



IBM Netfinity FAStT Storage Manager
for Windows NT

Installation and Support Guide



Netfinity FASt Storage Manager for Windows NT

Installation and Support Guide

Before using this information and the product it supports, be sure to read the general information under "Appendix. Notices" on page 69.

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About this book

This book provides information about installing, setting up, and working with IBM® Netfinity® FAStT Storage Manager 7.x in a Microsoft® Windows NT® operating system environment. This *Installation and Support Guide* is written for system administrators. Use this guide to:

- Determine the hardware and software required to install the storage-management software
- Integrate the necessary hardware components into your network
- Install the storage-management software
- Upgrade controller firmware, if necessary
- Identify storage-management features unique to Windows NT

How this book is organized

"Chapter 1. Introduction" provides an overview of IBM Netfinity FAStT Storage Manager 7.x and describes storage subsystem-management methods, configuration types, types of installations, and installation requirements.

"Chapter 2. Preparing for installation" discusses setting up an information record and a BOOTP server, and describes other setup tasks.

"Chapter 3. Installing software in a standard configuration" gives the procedure for installing the software in a standard (non-cluster) environment.

"Chapter 4. Installing software in a cluster server environment" gives the procedure for installing the software in a cluster server environment.

"Chapter 5. Completing the installation" describes Enterprise Management and Subsystem Management, modifying NVSRAM configuration settings, and completing the installation tasks.

"Chapter 6. Operating system support" discusses Windows NT restrictions and using the Hot Add utility, SM7devices utility, and other software features.

"Appendix. Notices" provides product notices and trademark information.

Notices used in this book

This book contains notices to highlight information or provide safety information:

- **Note**

These notices provide important tips, guidance, or advice.

- **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.

- **Caution**

These notices indicate situations that can be potentially hazardous to you. A caution notice is placed just *before* descriptions of potentially hazardous procedure steps or situations.

Related publications

The following publications are available in Adobe® Acrobat® Portable Document Format (PDF) on the IBM Netfinity FAStT Storage Manager CD and on the World Wide Web at <http://www.ibm.com/pc/support/>

Note: The items denoted by an asterisk (*) in the list indicate publications that are printed and come with the IBM Netfinity FAStT500 RAID Controller Enclosure Unit.

- *IBM Netfinity FAStT Storage Manager for Windows NT Installation and Support Guide* (this book)*
- *IBM Netfinity FAStT500 RAID Controller Enclosure Unit Installation Guide**
- *IBM Netfinity FAStT500 RAID Controller Enclosure Unit User's Reference*
- *IBM Netfinity Fibre Channel Storage Manager Concepts Guide*

When you complete the tasks in this *Installation and Support Guide*, refer to the following online Help.

- *IBM Netfinity FAStT Storage Manager Enterprise Management Online Help*. Use this help system for more information about working with the management domain.
- *IBM Netfinity FAStT Storage Manager Subsystem Management Online Help*. Use this help system for more information about managing storage subsystems.

You can access the help systems from the Enterprise Management and Subsystem Management windows in Netfinity FAStT Storage Manager 7.x. Click the **Help** menu on the toolbar or press F1. The online help is available also in PDF on the software CD.

The help systems contain operating information common to all operating environments. Refer to this *Installation and Support Guide* for information specific to Windows NT.

Additional publications are available for purchase from IBM. For a list of publications available in your country:

- In the U.S. and Puerto Rico, call 1-800-426-7282.
- In the United Kingdom, call 01705-565000 or 0161-9056001.
- In Canada, call 1-800-465-1234.
- In other countries, contact the IBM support organization that services your area, your IBM marketing representative, or your IBM reseller.

Chapter 1. Introduction

IBM Netfinity FAStT Storage Manager 7.x is a Java-based tool that simplifies the management of the Netfinity Fibre Array Storage Technology (FAStT)500 RAID Controller Enclosure Unit. Netfinity FAStT Storage Manager 7.x was formerly known as Netfinity Fibre Channel Storage Manager 7.

The Netfinity FAStT Storage Manager 7.x software presents an interface for storage-management based on information supplied by the storage subsystem controllers. You can install the storage-management software on a *management station*, which is the system responsible for managing all, or a portion of, a network. The management station communicates with network management agents that reside in the managed node by means of a network management protocol, such as Simple Network Management Protocol (SNMP). When you manage a storage subsystem using the client software installed on a management station, commands are sent to the storage subsystem controllers. The controller firmware contains the necessary information to carry out the storage-management commands. The controller is responsible for validating and executing the commands and providing status and configuration information back to the client software.

Throughout this book, the terms *storage-management software* and *SM7* refer to the Netfinity FAStT Storage Manager 7.x software. The term *SM7* is a shortened name for Storage Manager 7.x, which itself is a shortened name for Netfinity FAStT Storage Manager 7.x. Individual components of the storage-management software are identified by name.

Storage subsystem management methods

Storage Manager 7.x provides two methods for managing storage subsystems:

- Host-agent managed
- Directly managed

Host-agent managed

In this method, you manage storage subsystems through an Ethernet connection to a host rather than through Ethernet connections to each controller. The host-agent passes communications from management stations to the controllers in the storage subsystems through a Fibre Channel I/O path. To use this method, you must install the host-agent software, Redundant Disk Array Controller (RDAC) driver, and the Microsoft Virtual Machine (VM) on the host.

The advantages of managing storage subsystems through the host-agent include:

- You do not have to run Ethernet cables to the controllers.
- You do not need a BOOTP server to connect to the network.
- You do not need to perform the controller network configuration tasks described in "Chapter 2. Preparing for installation".
- You have to specify a host name or IP address for only the host when adding devices, instead of for the individual controllers in a storage subsystem. Storage subsystems attached to the host are automatically discovered.

The disadvantage of using the host-agent method is that you are limited to configuring one less LUN than the maximum number allowed by the operating system and the host adapter you are using. The host-agent requires a special logical drive called an *Access Volume* to communicate with the controllers in the storage subsystem.

Note: The Access Volume uses one of the allowable logical unit numbers (LUNs). Windows NT allows a maximum number of LUNs depending on which Service Pack is installed and which host adapter you are using. For more information, see "Number of logical drives supported" on page 64.

The following figure shows a system in which storage subsystems are managed through the host-agent.

