The IBM Fibre Channel managed hub (machine type: 3534) is compatible with the storage-management software.</p> <p>For specific fibre-channel managed hub setup requirements:</p> <ul style="list-style-type: none"> <li>• Read the documentation that comes with your managed hub.</li> <li>• Go to the the following Web site: <a href="http://www.ibm.com/storage/fchub">www.ibm.com/storage/fchub</a></li> </ul>

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

Hardware component	Requirements
Management station (for client software)	<ul style="list-style-type: none"> <li>• Intel® Pentium® or Pentium-equivalent microprocessor (133 MHz or faster)</li> <li>• CD-ROM drive</li> <li>• Mouse or similar pointing device</li> <li>• A minimum of 128 MB system memory</li> <li>• Ethernet network interface adapter</li> <li>• AGP or PCI video adapter (AGP preferred), ISA adapters are not supported</li> <li>• Monitor setting of 1024 x 768 pixels with 64 000 colors. The minimum display setting that is allowed is 800 x 600 pixels with 256 colors.</li> <li>• 60 MB of free hard disk space</li> <li>• Hardware-based Windows acceleration: Desktop computers that use system memory for video memory are not preferred for use with the storage-management software.</li> </ul> <p><b>Important:</b> Many PC-based servers are not designed to run graphic-intensive software. If your server has difficulty running the storage management software smoothly without video artifacts, you might need to upgrade the server video adapter.</p>

## Firmware requirements

To use all the features of Storage Manager 8.3, your storage subsystem must contain controllers with firmware version 5.3x.xx.xx. To manage storage subsystems with Storage Manager 8.3, your existing storage subsystems must contain controllers with firmware versions 04.00.02.xx or higher. If you want to upgrade from firmware versions 04.01.xx.xx (or higher) to 5.3x.xx.xx, an optional firmware upgrade is available for purchase (for machine types 3542 and 3552 only). For more information, contact your IBM service representative.

## Software requirements

Table 12 lists the disk space that is required for installing Storage Manager 8.3 in a Linux environment.

Table 12. Installation requirements by software package

Package	Disk space requirement
Storage Manager 8.3 Client (SMclient)	15 MB on /opt 2 MB on /tmp
IBM FAStT Management Suite Java (FAStT MSJ)	35 MB
Storage Manager 8.3 Utility (SMutil)	7 MB on/opt
IBM Host Adapter device driver	1 MB
Storage Manager 8.3 runtime (SMruntime)	42 MB on/opt 1 MB on/var

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## Operating system requirements

Each management station or host computer requires the following minimum operating system and kernel levels:

Operating system	Kernel
Red Hat Advanced Server 2.1	2.4.9-e.10
SuSE Linux Enterprise Server Version 8 (SLES 8)	2.4.19

**Note:** Linux supports a maximum of 128 logical drives with 32 LUNs per storage partition.

---

## Number of supported logical drives

There is a limit to how many logical unit numbers (LUNs) can access the logical drives on a single storage subsystem. The maximum number of logical drives that a FASTT storage subsystem with firmware version 5.3x.xx.xx can have depends on the model of the FASTT storage subsystem. Table 13 and Table 14 indicate drive limitations on storage subsystems by model type.

Table 13. Logical drives without the Remote Mirror option enabled

Machine type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum FlashCopy logical drives
3542	512 (See note 1)	32 (See note 5)	256 (See note 2)
3552	512 (See note 1)	32 (See note 5)	256 (See note 2)
1722	1024 (See note 1)	32	N/A (not supported for this release)
1742	2048 (See note 1)	32 (See note 5)	1024 (See note 2)

Table 14. Logical drives using the Remote Mirror option

Machine type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum FlashCopy logical drives
3542	N/A	N/A	N/A
3552	128 (See notes 3 and 6 on page 15)	32 (See note 5)	64 (See note 2)
1722	N/A	N/A	N/A
1742	256 (See notes 1, 4, and 6 on page 15)	32 (See note 5)	128 (See note 2)

### Notes:

1. When using firmware version 5.xx.xx, the firmware reserves one logical drive to be used by the system.
2. Maximum of four FlashCopy logical drives for each standard logical drive.
3. Maximum of eight remote mirror pairs.
4. Maximum of 16 remote mirror pairs.
5. 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 that is supported by the operating system and the host adapter. The access logical drive is also referred to as the universal Xport device.

6. For firmware version 5.3x.xx.xx, 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 to be used by the system.

**FAST600**

The FlashCopy and Remote Mirror option features are not supported on the FAST600 Fibre Channel Storage Server.





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## Chapter 2. Planning and preparing for installation

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

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### Reviewing a sample network

The example in Figure 5 shows a direct-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

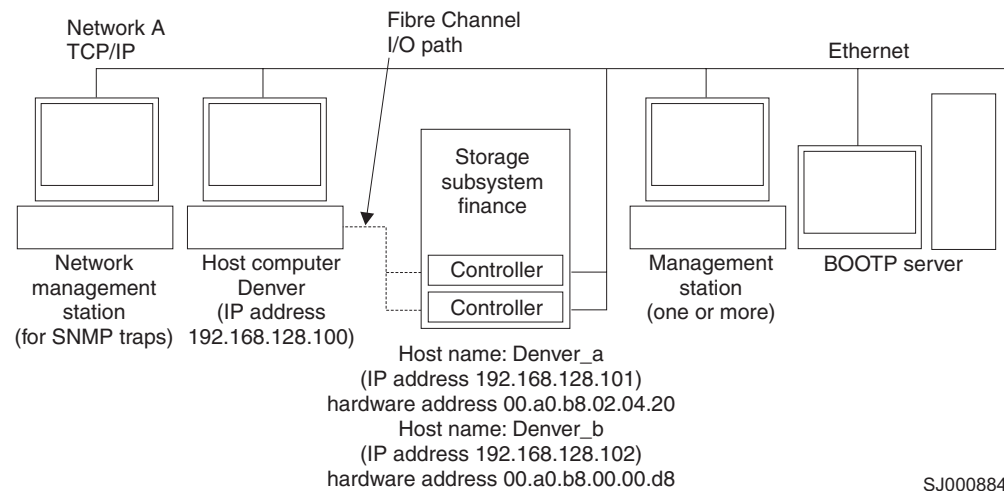


Figure 5. Sample network using direct-managed storage subsystems

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### Preparing for a network installation — overview

To begin installing the Storage Manager software, ensure that all hardware components (host computers, storage subsystems, and cables) are installed and operating correctly. Also be sure that you have all the host and controller information needed for the software to operate correctly. You might need to refer to the installation guides of the specific hardware components.

Following is a high-level overview of the steps that are involved in setting up a network installation.