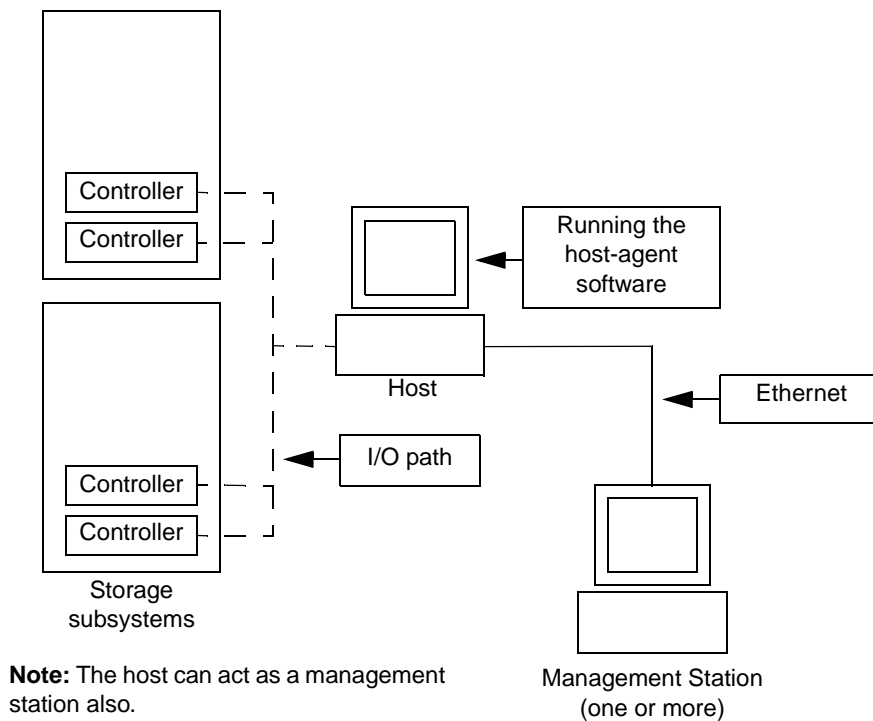


Figure 1. Host-agent managed storage subsystems

Directly managed

In this method, you manage storage subsystems directly over the network through each controller's Ethernet connection. To manage the storage subsystem through these Ethernet connections, you must define each controller's IP address and host name and attach a cable to the Ethernet connectors on the storage subsystem controllers.

The advantages of managing storage subsystems directly include:

- The Ethernet connections to the controllers enable a management station running Windows NT, to manage storage subsystems connected to a host with an operating system other than those supported by Storage Manager 7.x.
- You do not need to use an Access Volume to communicate with the controllers as you do if you are running the host-agent software. You can configure the maximum number of LUNs supported by the operating system and the host adapter you are using.

The disadvantages of managing storage subsystems directly include:

- It requires two Ethernet cables to connect both storage subsystem controllers to a network.
- You must specify an IP address or host name for each controller when adding devices.
- A BOOTP server and network preparation tasks are required. For a summary of the preparation tasks, see Table 4 on page 13.

The following figure shows a system in which storage subsystems are managed directly.

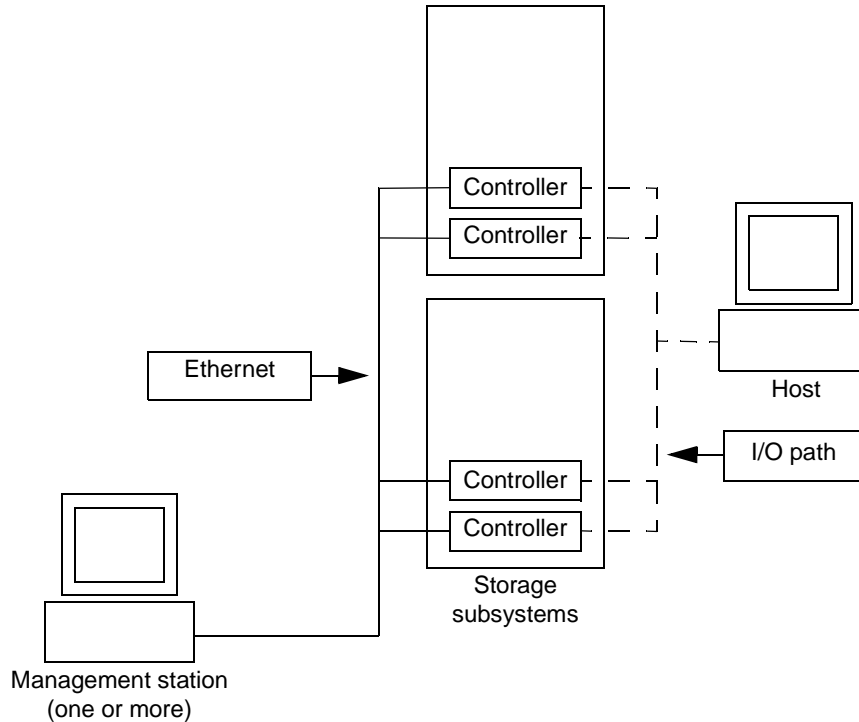


Figure 2. Directly managed storage subsystems

Software components

Storage Manager 7.x contains the following software components:

- Client software
- Host-agent
- RDAC package

Client software

The Storage Manager 7.x client (SM7client) component provides the graphical user interface for managing storage subsystems through the Ethernet network. The interface is completely new and streamlined from previous versions of the storage-management software. The SM7client contains two main components:

- Enterprise Management for adding, removing, and monitoring storage subsystems within the management domain
- Subsystem Management for managing the components of an individual storage subsystem

Host-agent package

The Storage Manager 7.x Agent (SM7agent) consists of two software components:

- Host-agent software
- SM7devices utility

The host-agent software enables you to manage storage subsystems through the host Ethernet connection. The host-agent software takes requests from a management station connected to the host through an Ethernet connection, and passes the requests to the storage subsystem controllers through the I/O path. For more information about managing storage subsystems through the host-agent, see "Storage subsystem management methods" on page 1.

The SM7devices utility enables you to associate storage subsystem logical drives with operating system device names. For more information about using SM7devices, see "Using the SM7devices utility" on page 67.

RDAC package

The Redundant Disk Array Controller (RDAC) package consists of two software components:

- RDAC multipath device driver
- Hot Add utility

The RDAC multipath device driver provides failover support to the other controller if a component along the I/O path fails.

The Hot Add utility enables you to register newly created logical drives with the operating system. For information on using the Hot Add utility, see "Using the Hot Add utility" on page 67.

Configuration types

You can install Netfinity FAStT Storage Manager 7.x in one of two configurations:

- Standard (non-cluster) configuration
- Cluster server configuration

Standard (non-cluster) configuration

The following table describes the storage-management software components that you can install in a standard configuration (not a cluster server environment).

Table 1: Standard configuration installation

Software component	Installed On	Notes
Storage Manager 7.x client (SM7client)	<p>You can install the client package on either of the following:</p> <ul style="list-style-type: none"> • Management station (for direct or host-agent management) • Host machine (for a non-network configuration similar to previous versions of the storage-management software) 	<ul style="list-style-type: none"> • Management stations If you install the SM7client on one or more management stations, you can choose to manage storage subsystems directly through Ethernet connections to the controllers, over the network through the host-agent, or a combination of both methods. • Host machines If you install the SM7client on the host machine, you do not need to be connected to a network as long as the host-agent software is installed. However, the host machine must have the TCP/IP-protocol software installed and you must assign a static IP address to the host.
RDAC	Host machine	The RDAC component is required for controller failover support and is a required component for installing and using the software contained in the host-agent package.
Microsoft Virtual Machine	Host machine	The Microsoft Virtual Machine is a required component for installing and using the software contained in the host-agent package.
Storage Manager 7.x agent (SM7agent)	Host machine	You must install the SM7agent even if you choose not to manage storage subsystems with the host-agent software. The host-agent contains important utilities necessary for operating the storage-management software.

The following figure shows an example of a standard configuration, including a management station. You can install the SM7client on a standalone host machine if that host has the TCP/IP-protocol software installed and the host has a static IP address. If you want to manage storage subsystems with the host-agent software, you must also install the Microsoft Virtual Machine (VM) on the host.

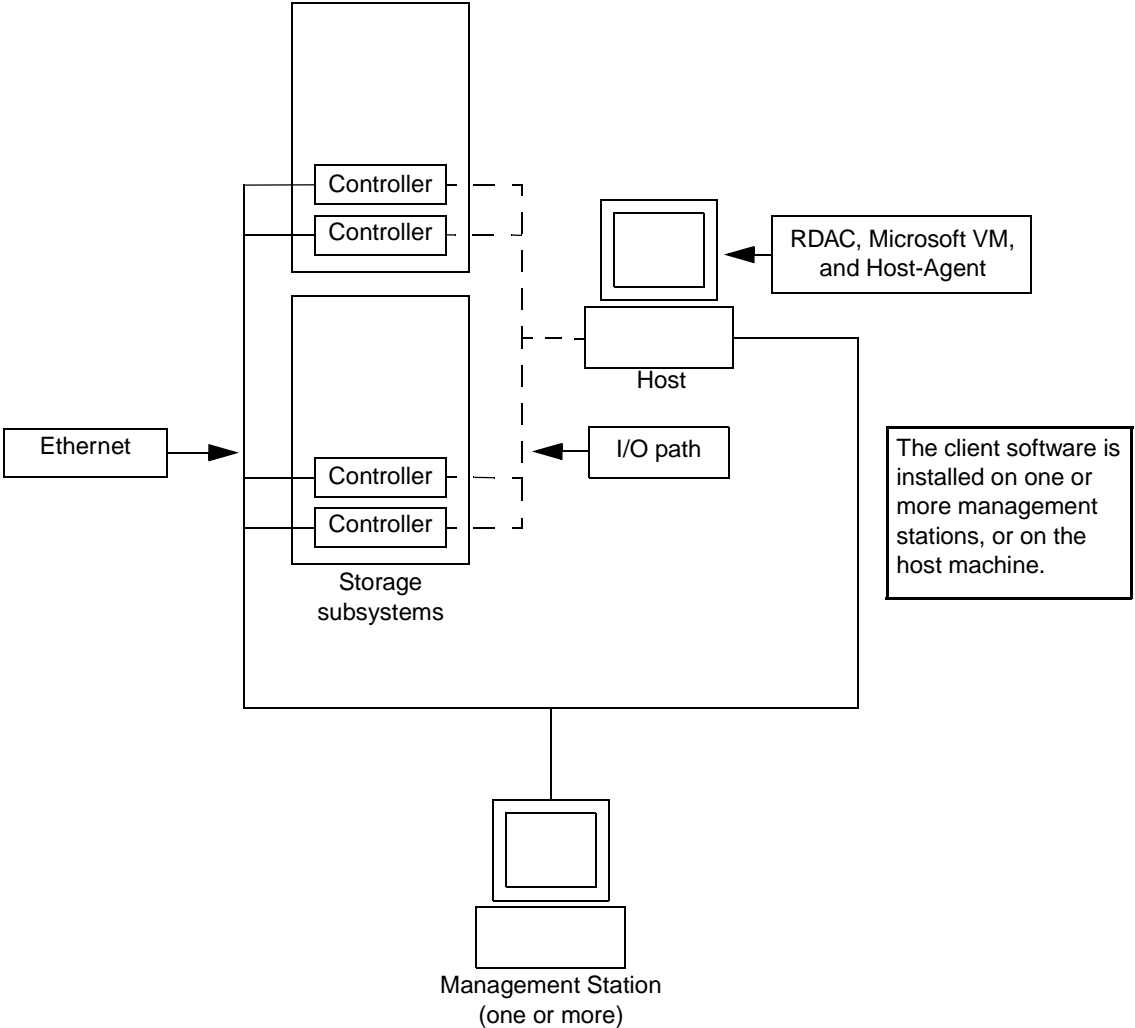


Figure 3. Sample standard (non-cluster) configurations

Cluster server configuration

The following table describes the storage-management software components that you can install in a cluster server environment.

Table 2: Cluster server installation

Software Component	Installed On	Notes
Storage Manager 7.x client (SM7client)	You can install the SM7client package on the following: <ul style="list-style-type: none"> • Management station (for direct or host-agent management) • Nodes A and B (for direct or host-agent management) 	<ul style="list-style-type: none"> • Management stations If you install the SM7client on one or more management stations, you can choose to manage storage subsystems directly through Ethernet connections to the controllers, over the network through the host-agent, or a combination of both methods. • Nodes A and B If you install the SM7client on the cluster servers (Nodes A and B), you do not need to be connected to a network as long as the host-agent software is installed. However, the host machine must have the TCP/IP-protocol software installed, and you must assign a static IP address to the cluster server.
RDAC	Nodes A and B	The RDAC component is required for controller failover support and is a required component for installing and using the software contained in the host-agent package.
Microsoft Virtual Machine	Nodes A and B	The Microsoft Virtual Machine is a required component for installing and using the software contained in the host-agent package.
Storage Manager 7.x agent (SM7agent)	Nodes A and B	You must install the host-agent even if you choose not to manage storage subsystems with the host-agent software. The host-agent contains important utilities necessary for operating the storage-management software.

The following figure shows an example of a cluster server configuration.

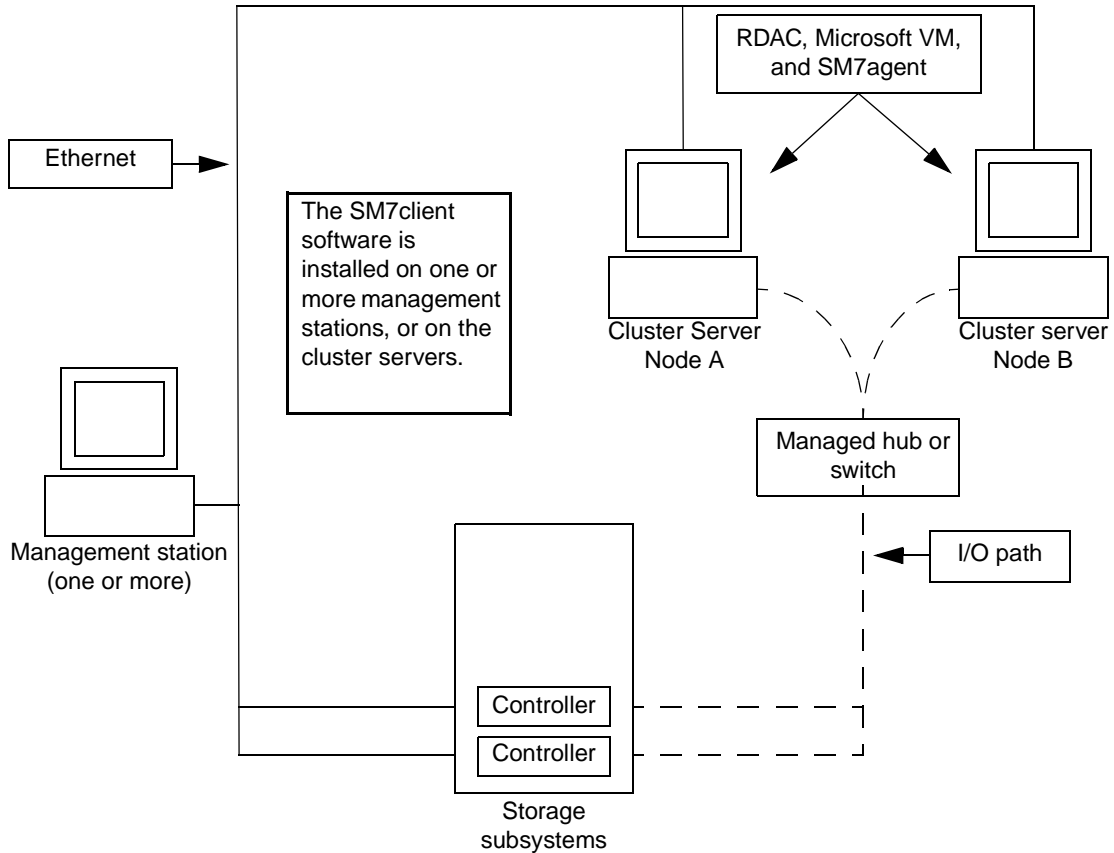


Figure 4. Sample cluster server configuration (single loop)

Installation requirements

You must install the hardware and software components that are listed in the following sections before installing the storage-management software.