- Step 1. Establish a naming convention for the storage subsystems that are connected to the network. See “Step 1: Naming the storage subsystems” on page 18 for more information.
- Step 2. Record the storage subsystem names and management types in the Storage Subsystems and Controller information record. A blank information record form is provided in Table 19 on page 53. Throughout the remaining

steps, you will need to return to this form to record information such as hardware Ethernet addresses and IP addresses.

- Step 3. Determine the hardware Ethernet addresses for each controller in storage subsystems that are connected to the network. See “Step 3: Identifying the hardware Ethernet MAC address for each controller” on page 19 for more information.
- Step 4. Obtain the IP address of each controller in the storage subsystems to configure the DHCP BOOTP server. See “Step 4: Assigning IP addresses for hosts and controllers” on page 21 for more information.
- Step 5. Set up the DHCP BOOTP server to provide network configuration information for a specific controller.
- Step 6. Verify that the TCP/IP software is installed, and set up the host or DNS table. Installing the client software on a management station ensures that the management station is configured to reach the controllers over the network.
- Step 7. 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 when naming storage subsystems:

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

Storage Subsystem Finance

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## Step 2: Recording the subsystem names

After you decide on a naming scheme, record the storage subsystem names in the Storage Subsystem and Controller information record. A blank form is provided in Table 19 on page 53.

Table 15 shows an example of a completed information record for a direct-managed storage subsystem.

*Table 15. Sample information record*

Storage subsystem name	Management type	Controllers - Ethernet and IP addresses, and host name		Host - IP address and host name
		Controller A	Controller B	

Table 15. Sample information record (continued)

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	

### 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 Ethernet MAC address for each controller.

Perform the following steps to identify the hardware Ethernet MAC address for machine types 1722 and 3542:

1. Locate the Ethernet MAC address at the back of the unit, under the controller gigabit interface converter (GBIC) ports, as shown in Figure 6. The number is 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 (see Table 19 on page 53).

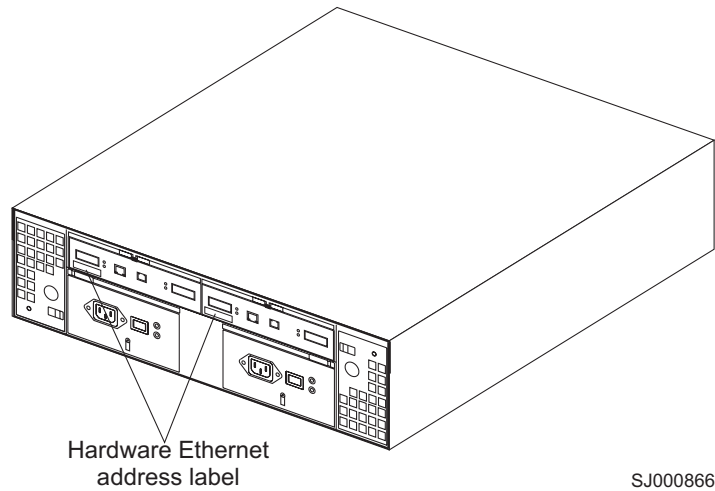
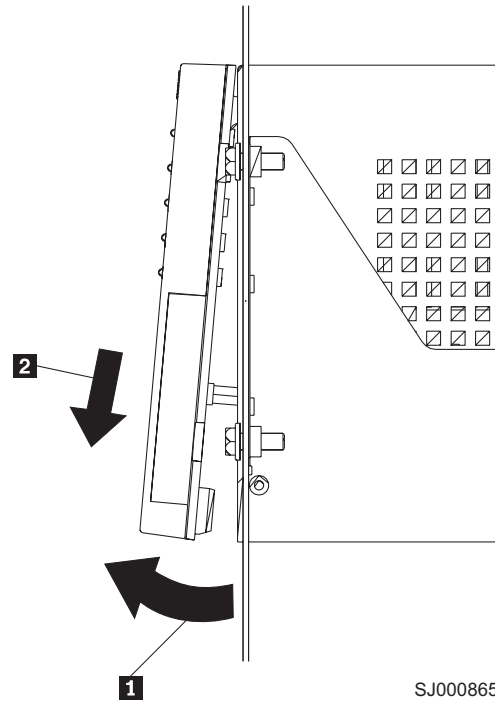


Figure 6. Locating the Ethernet MAC address for machine types 1722 and 3542

Perform the following steps to identify the hardware Ethernet MAC address for machine types 3552 and 1742:

1. Remove the front bezel from the controller unit, as shown in Figure 7 on page 20. Carefully pull the bottom of the bezel out **1** to release the pins; then,

slide the bezel down **2** .



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Figure 7. Removing the controller unit bezel (machine types 3552 and 1742)

2. On the front of each controller, look for a label with the controller hardware Ethernet address. The number is in the form xx.xx.xx.xx.xx.xx (for example, 00.a0.b8.00.00.d8).
3. Record each Ethernet address in the information record (see Table 19 on page 53).
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 8 on page 21.

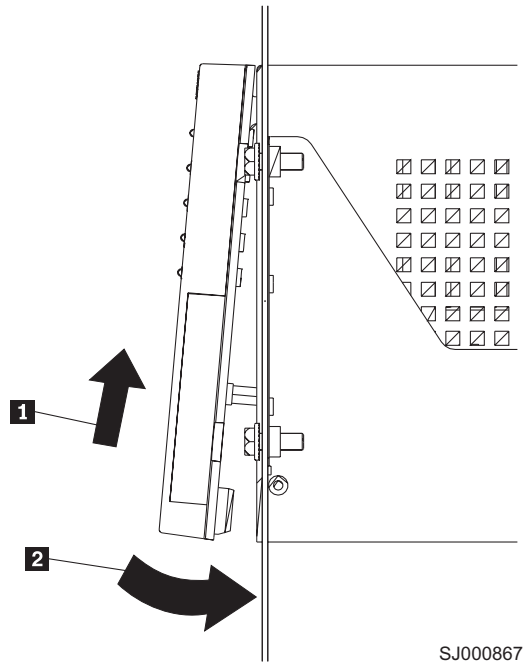


Figure 8. Replacing the controller-unit bezel (machine types 3552 and 1742)

5. Continue with “Step 4: Assigning IP addresses for hosts and controllers”.

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## Step 4: Assigning IP addresses for hosts and controllers

If you plan to manage our storage subsystem using the direct-management method, assign a unique IP address for each host and controller in all storage subsystems on the network. Record the IP address for each controller in the information record (see Table 19 on page 53). Then, go to “Step 5: Setting up the DHCP or BOOTP-compatible server” on page 22.