Hardware requirements

The following hardware is required:

- For directly-managed storage subsystems, you must have *one* of the following types of BOOTP servers installed on the network:
 - UNIX[®] BOOTP server (usually provided with the UNIX operating system)
 - Microsoft BOOTP-compatible DHCP server for Windows NT Server 4.0 with Service Pack 4 or 5

- Storage subsystems with controllers using firmware version 4.x.
- Compatible host adapters, managed hubs, and switches, depending on the type of configuration. Refer to the README file on the installation CD for the latest information about host adapters and host adapter drivers.

Firmware requirements

Storage Manager 7.x operates only with controller models 4776 or later and firmware version 4.00 or later. If you want to manage controllers with Storage Manager 7.x, you must upgrade the firmware to version 4.00 or later.

Software requirements

The following table contains the installation requirements for each of the software packages.

Table 3: Installation requirements by software

Requirement	Software			
	SM7client	RDAC	Microsoft VM	SM7agent
Available disk space	20 MB	1 MB	1 MB	1 MB
Administrator privileges	Not required	Required	Required	Required
Minimum display settings	800 x 600 pixels, 256 colors	640 x 480 pixels, 256 colors ¹	640 x 480 pixels, 256 colors ¹	640 x 480 pixels, 256 colors ¹

¹ These settings are for the InstallShield installation of the software.

Operating system requirements

- *Management stations* – install one of the following operating systems:
 - Windows NT Server 4.0 with Service Pack 4 or 5
 - Windows NT Workstation 4.0 with Service Pack 4 or 5
- *Hosts* – install one of the following operating systems:
 - Windows NT Server 4.0 with Service Pack 4 or 5
 - Windows NT Workstation 4.0 with Service Pack 4 or 5
 - Windows NT 4.0 Enterprise Edition with Service Pack 4 or 5
- *Cluster servers* – install Windows NT 4.0 Enterprise Edition with Service Pack 4 or 5

Chapter 2. Preparing for installation

This chapter helps you plan and prepare for installing the storage-management software.

Deciding how to manage storage subsystems

If you have not already done so, see "Storage subsystem management methods" on page 1 for information about the following two methods for managing storage subsystems:

- Direct management through Ethernet connections to each controller on the storage subsystem
- Host-agent management through the host-agent software installed on the host machine connected to the storage subsystem

You can use one or both methods. However, because many of the preparation tasks for installation depend on which method you use, before you begin decide how you want to manage the storage subsystems on your network.

Reviewing a sample network

Figure 5 on page 12 shows a sample network setup. Network A shows an example of a directly-managed storage subsystem installation. This network contains the following components:

- BOOTP server
- Network management station (NMS) for Simple Network Management Protocol (SNMP) traps
- Host connected to a storage subsystem through a Fibre Channel I/O path
- Management station connected by Ethernet cables to the storage subsystem controllers

Network B shows an example of a host-agent managed storage subsystem installation. This network contains a host connected to a storage subsystem through a Fibre Channel I/O path, and a management station connected to the Ethernet network.

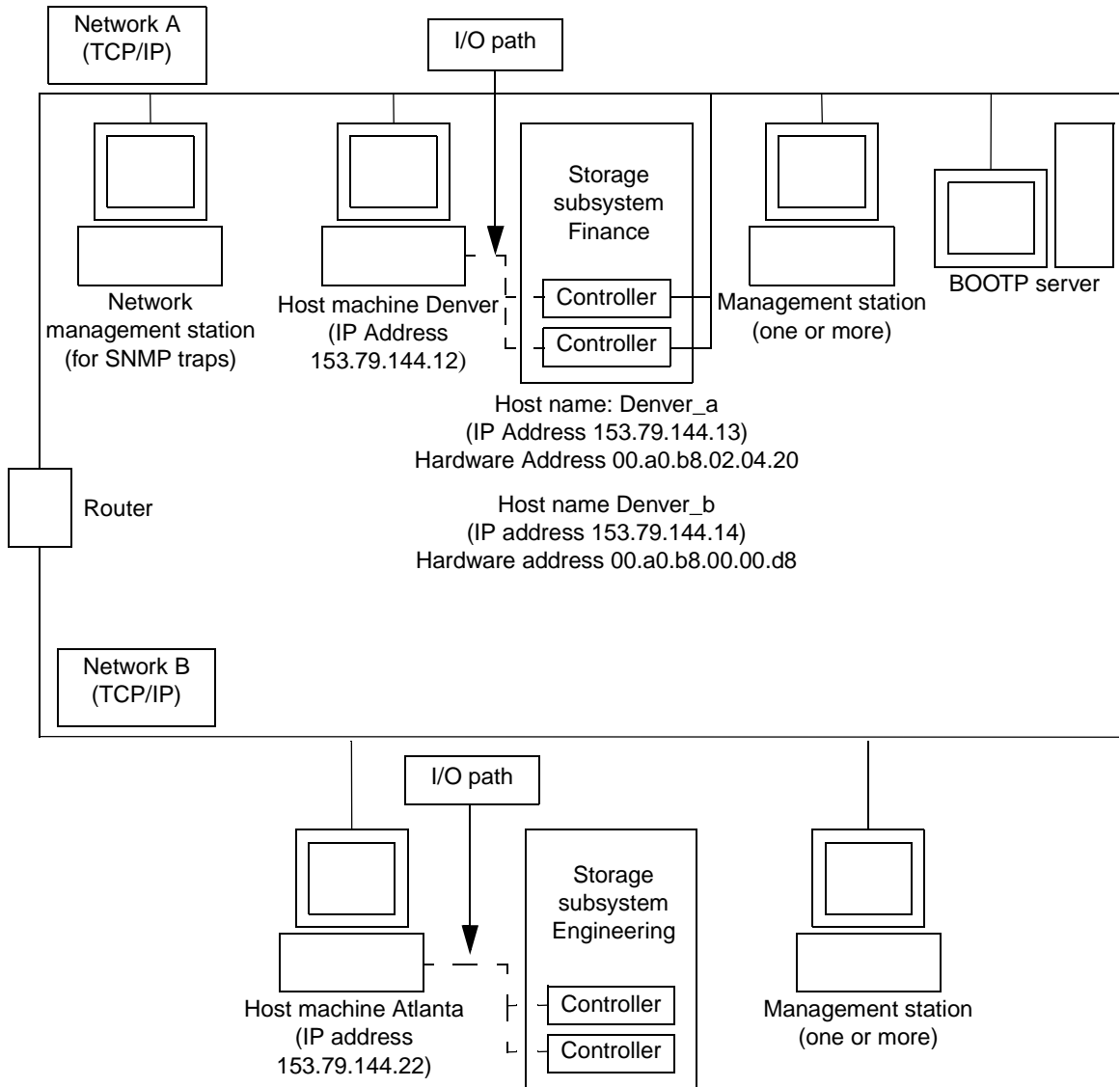


Figure 5. Sample network

Setting up an information record

Before you install the storage-management software, make sure that the network components are set up and operating properly, and that you have all the host and controller information needed for the software to operate correctly. To do this, perform the tasks summarized in Table 4 (referring to the appropriate procedures). Use Table 6 on page 16 as a data sheet to record storage subsystem and controller information.

Table 4: Network preparation task summary

Task to perform	For direct or host-agent?	Why perform this task?	For instructions, see:
1 Install all hardware components (host machines, storage subsystems, cables, and so on) that you want to connect to the network.	Both	To ensure that the network hardware is present.	The installation guide specific to the hardware components.
2 Establish and record a naming convention for the storage subsystems connected to the network.	Both	To add the storage subsystems to the management domain after installing the software.	"Deciding how to name the storage subsystems" on page 17.
3 Determine the hardware Ethernet address for each controller in all storage subsystems connected to the network.	Direct	To set up the BOOTP server to provide network configuration information to the controllers.	"Identifying the hardware Ethernet address for each controller" on page 17.

Table 4: Network preparation task summary (continued)

Task to perform	For direct or host-agent?	Why perform this task?	For instructions, see:
<p>4 Obtain IP addresses and host names from the network administrator</p>	Both	<p>For host-agent management, you need the IP addresses and host names of the host on which the host-agent software will run.</p> <p>For direct management, you need the IP addresses of each controller in the storage subsystems to configure the BOOTP server so it can provide network configuration information to the controllers. Also, you use the IP addresses of the controllers to set up the host or DNS table.</p>	<p>"Obtaining IP addresses for hosts and controllers" on page 19.</p>
<p>5 Set up the BOOTP server to provide network configuration information for a specific controller.</p>	Direct	<p>To provide network configuration information to the controllers using the BOOTP server.</p>	<p>"Setting up the BOOTP server" on page 19.</p>
<p>6 Verify that the TCP/IP protocol is installed and set up the host or DNS table.</p>	Direct	<p>Installing the client software on a management station, ensures that the management station is configured to reach the controllers over the network. If the client software is installed on the host, the TCP/IP-protocol software is still necessary for successful communication between the client software and the controllers.</p>	<p>"Verify the TCP/IP protocol and set up the host or DNS table" on page 27.</p>
<p>7 Power on the devices connected to the network.</p>	Both	<p>To ensure that all devices and links are operational.</p>	<p>The installation guide specific to the hardware components.</p>

The following table shows a sample information record with entries for a directly managed storage subsystem and a host-agent managed storage subsystem.

Table 5: Sample information record

Storage subsystem name (see page 17)	Management type (see page 11)	Controllers—Ethernet and IP addresses, and host name (see pages 17 and 19)		Host—IP address and host name (see page 19)
Storage Subsystem Finance	Direct	Hardware Ethernet address = 00a0b8020420	Hardware Ethernet address = 00a0b80000d8	
		IP address = 153.79.144.13	IP address = 153.79.144.14	
		Host = Denver_a	Host = Denver_b	
Storage Subsystem Engineering	Host-agent			IP address = 153.79.111.22
				Host = Atlanta

Table 6 on page 16 provides a data sheet on which you can record storage subsystem names, management types, hardware Ethernet addresses, and IP addresses. Make a copy of this table and complete the information for your storage subsystems and controllers. Use the information recorded in Table 6 to set up the BOOTP table for the network server and the host or DNS (Domain Name System) table. The information in Table 6 helps you add storage subsystems after initial installation. The column headings show a page reference for detailed instructions about obtaining the information. For a sample information record, see Table 5.

Table 6: Storage subsystem and controller information record

Storage subsystem name (see page 17)	Management type (see page 11)	Controllers—Ethernet and IP addresses, and host name (see pages 17 and 19)		Host—IP address and host name (see page 19))
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				
Storage subsystem name:				

Completing the preparation tasks

The following list contains task you might need to do before you are ready to install Storage Manager 7.x.

- "Deciding how to name the storage subsystems"
- "Identifying the hardware Ethernet address for each controller"
- "Obtaining IP addresses for hosts and controllers"
- "Setting up the BOOTP server"
- "Verify the TCP/IP protocol and set up the host or DNS table"
- "Enabling ports for operation through a firewall"

Deciding how to name the storage subsystems

As you set up your network, decide the naming convention for the storage subsystems. After 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.

The following list provides tips for 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 would quickly lose their meaning in the future.
- The software displays storage subsystem names with the prefix "Storage Subsystem." Therefore, if you rename a storage subsystem "Engineering," it displays as Storage Subsystem Engineering.

Once you have decided on a naming scheme, record the storage subsystem names in the information record (Table 6 on page 16).

Identifying the hardware Ethernet address for each controller

Use the following procedure if you plan to directly manage storage subsystems through Ethernet connections to each controller. If you plan to manage storage subsystems using the host-agent software, skip this procedure and go to "Obtaining IP addresses for hosts and controllers" on page 19.

- 1** Remove the front bezel from the controller unit, as shown in Figure 6. Carefully pull the bottom of the bezel out to release the pins; then slide the bezel down.

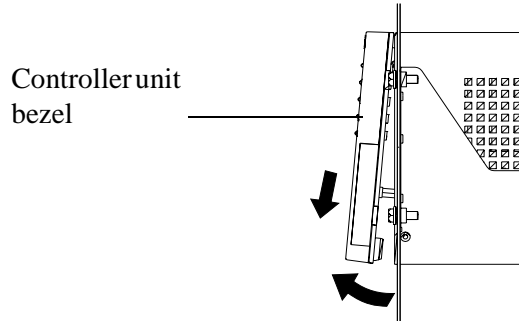


Figure 6. Removing the controller unit bezel

- 2 Unlock and open the levers on the RAID controllers.

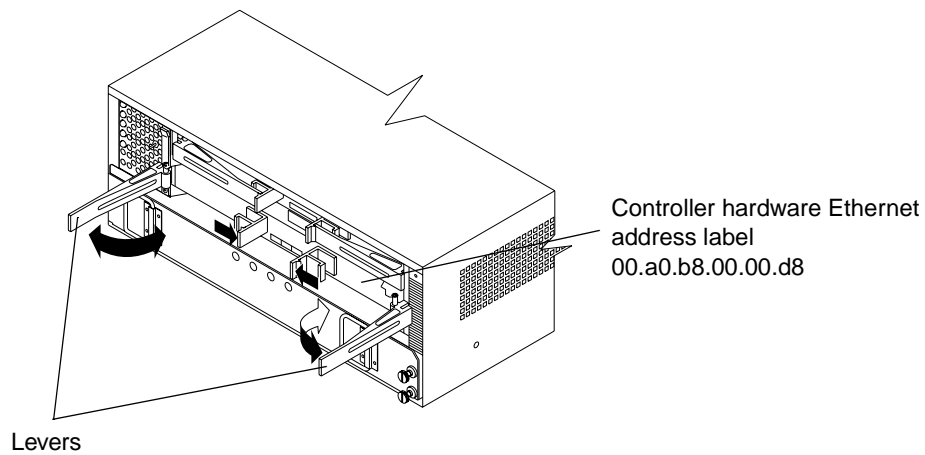


Figure 7. Location of the levers and the Ethernet address label

- 3 Look on the front of each controller for a label with the controller hardware Ethernet address, as shown in Figure 7.