**Note:** If you want to assign static IP addresses for the controllers, see Retain Tip H171389 “Unable To Setup Networking Without DHCP/BOOTP” at the following Web site:

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

Then, go to “Step 6: Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

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 (see Table 19 on page 53). Then, go to “Step 6: Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

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## Step 5: Setting up the DHCP or BOOTP-compatible server

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

- Router or Gateway
- DNS Server
- Host name
- DNS Domain Name

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

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

### Setting up a Windows NT 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 procedure to install one.

#### Installing the DHCP Manager

Perform the following steps to install the DHCP Manager:

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

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

#### Setting up a DHCP server

Use the following procedure, along with the information that you recorded in the Storage Subsystem and Controller information record 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 controllers that you want to configure using the DHCP server.
  - a. Click **Local Machine**.

- b. Click **Scope** → **Create**. The Create Scope - (Local) window opens as shown in Figure 9.

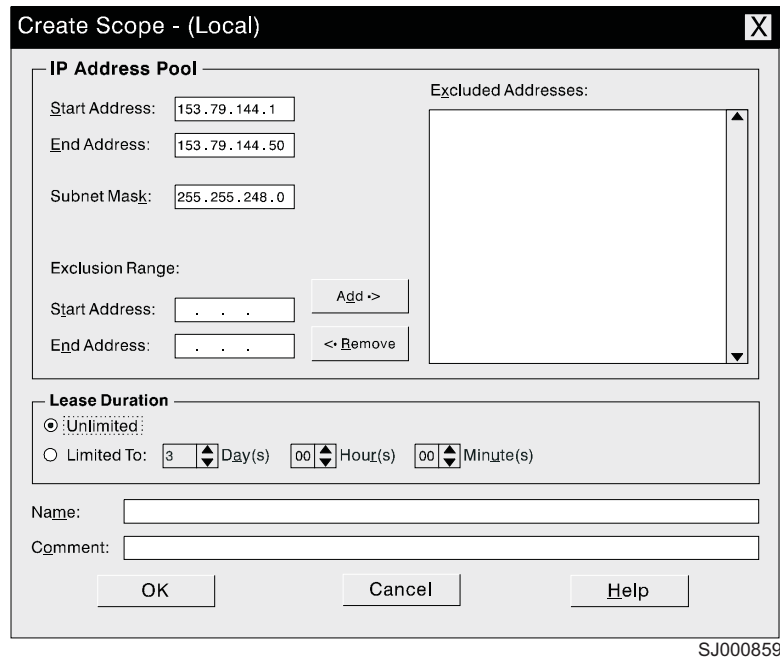


Figure 9. Create Scope - (Local) window

- 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 (which you obtained from your network administrator).
- e. In the **Lease Duration** field, click **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 16 shows the global options that you need to set.

Table 16. Global options for a Windows NT DHCP server

Number	Description	Notes
003	Router or Gateway	
006	DNS Server	
012	Host name	Unique for each controller
015	DNS domain name	For example, ibm.com

You can apply options to specific controllers later. The procedure is described in step 5 on page 25.

- a. Click **DHCP Options** → **Global**. The DHCP Options: Global window opens as shown in Figure 10.

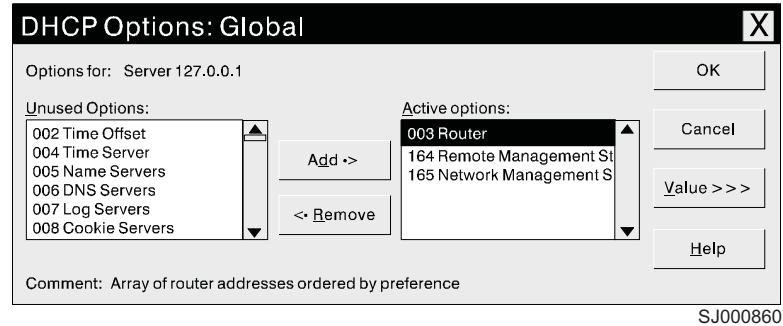


Figure 10. DHCP Options: Global window

- b. To make a global option active, select an item in the Unused Options list; then, 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 active, the **Edit Array** field displays. Click **Edit Array**; the Edit Array Editor window opens. Do one of the following:

- 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 11.

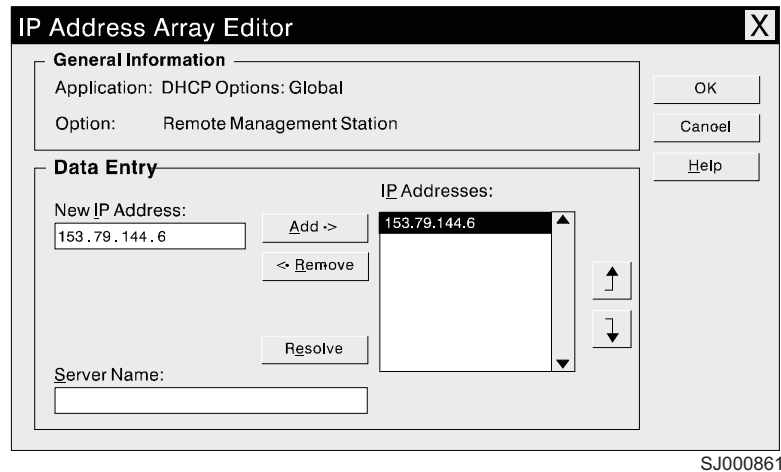


Figure 11. IP Address Array Editor window

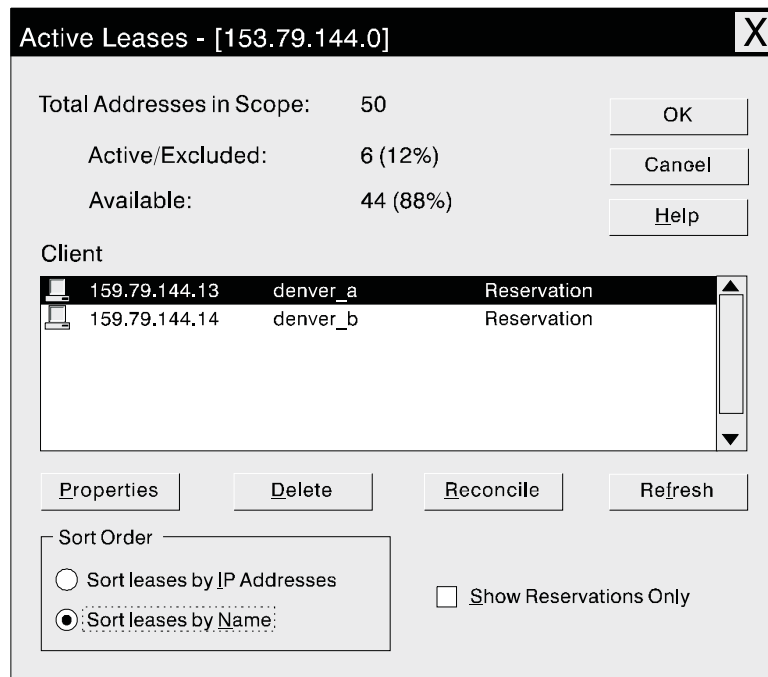
- 2) Type a unique IP address for the option that you added.
  - 3) Click **Add** to move the new IP address to the IP Addresses list.
  - 4) Click **OK**. This returns you to the DHCP Options: Global window.
- If you do not need to add an IP address, click **Cancel**. This returns you to the DHCP Options: Global window.
- d. Repeat step 3b through step 3c until all global options are added.
  - e. When you finish adding the Global Scope Options, click **OK** at the DHCP Options: Global window.