The number will be in the form *xx.xx.xx.xx.xx.xx* (for example, 00.a0.b8.00.00.d8).

- 4 Record each Ethernet address in the information record (Table 6 on page 16).
- 5 To replace the bezel, slide the top edge under the lip on the chassis; then push the bezel bottom until the pins snap into the mounting holes, as shown in Figure 8 on page 19.

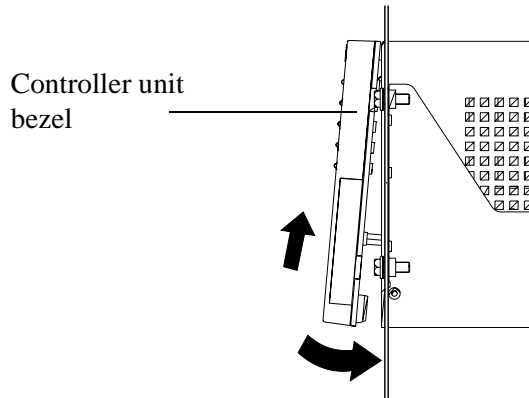


Figure 8. Replacing the controller unit bezel

- 6 Continue with "Obtaining IP addresses for hosts and controllers".

Obtaining IP addresses for hosts and controllers

If you want to	Go to
Manage storage subsystems directly	Step 1
Manage storage subsystems with the host-agent	Step 2

Note: If you intend to manage some storage subsystems directly and others with the host-agent software, complete both of the following steps.

- 1 Assign (or obtain from the network administrator) a unique IP address and associated host name for each controller in every storage subsystem on the network. Record the IP address and host name for each controller in the information record (Table 6 on page 16). Then go to "Setting up the BOOTP server" on page 19.
- 2 Contact the network administrator to obtain the IP address and host name for each host on which you plan to install the host-agent software for managing storage subsystems. Record the IP address and host name for the host in the information record (Table 6 on page 16). Then go to "What's next?" on page 28.

Setting up the BOOTP server

Use the following procedure if you plan to directly manage storage subsystems through the Ethernet connection to each controller. If you plan to manage storage subsystems using the host-agent software, go to "What's next?" on page 28.

Table 7 contains the required entries for setting up a UNIX BOOTP server or a BOOTP-compatible DHCP server. Review the entries and then select the correct procedure for the type of BOOTP server you are using.

Table 7: Required entries for setting up the BOOTP server

Entry	Description	Sample format in BOOTP server
Subnet mask	Mask used to route packets to defined subnets.	dot notation (sm=255.255.248.0)
Router	IP address of the machine that routes packets to networks.	dot notation (gw=153.79.144.2)
Host name for the controller	Host name associated with the controller (see Table 6 on page 16).	host name (Denver_a)
IP address	IP address of the controller (see Table 6 on page 16).	dot notation (ip=153.79.144.13)
Ethernet address	Controller's hardware Ethernet address (see Table 6 on page 16).	hexadecimal notation (ha=00a0b8020420)

Select the appropriate procedure for setting up the BOOTP server.

UNIX BOOTP	Microsoft BOOTP-compatible DHCP
Continue with "Using a UNIX BOOTP server" on page 20.	Go to "Using Microsoft DHCP as a BOOTP-compatible server" on page 21.

Using a UNIX BOOTP server

- 1 Use Table 6 on page 16 and Table 7 to set up the BOOTP table and make the required entries for supporting the controllers in the network storage subsystems. For more information, see "Example for editing a UNIX BOOTP table" on page 21.

Note: To set up this BOOTP server, use a text editor to edit the bootptab file in the /etc directory.

- 2 Turn on power to the storage subsystems so the parameters in the BOOTP table take effect.
- 3 When you finish setting up the BOOTP table, go to "Verify the TCP/IP protocol and set up the host or DNS table" on page 27.

Example for editing a UNIX BOOTP table

The following example of a BOOTP table assumes you are configuring a UNIX BOOTP server, such as a server on Network A, as shown in Figure 5 on page 12. The `s4.default:\` entry denotes settings that are common to all controllers. The `tc=s4.default:\` entry associates this common setting group to a specific controller.

```
s4.default:\ (common settings)

    ht=ether:\

    sm=255.255.248.0:\

    gw=153.79.144.2:\

    hn:

denver_a:\

    tc=s4.default:\ (refers to common settings)

    ip=153.79.144.13:\

    ha=00a0b8020420:

denver_b:\

    tc=s4.default:\

    ip=153.79.144.14:\

    ha=00a0b80000d8:
```

Using Microsoft DHCP as a BOOTP-compatible 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, use the following installation procedure.

Note: The following steps and window examples assume you are configuring a Windows NT DHCP server using its DHCP Manager.

Use the following procedure to install the DHCP Manager:

- 1** Click **Start** → **Settings** → **Control Panel**.
- 2** Double-click the **Network** icon.
- 3** In the Network window that opens, click the **Services** tab.
- 4** Click **DHCP Server Network Services** → **Add**.
- 5** Reinstall Windows NT Service Pack 4 or 5 to get new DHCP settings or information associated with the respective service pack.
- 6** Continue with "Setting up a DHCP server".

Setting up a DHCP server

Use the following procedure, along with Table 6 on page 16 and Table 7 on page 20, to set up the 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 window opens.

The screenshot shows the 'Create Scope - (Local)' dialog box. It is titled 'Create Scope - (Local)' and has a close button (X) in the top right corner. The dialog is divided into two main sections: 'IP Address Pool' and 'Lease Duration'. The 'IP Address Pool' section contains fields for 'Start Address' (153.79.144.1), 'End Address' (153.79.144.50), and 'Subnet Mask' (255.255.248.0). Below these are 'Exclusion Range' fields for 'Start Address' and 'End Address', with 'Add >' and '< Remove' buttons. To the right is an 'Excluded Addresses' list box. The 'Lease Duration' section has a radio button selected for 'Unlimited' and another for 'Limited To: 3 Day(s) 00 Hour(s) 00 Minute(s)'. At the bottom are 'Name:' and 'Comment:' text boxes, and 'OK', 'Cancel', and 'Help' buttons.

- c Enter the starting and ending IP addresses of the controllers you are configuring on the network.

For example, if you are configuring 50 controllers on a 153.79.144.0 subnet, the starting address should be set to 153.79.144.1 and the ending address should be set 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, enter its address for both the starting and ending addresses.

- d Enter the subnet mask (obtained from your network administrator).
- e Set the Lease Duration to **Unlimited**. This makes the DHCP connection permanent.
- f If you want, add a Scope Name and Comment.
- g Click **OK**.
- h When the scope has successfully completed, click **Yes** to activate it.

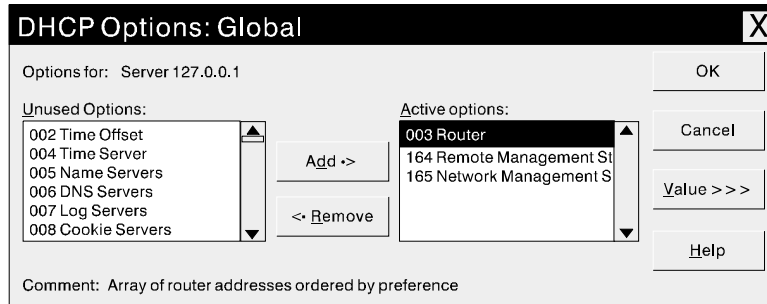
You return to the DHCP Manager window.

- 3 Use the following to configure global scope options. The scope options enable you to configure settings applicable to all controllers. To determine which parameters to apply to the entire group, see Table 7 on page 20.

Note: You can apply options to specific controllers later using Step 5 on page 25.

- a Click **DHCP Options** → **Global**.

The DHCP Options: Global window opens.



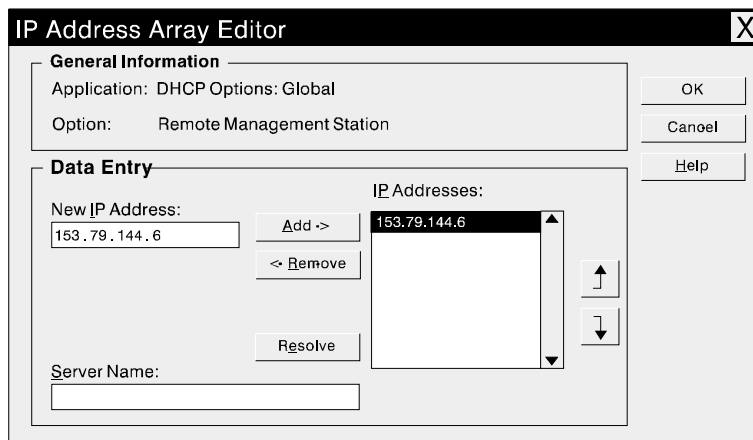
- b Highlight an item in the Unused Options list and click **Add** to move it to the Active options list. Each option is preceded by its tag number.

- c Click **Value** to assign a value to the active option.

The Value option is not selectable and the Edit Array option window opens in the lower part of the screen.

- d If you need to add an IP address, click **Edit Array**.

The IP Address Array Editor window opens.



The above figure shows an example of adding the IP address for a management station.

If you do not need to add an IP address, go to Step g.

- e Enter the unique IP address for the option you added.
f Click **Add** to move the New IP Address to the IP Addresses list.
g Click **OK**.

You return to the DHCP Options: Global window.

- h** Repeat Step b through Step g until all global options are added.
- i** When you finish adding the Global Scope Options, click **OK** at the DHCP Options: Global window.

You return to the DHCP Manager window.

- 4** Use the following procedure to create a reservation for each controller. Use the data sheet you created in Table 6 on page 16 to make sure you include all of the controllers for every storage subsystem on the network.

- a** Click **Scope** → **Add Reservations**.

- b** In the **IP Address** field, enter the IP address for the first controller on your data sheet.

- c** In the **Unique Identifier** field, enter the controller hardware Ethernet address.

- d** In the **Client Name** field, enter the controller eight-character name.

- e** Click **Add**.

The window is reset and ready for the next entry.

- f** Repeat Step b through Step e for each controller listed in Table 6 on page 16.

- g** When you finish entering the information for all of the controllers, click **Close**.

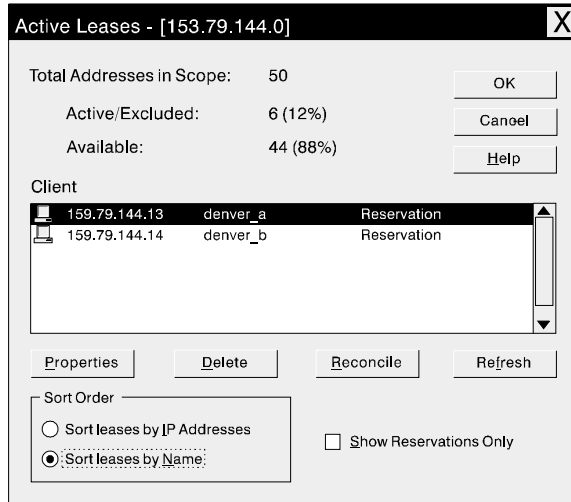
You return to the DHCP Manager window.

- 5** Use the following procedure to configure controller-specific options. Creating a controller-specific option enables you to associate a controller configuration entry with a specific controller added in Step 4.

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**.

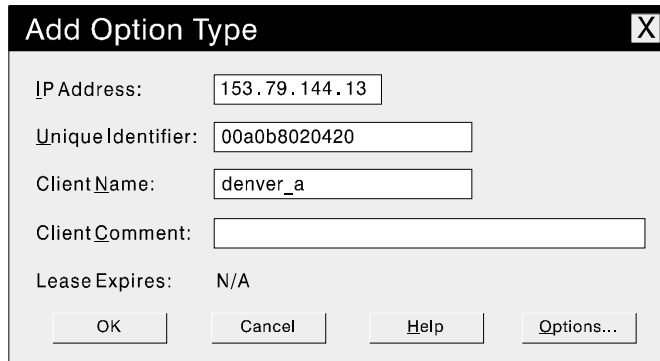
The Active Leases window opens.



- b Highlight a controller in the list.

- c Click **Properties**.

The Add Option Type window opens. The Unique Identifier is the hardware Ethernet address that you added in step 4c on page 25.



- d Click **Options**.

The DHCP Options: Reservations window opens.

- e Highlight an entry in 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** Enter the information for the value of the option.

For example, for Host Name, enter the host name for the controller (from Table 6 on page 16) in the String box. Click **Edit** if the value you need to add is an IP address for a router.

- h** Repeat Step e through Step g until you finish adding specific options for this controller.

- i** Click **OK**.

You return to the Add Option Type window.

- j** Click **OK**.

You return to the Active Leases window.

- k** Repeat Step b through Step j until you finish adding controller-specific options for every controller.

- l** When you finish adding specific options for all controllers, click **OK** at the Active Leases window.

You return to the DHCP Manager window.

- 6** Continue with "Verify the TCP/IP protocol and set up the host or DNS table".

Verify the TCP/IP protocol and set up the host or DNS table

Make sure that the host names for the controller correspond to the appropriate IP addresses for the controllers. 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 (Domain Name System) table.

Note: You might choose to use the Windows Internet Name Service (WINS) rather than DNS.

- 1** Click **Start** → **Settings** → **Control Panel** → **Network** → **Protocols** to verify that the TCP/IP protocol is installed and configured properly.

Note: If the TCP/IP protocol is not installed, load it from the Windows NT Installation CD. Click **Start** → **Settings** → **Control Panel** → **Network** → **Protocols** → **Add**.

- 2** Update either the host or DNS table to specify a host name to associate with an IP address. If you do not have a DNS, edit the two host tables found in the following directories:

c:\winnt\system32\drivers\etc\hosts

c:\winnt\system32\drivers\etc\lmhosts

For example, to set up the host tables for the controllers connected to Network A (Figure 5 on page 12), use a text editor to create the following IP address and controller name entries.