4. Create a reservation for each controller. Use the Storage Subsystem and Controller information record (Table 19 on page 53) 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 that is listed on your information record.
  - c. In the **Unique Identifier** field, type the controller hardware Ethernet address. Do not type decimal points or spaces.
  - d. In the **Client Name** field, type the controller eight-character name.
  - e. Click **Add**.
  - f. Repeat step 4b through step 4e for each controller that is listed on information record.
  - g. When you finish adding the information for all of the controllers, click **Close**. This returns you to the DHCP Manager window.
5. Configure controller-specific options. By creating a controller-specific option, you can associate a controller configuration entry with a specific controller.

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

- a. Click **Scope** → **Active Leases** as shown in Figure 12. The Active Leases window opens.



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Figure 12. Active Leases window

- b. Select a controller in the list.
- c. Click **Properties**. The Add Option Type window opens as shown in Figure 13 on page 26. The fields of the Add Option Type window are already filled in with the information that was specified in previous steps. For example, the **Unique Identifier** is the hardware Ethernet address that you

identified in step 4c.

IP Address: 153.79.144.13

Unique Identifier: 00a0b8020420

Client Name: denver\_a

Client Comment:

Lease Expires: N/A

OK Cancel Help Options...

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Figure 13. 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 Storage Subsystem and Controller information record (Table 19 on page 53) in the **String** field. Click **Edit** if the value that you need to add is an IP address for a router.
  - h. Repeat step 5e through step 5g until you add all the specific options for this controller.
  - i. Click **OK**. This returns you to the Add Option Type window.
  - j. Click **OK**. This returns you to the Active Leases window.
  - k. Repeat step 5b through step 5j until you finish adding controller-specific options for every controller.
  - l. Click **OK** on the Active Leases window. This returns you to the DHCP Manager window.
6. Continue with “Step 6: Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

## 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 “Setting up a DHCP server” on page 22. If a DHCP Manager is not installed on the system, use the following procedure to install one.

### Installing the DHCP Manager

Perform the following steps to install the DHCP Manager:

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

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

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 Configure Your Server Window opens.
10. Click **Next**.
11. Click **Open the DHCP Manager**. The DHCP window opens.
12. Continue with step 2 of “Setting up a DHCP server” on page 22.

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

### **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. Before you begin, read through the procedure to determine what information is required; then, request the information from your network administrator. During this procedure, you will need to refer to the Storage Subsystems and Controller information record.

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

- b. The IP address range for the controllers that you are configuring and the subnet mask. See Figure 14.

**New Scope Wizard**

**IP Address Range**  
You define the scope address range by identifying a set of consecutive IP addresses.

Enter the range of addresses that the scope distributes.

Start IP address: 192 . 168 . 1 . 1

End IP address: 192 . 168 . 1 . 50

A subnet mask defines how many bits of an IP address to use for the network/subnet IDs and how many bits to use for the host ID. You can specify the subnet mask by length or as an IP address.

Length: 24

Subnet mask: 255 . 255 . 255 . 0

< Back    Next >    Cancel

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Figure 14. New Scope Wizard: IP Address Range window

- c. Any IP addresses that you want to exclude from the IP address range
- d. The IP address lease duration
- e. Common DHCP options:
  - The IP address for a router
  - The 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. Go to “Step 6: Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

## Setting up a Novell NetWare DHCP server

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

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

1. Install DNS/DHCP Services, either during or after installing Novell NetWare 6.0.
2. Install the DNS/DHCP Management Console.
3. Create the DHCP server object.
4. Create the subnet address.
5. Create the subnet address range.
6. Create the IP address object.
7. Start the DHCP server.

### Installing NetWare 6.0 with DNS/DHCP Services

You can add Novell DNS/DHCP services either during or after the NetWare installation.

**Adding Novell DNS/DHCP Services during the NetWare 6.0 installation:** Do the following 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 the installation.

**Note:** Installing the DNS/DHCP Service extends the Novell Directory Services (NDS) schema and creates 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 that you will use to administer DNS and DHCP:

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

### Creating a 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. From 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 subnet address ranges

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 IP address objects

Use the DNS/DHCP Management Console to create IP address objects. IP address objects are used 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**; then, 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, type the hardware Ethernet MAC address for the controller.
8. Select the **Define Additional Properties** check box.
9. In the **Host name** field, type the eight-character name for the controller.
10. In the **Usage** field, select **Permanent**.
11. Repeat step 3 through step 10 for each controller.

### Starting the DHCP server

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

```
LOAD DHCP SRVR
```

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

#### Notes:

1. To load the DHCP server automatically each time the server starts, place the DHCP SRVR command in the SYS:\SYSTEM\AUTOEXEC.NCF directory.
2. For additional information about how to set up, configure, or use Novell DNS/DHCP Services, see the NetWare 5.1 documentation, located on the Novell documentation CD or go to the Novell Web site at:  
[www.novell.com/documentation](http://www.novell.com/documentation)

## Setting up a UNIX BOOTP server

To use a UNIX BOOTP server, you must set up a BOOTP table. Table 17 shows the information that is required for the BOOTP table.

Table 17. 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=255.255.255.0)
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 the Storage Subsystem and Controller information record for this information.	host name (Denver_a)
IP address	IP address of the controller. See the Storage Subsystem and Controller information record for this information.	dot notation (ip=192.168.128.101)
Ethernet address	The Ethernet address of the controller hardware. See the Storage Subsystem and Controller information record for this information.	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.

The following is an example of the BOOTP table used to configure a network:

```
s4.default:\ (common settings)
ht=ether:\
sm=255.255.248.0:\
gw=192.168.128.1:\
hn:
denver_a:\
tc=s4.default:\ (common settings)
ip=192.168.128.101:\
ha=00a0b8020420:
denver_b:\
tc=s4.default:\
ip=192.168.128.102:\
ha=00a0b80000d8:
```

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

2. If the storage subsystem is running, shut down and then restart the subsystem. This ensures that the parameters in the BOOTP table take effect.
3. Continue with “Step 6: Verifying the TCP/IP protocol and setting up the host or DNS table”.

---

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

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

This chapter describes how to install the storage management software.

If you have existing storage systems, make sure that you have read “Installation environments” on page 9 and “Managing coexisting storage subsystems” on page 10.

To ensure proper installation, make sure you have completed all preparation tasks described in Chapter 2, “Planning and preparing for installation”, on page 17.

**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 *Installation and Support Guide*.

---

### Installation Overview

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

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 8.3 Runtime.
3. Install Storage Manager Client 8.3 Client.
4. Disable and enable the Event Monitor.
5. Install Storage Manager 8.3 Utility.
6. Uninstall existing IBM FAStT Management Suite Java (use this procedure when installing Storage Manager 8.3 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 steps 2 through 4 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 FAST Storage Manager Version 8.3 on a management station or a host computer, go to “Installing the 8.3 software”.
  - 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 8.3 software

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

### Installing Storage Manager 8.3 Runtime (SMruntime)

Perform the following steps to install SMruntime:

1. Close all open programs.
2. Insert the IBM TotalStorage FAST Storage Manager Version 8.3 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 8.3 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 8.3 Client (SMclient)” on page 37.

## Installing the Storage Manager 8.3 Client (SMclient)

Perform the following steps to install the SMclient:

1. Close all open programs.
2. Insert the IBM TotalStorage FAStT Storage Manager Version 8.3 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 8.3 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 steps 1 through 6 of the installation procedure.

2. Continue the installation with “Installing IBM FAStT Management Suite Java” on page 38 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, is installed 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 have 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 8.3 Utility (SMutil)

Perform the following steps to install the SMutil:

1. Close all open programs.

2. Insert the IBM TotalStorage FAStT Storage Manager Version 8.3 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 8.3 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”.

## Uninstalling IBM FAStT Management Suite Java

If you are installing Storage Manager 8.3 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 Management Suite Java that came on the IBM TotalStorage FAStT Storage Manager Version 8.3 CD.

Perform the following steps to uninstall FAStT MSJ:

1. From a command 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 TotalStorage FAStT Storage Manager Version 8.3 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 prompt:  

```
sh FAStT
```
5. Press Tab; then, press Enter. The Introduction window opens.
6. Click **Next**.

7. Start your Linux server again.
8. Continue with “Installing the IBM Host Adapter device driver (qla2200.o or qla2300.o)”.

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

## Installing the IBM Host Adapter device driver (qla2200.o or qla2300.o)

The IBM Host Adapter device driver enables the operating system to communicate with the host adapter. The IBM FAStT Host Adapter, IBM FAStT FC-2 Host Bus Adapter, and IBM TotalStorage FAStT FC2-133 Host Bus Adapter are high-performance, direct memory access (DMA), bus-master, host adapters that are designed for high-end systems. These host bus adapters support all fibre-channel peripheral devices that support private loop direct attach (PLDA) and fabric loop attach (FLA). For more information, see the *IBM FAStT Host Adapter Installation and User’s Guide*, *IBM FAStT FC-2 Host Bus Adapter Installation and User’s Guide*, or the *IBM TotalStorage FAStT FC2-133 Host Bus Adapter Installation and User’s Guide*.

The current readme file and latest multipath I/O device driver are available at the following Web site:

[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)

---

## Introduction to SANavigator

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

## SANavigator features

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

- Discovery

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

- Monitoring

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

- Launching device applications and utilities

You can launch applications and utilities such as IBM FAStT Storage Manager and IBM FAStT MSJ from SANavigator by right-clicking the respective devices. A pop-up menu displays that allows you to select the applications and link to the IBM Fibre Channel Solution Support Web site at:

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

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

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

## System requirements

The following list outlines the minimum requirements for SANavigator:

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

## Installing SANavigator

SANavigator installation is easy and fast. After installing IBM FAST Storage Manager Version 8.3, consider installing the FAST 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 FAST MSJ User's Guide*, and FAST MSJ program are located on the IBM FAST Storage Manager version 8.3 CD. For information about how to install and run SANavigator, see the *FAST Hardware Maintenance Manual and Problem Determination Guide*.



---

## Chapter 4. Completing the installation

This chapter contains procedures for using Enterprise Management and Subsystem Management to complete the following installation tasks:

- Performing an initial automatic discovery of storage subsystems
- Adding devices
- Setting up alert notifications
- Naming the storage subsystems
- Downloading firmware and NVSRAM
- Creating arrays and logical drives
- Deleting logical drives
- Creating a FlashCopy logical drive
- Defining the default host type
- Configuring heterogeneous hosts
- Identifying logical drives by operating system device names
- Using the Remote Mirror option
- Performing other storage subsystem tasks

### **FAST600**

The FlashCopy and Remote Mirror option features are not supported on the FAST600 Fibre Channel Storage Server.

The Enterprise Management window opens when you start FAST Storage Manager. Use the Enterprise Management window to perform the following tasks:

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

---

## Performing an initial automatic discovery of storage subsystems

Perform the following steps to complete an initial automatic discovery of storage subsystems:

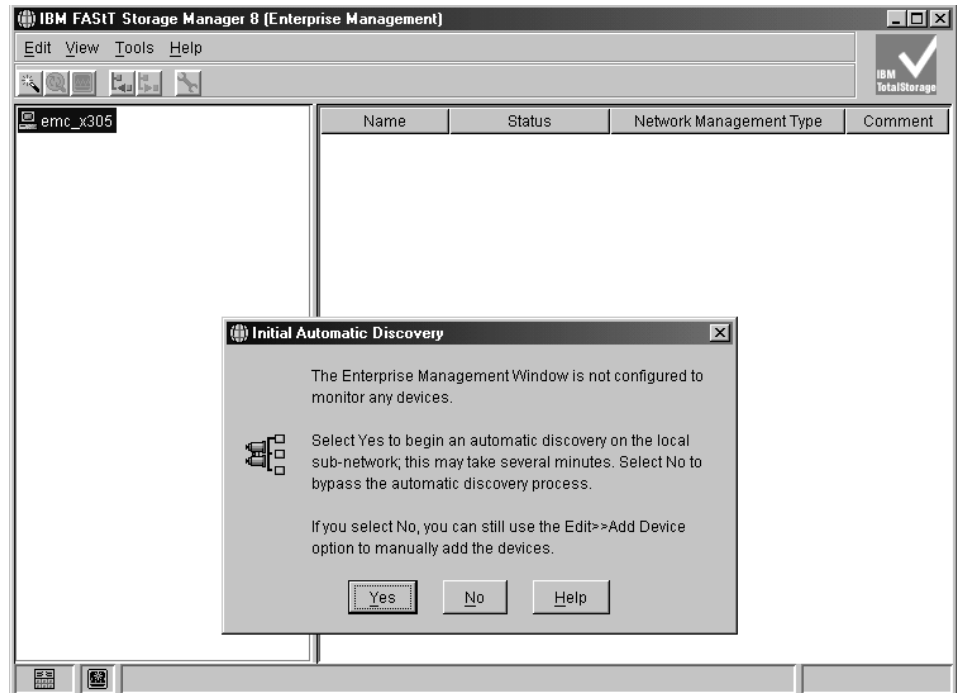
1. At the command prompt type the following command:

```
SMclient
```

**Note:** If `/opt/SMclient` is not contained in the path environment, the full path name is required on the command line:

```
/opt/IBM_FAST/client/SMclient
```

The client software starts, displaying the Confirm Initial Automatic Discovery window, as shown in Figure 15.



SJ000872

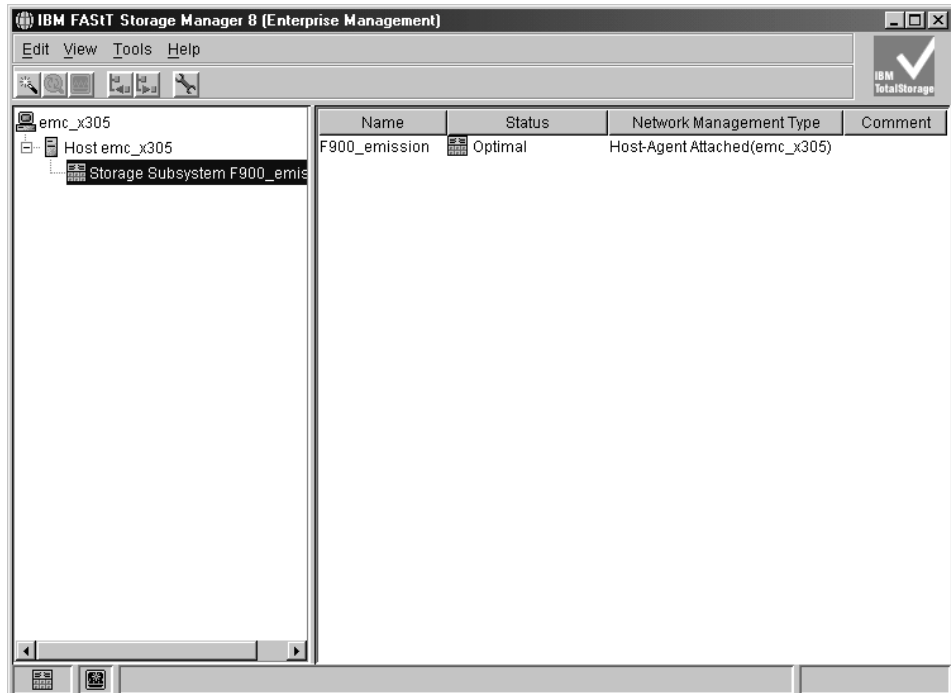
Figure 15. Confirm Initial Automatic Discovery window

**Note:** The Enterprise Management window might take several minutes to open. No wait cursor is displayed.

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

After the initial automatic discovery is complete, the Enterprise Management window displays all hosts and storage subsystems that are attached to the local subnetwork. See Figure 16 on page 43.

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



SJ000873

Figure 16. Enterprise Management window

3. Verify that each host and storage subsystem is displayed in the Enterprise Manager window.

Perform the following steps if a host or storage subsystem is not displayed:

- a. Check the hardware and connections for possible problems (see the hardware documentation for specific procedures).
- b. See the Enterprise Management online help for additional information about discovering storage subsystems.
- c. Verify that all hosts and storage subsystems are on the local subnetwork. If they are not, use the Add Device option.

**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.

4. Verify that the status of each storage subsystem is Optimal. If a device shows a status of Unresponsive, use the software to remove the device from the management domain and then add it again. See the Enterprise Management window online help for instructions on how to remove and add devices.
5. Continue with “Adding devices”.

---

## Adding devices

You can add more hosts or storage subsystems outside the local subnetwork. For more information about this option, see the Enterprise Management window online help.

**Important:** 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 SNMP traps
- Notification to designated e-mail addresses
- Notification to designated alphanumeric pagers (requires additional software to convert e-mail messages)

**Note:** If you do not install Event Monitor, you must monitor storage subsystems within the management domain. The Enterprise Management window must remain open; if you close the window, you will not receive alert notifications. See the Enterprise Management window online help for additional information.

Perform the following steps to set up alert notification to an NMS using SNMP traps:

1. Insert the IBM TotalStorage FASiT Storage Manager Version 8.3 CD into the CD-ROM drive on an NMS. You need to set up the designated management station only once.
2. Copy the SM8.MIB file from the SM8mib directory to the NMS.
3. Follow the steps required by your NMS to compile the management information base (MIB) file. For details, contact your network administrator or see the documentation specific to the storage management product that you are using.
4. Continue with “Naming storage subsystems”.

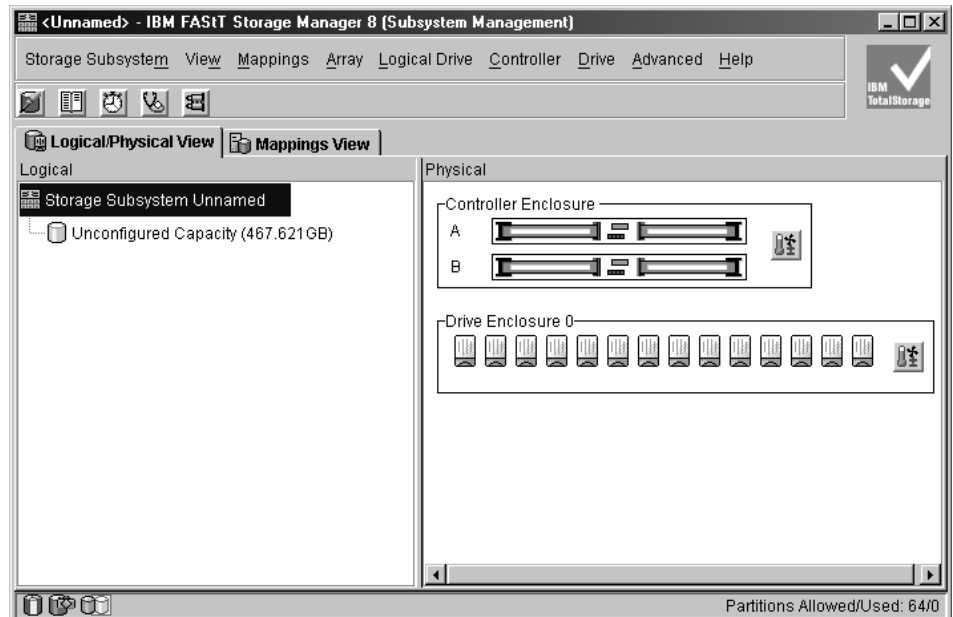
---

## Naming storage subsystems

Perform the following steps to name your storage subsystem:

1. In the Enterprise Management window, select a storage subsystem.

2. Click **Tools** → **Manage Device**. The Subsystem Management window opens, as shown in Figure 17.



SJ000874

Figure 17. Subsystem Management window

3. From the toolbar, click **Storage Subsystem** → **Rename**. The Rename Storage Subsystem window opens.
4. Type the name of the storage subsystem from the Storage Subsystem and Controller information record; then, click **OK**.
5. Repeat for each unnamed storage subsystem. For more information, see the topic on renaming storage subsystems in the Subsystem Management window online help.
6. Continue with “Downloading firmware and NVSRAM”.

## Downloading firmware and NVSRAM

This section provides instructions for downloading firmware and NVSRAM. You must download firmware version 5.3x.xx.xx before you download NVSRAM. Files that you need to update the firmware or NVSRAM are available at the following Web site:

[www.ibm.com/storage/techsup.htm](http://www.ibm.com/storage/techsup.htm)

## Downloading firmware

Perform the following steps to download firmware version 5.3x.xx.xx:

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 on-screen instructions.
4. Continue with “Downloading NVSRAM” on page 46.

## Downloading NVSRAM

Perform the following steps to download NVSRAM:

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 on-screen instructions.
4. Continue with “Creating arrays and logical drives”.

---

## Creating arrays and logical drives

### Important

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. In the event of a catastrophic failure, it can be used to help recover the configuration.

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

If you have a storage server with firmware 04.01.xx.xx or earlier, you must also perform controller state capture in addition to saving the storage subsystem profile. To use the Capture State Information feature, upgrade your controller to firmware 04.01.02.34 or later and install the IBM FASTT Storage Manager Field Tool, Version 5.21. This program is available at the following Web site:

[ssddom02.storage.ibm.com/techsup/webnav.nsf/support/disk](http://ssddom02.storage.ibm.com/techsup/webnav.nsf/support/disk)

Perform the following steps to create a storage subsystem profile using the Capture State Information feature:

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 capture is complete.

A *logical drive* is the basic data storage structure essential to a 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.

Perform the following steps to create arrays and logical drives:

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 on-screen instructions to create arrays and logical drives.
5. Continue with “Defining the default host type” on page 48.

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

---

## Deleting logical drives

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

Before deleting logical drives with the storage management software or using **Configure** → **Reset Configuration** stop all input and output activity to the affected storage subsystem. Then dismount any Linux volumes that are associated with the logical drives.

---

## Creating a FlashCopy logical drive

### FAST600

The FlashCopy and Remote Mirror option features are not supported on the FAST600 Fibre Channel Storage Server.

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

- It is created quickly and requires less disk space than an actual logical drive.
- It can be assigned 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 affect the actual production environment.
- The maximum number of FlashCopy logical drives allowed is one half of the total logical drives that are supported by your controller model.

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

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

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. See the Subsystem Management online help for instructions on how to add the FlashCopy logical drive to the host.

---

## Defining the default host type

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

Perform the following steps to define a default host type:

1. Click **Storage subsystem** → **Change** → **Default host-type**. The Default Host-type window opens.
2. From the pull-down menu, 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 that run different operating systems to access a single storage subsystem. Previous releases of IBM 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) or variants of the same operating system (for example, Windows NT running in a cluster environment or Windows NT running in a noncluster environment). When a host type is specified in the Define New Host Port window, the heterogeneous hosts feature enables the controllers in the storage subsystem to tailor their behavior (such as LUN reporting) to the needs of the host.

**Important:** To use the heterogeneous host feature, the following conditions must be met:

- Storage partitioning is enabled.
- 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.

Perform the following steps to configure the heterogeneous host:

1. From the Subsystem Management window, click **Configure** → **Storage Partition**.
2. Follow the on-screen instructions.
3. To display the association between a storage subsystem and operating system device name, continue with “Identifying logical drives by operating system device names” on page 49. Otherwise, continue with “Performing other storage subsystem management tasks” on page 49.

**Note:** Partitioning is a premium feature. If you disable partitioning and you did not save a copy of your key file to disk, you *must* contact your IBM technical support representative to obtain a key to re-enable partitioning.



---

## Identifying logical drives by operating system device names

The SMutil software package includes a utility that lets you see which storage subsystem logical drive is associated with a particular operating system device name. This capability is useful for operations such as data placement and logical drive deletion.

Type the following command and press Enter:

```
SMdevices
```

The software displays device identification information similar to the following:

```
/dev/sdb (/dev/sgc) [Storage subsystem <name>, Logical drive 1, LUN 0,
Logical drive WWN<600a0b8000091c9c000000df3bcadaae>, Alternate Path:
In Use]
/dev/sdc (/dev/sgc) [Storage subsystem <name>, Logical drive 2, LUN 1,
Logical drive WWN <600a0b8000091c9c000000e33bcadb05>, Alternate Path:
Not In Use]
/dev/sdd (/dev/sgc) [Storage subsystem <name>, Logical drive 3, LUN 2,
Logical drive WWN <600a0b8000091c9c000000e73bcadb5c>, Alternate Path:
In Use]
```

where:

- /dev/... is the Linux device node name.
- Storage subsystem is the storage subsystem name.
- Logical drive is the logical drive name.
- LUN is the logical unit number associated with the logical drive.
- WWN is the world wide name for the logical drive.

---

## 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 I/O operations. For more information about this feature, see the *IBM FASiT Remote Mirror Option Installation and User's Guide*, or contact your IBM reseller or marketing representative.

---

## Performing other storage subsystem management tasks

Other storage subsystem management tasks you can perform include:

- Locate a storage subsystem
- View a storage subsystem profile
- Enter or change a storage subsystem password
- Create and manage logical drives and subsystems
- Use the Performance Monitor
- Create storage partitions (if applicable) and heterogeneous hosts

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

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

---

## Appendix A. Linux operating system limitations

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

---

### Supported logical drives

The supported logical drive limits are as follows:

- When using Linux Storage Management Services (SMS), you can configure up to 128 LUNs or the maximum for the host adapter model.
- Host adapters support a specific number of logical drives. See the host adapter documentation for specific information.

---

### Linux limitations

**Important:** Always check for a readme file on any installation media. This readme file contains information that was not available when this *Installation and Support Guide* was prepared.

Table 18 lists the limitations that apply when you use the IBM TotalStorage FAStT Storage Manager Version 8.3 with Linux.

Table 18. 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.

Table 18. Linux limitations and workarounds (continued)

<b>Limitations</b>	<b>Workaround</b>
Your windows and online help display a brownish hash pattern when you run in 256 color mode.	Run the Storage Manager 8.3 application in a higher display mode.
When performing 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.
When you connect an IBM TotalStorage FASTT EXP700 Storage Expansion Unit to a FASTT200, the drive speed must be set to 1 Gb per second.	None.





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## Important notes

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

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

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

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

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

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

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## Glossary

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

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

This glossary also includes terms and definitions from:

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

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

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

### See also

Refers you to a related term.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**portable document format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**private loop.** A freestanding Arbitrated Loop with no fabric attachment.

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

**PTF.** See *program temporary fix*.

**RAM.** See *random-access memory*.

**random-access memory (RAM).** A temporary storage location in which the central processing unit (CPU) stores and executes its processes.

**RDAC.** See *redundant disk array controller*.

**read-only memory (ROM).** Memory in which the user cannot change stored data except under special conditions.

**recoverable virtual shared disk (RVSD).** A virtual shared disk on a server node configured to provide continuous access to data and file systems in a cluster.

**red, green, blue (RGB).** (1) Color coding in which the brightness of the additive primary colors of light, red, green, and blue are specified as three distinct values of white light. (2) Pertaining to a color display that accepts signals that represent red, green, and blue.

**redundant disk array controller (RDAC).** (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

**RGB.** See *red, green, blue*.

**ROM.** See *read-only memory*.

**router.** A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses.

**RVSD.** See *recoverable virtual shared disk*.

**SAN.** See *storage area network*.

**scope.** Defines a group of controllers by their IP addresses. You must create and configure a scope so that dynamic IP addresses can be assigned to controllers on your network..

**SCSI.** See *small computer system interface*.

**segmented loop ports (SL\_Ports).** SL\_Ports allow you to divide a Fibre Channel Private Loop into multiple segments. Each segment can pass frames around as an independent loop and can connect through the fabric to other segments of the same loop.

**serial storage architecture (SSA).** An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with SCSI devices, allows full-duplex packet multiplexed serial data transfers at rates of 20Mb/sec in each direction.

**server.** A functional hardware and software unit that delivers shared resources to workstation client units on a computer network.

**server/device events.** Events that occur on the server or a designated device that meet criteria that the user sets.

**Simple Network Management Protocol (SNMP).** In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

**SL\_Port.** See *segmented loop ports*.

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

**SNMP.** See *Simple Network Management Protocol*.

**SNMPv1.** The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

**SNMP time-out.** The maximum amount of time the SANavigator tool will wait for a device to respond to a request. The specified time applies to one retry only.

**SNMP trap events.** SNMP is based on a manager/agent model. SNMP includes a limited set of management commands and responses. The management system issues messages that tell an agent to retrieve various object variables. The managed agent sends a Response message to the management system. That message is an event notification, called a trap, that identifies conditions, such as thresholds, that exceed a predetermined value.

**SRAM.** See *static random access memory*.

**SSA.** See *serial storage architecture*.

**static random access memory (SRAM).** Random access memory based on the logic circuit known as flip-flop. It is called *static* because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly refreshed. It is however, still volatile, meaning that it can lose its contents when the power is switched off.



**storage area network (SAN).** A network that links servers or workstations to disk arrays, tape backup subsystems, and other devices, typically over Fibre Channel.

**storage management station.** A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel I/O path.

**subnet.** An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

**super video graphics array (SVGA).** A video display standard that Video Electronics Standards Association (VESA) created to provide high resolution color display on IBM PC compatible personal computers. The resolution is 800 x 600 4-bit pixels. Each pixel can therefore be one of 16 colors.

**SVGA.** See *super video graphics array*.

**sweep method.** A method of sending SNMP requests for information to all the devices on a subnet by sending the request to every device on the network. Sweeping an entire network can take a half an hour or more. If broadcast is disabled, the recommended method is to enter the individual IP addresses of the SAN devices into the SANavigator tool. This method produces good results without unnecessarily using time to wait for responses from every IP address in the subnet, especially for IP addresses where no devices are present. There might, however, be times when a full subnet sweep will produce valuable diagnostic information about the network or a device's configuration.

**switch.** A Fibre Channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

**switch group.** A switch and the collection of devices connected to it that are not in other groups. Switch Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**system name.** Device name assigned by the vendor's third-party software.

**TCP.** See *Transmission Control Protocol*.

**TCP/IP.** See *Transmission Control Protocol/Internet Protocol*.

**terminate and stay resident program (TSR program).** A program that installs part of itself as an extension of DOS when it is executed.

**TFT.** See *thin-film transistor*.

**thin-film transistor (TFT).** A transistor created by using thin film methodology.

**topology.** The physical or logical arrangement of devices on a network. The three Fibre Channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

**TL\_Ports.** See *translated loop port*.

**translated loop ports (TL\_Ports).** Each TL\_Port connects to a private loop and allows connectivity between the private loop devices and *off loop* devices (devices not connected to that particular TL\_Port).

**Transmission Control Protocol (TCP).** A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packed-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

**trap.** In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

**trap recipient.** Receiver of a forwarded SNMP trap. Specifically, a trap receiver is defined by an IP address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

**TSR program.** See *terminate and stay resident program*.

**user action events.** Actions that the user takes, such as changes in the SAN, changed settings, and so on. Each such action is considered a User Action Event.

**vendor.** Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered but will always remain editable.

**VGA.** See *video graphics adapter*.

**video graphics adapter (VGA).** A computer adapter that provides high-resolution graphics and a total of 256 colors.

**video random access memory (VRAM).** A special type of dynamic RAM (DRAM) used in high-speed video applications, designed for storing the image to be displayed on a computer's monitor.

**VRAM.** See *video random access memory*.

**WORM.** See *write-once read-many*.

**Worldwide Name (WWN).** A registered, unique 64-bit identifier assigned to nodes and ports.

**write-once read-many (WORM).** Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered. Typically the storage medium is an optical disk whose surface is permanently etched by using a laser in order to record information. WORM media are high-capacity storage devices and have a significantly longer shelf life than magnetic media.

**WWN.** See *worldwide name*.

**XGA.** See *eXtended graphics array*.

**zoning.** A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.

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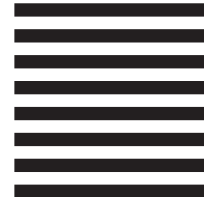
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