IP address	Host name for the controller
127.0.0.01	localhost
153.79.144.13	denver_a
153.79.144.14	denver_b

- 3 If you want to manage storage subsystems through a firewall, continue with "Enabling ports for operation through a firewall". Otherwise, go to "What's next?".

Enabling ports for operation through a firewall

If you plan to manage storage subsystems through a packet-filtering firewall, configure the firewall to open port 2463 to TCP data.

What's next?

You have completed the preparations tasks and are now ready to install the storage-management software. The installation process you follow depends on how you want to configure the system.

If you want to	Go to
Install the software in a standard (non-cluster) configuration	"Chapter 3. Installing software in a standard configuration" on page 29.
Install the software in a cluster server environment	"Chapter 4. Installing software in a cluster server environment" on page 39.

Chapter 3. Installing software in a standard configuration

This chapter describes how to install the storage-management software in a standard (non-cluster) configuration.

Important: Always check for a README file on any installation media. This README file might contain important information that was not available at the time this *Installation and Support Guide* was prepared.

Installation process

Begin the installation of the storage-management software with "Installing SM7client" on page 30. Continue the process until you have completed "Installing SM7agent" on page 36.

The following figure shows a flowchart of the installation process.

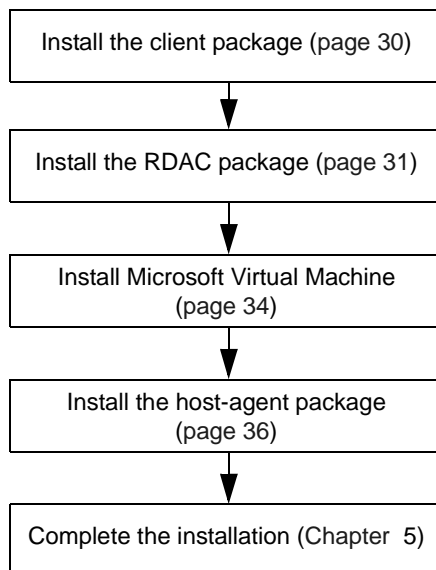


Figure 9. Installation process

Installing SM7client

Use the following procedure to install the SM7client on a management station configured with one of the following:

- Windows NT Server 4.0 with Service Pack 4 or 5
- Windows NT Workstation 4.0 with Service Pack 4 or 5

Important: If you want to install SM7client on a standalone host and manage storage subsystems through the I/O path rather than over the network, you must install the TCP/IP-protocol software on the host and assign a static IP address to the host. The host operating system must be Windows NT Server 4.0 or Windows NT Workstation 4.0.

Before you begin

Before you install the software, make sure that:

- The management station has at least 20 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors.
- You have closed all other programs.

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.
- 4 Click **Browse**.
The Browse window opens.
- 5 Select the CD-ROM drive.
- 6 Select the \SM7client directory.
- 7 Select the setup.exe file, and then click **Open**.

8 Click **Finish**.

The setup program Welcome window opens.

9 Click **Next** to begin the installation.

The Choose Destination Location window opens.

10 Click **Browse** if you want to change the destination location.

11 Click **Next**.

12 When the installation is complete, click **Finish**.

Verifying the installation

Use the following procedure to verify that the installation was successful.

1 Click **Start** → **Programs**.

2 Verify that Netfinity Fibre Channel Storage Manager 7 client appears in the list of programs.

3 Go to "Installing RDAC".

Installing RDAC

Use the following procedure to install RDAC on a host machine connected to one or more storage subsystems.

RDAC consists of the following components:

- The multipath device driver necessary for controller failover support
- The Hot Add utility for dynamically adding logical drives to the operating system (see "Using the Hot Add utility" on page 67)

Important: You must install RDAC before installing the SM7agent package.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.

- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors.
- You close all other programs.

Assigning drive letters

The installation procedure loads the RDAC device driver before the native Windows NT class device driver. This is necessary to enable RDAC functionality. However, this means that the system recognizes the storage subsystem logical drives before it recognizes any local drives, and assigns drive letters accordingly.

Note: *Before* you install this software, you *must* have “sticky” drive letters assigned to the existing local drives.

Use the following procedure to determine if you need to assign sticky drive letters and to assign them, if necessary.

- 1 Power off the storage subsystem to prevent Disk Administrator (WINDISK) from locking up while you are assigning drive letters and installing the RDAC device driver.
- 2 Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and to check the number of partitions.

If you have <i>two</i> or more partitions:	If you have only <i>one</i> partition:
Go to Step 3.	Go to Step 4.

- 3 If you have *at least two* partitions (the boot partition and one other partition) and *both* of the following conditions apply, go to "Installation instructions" on page 33. Otherwise, go to Step 4.
 - The last partition you created was created with Disk Administrator.
 - The partition has a drive letter assigned and has a status of Unknown or has a file system on it (that is, it has a status other than Unformatted).

- 4 Use the following procedure to create a new partition.

Important: If you have no room for a second partition on the local system, you can use a storage subsystem logical drive for the second partition. The storage subsystem must have at least one logical drive configured on it. You can access the logical drive without installing the storage-management software. Connect the storage subsystem and power on the system; then, restart the system. Configured logical drives appear in the Disk Administrator and you can create a second partition on a logical drive using Step a through Step c. You can delete or modify the logical drive later, without causing the boot partition drive letter to be reassigned.

- a Select a drive containing free disk space.
 - b Click **Partition** → **Create**. The partition is created (a drive letter is assigned and the partition status is Unformatted).
 - c Click **Partition** → **Commit Changes Now**. The partition status changes to Unknown, and sticky drive letters are assigned to all existing partitions.
- 5 Continue with "Installation instructions".

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.
- 4 Click **Browse**.
The Browse window opens.
- 5 Select the CD-ROM drive.
- 6 Select the \RDAC directory.
- 7 Select the setup.exe file, and then click **Open**.
- 8 Click **Finish**.
The setup program Welcome window opens.
- 9 Click **Next** to begin the installation.
When RDAC is installed, the Setup Complete window opens.

- 10 Click **No, I will restart my computer later**; then, click **Finish**.
- 11 Click **Start** → **Shutdown**.
The Shut Down Windows window opens.
- 12 Click **Shutdown** to shut down the server.
- 13 Power on the storage subsystem.
- 14 After the storage subsystem is powered on completely, power on the host to ensure that the changes take effect.

Verifying the installation

Use the following procedure to verify that the installation was successful.

- 1 Click **Start** → **Settings** → **Control Panel** → **Devices**.
The Devices window opens.
- 2 Scroll through the list of devices until you find **symarray**.
- 3 Make sure that the status of the **symarray** device is Started.
- 4 Continue with "Installing Microsoft Virtual Machine (VM)".

Installing Microsoft Virtual Machine (VM)

Use the following procedure to install Microsoft Virtual Machine (VM) on a host machine connected to one or more storage subsystems.

Important: You must install the Microsoft Virtual Machine (VM) before installing SM7agent.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors.

- You close all other programs.

Important: The Netfinity FASSt Storage Manager 7.x Installation CD contains a version of Microsoft VM that was tested with the storage-management software. Before you install this version, go to the Web site at <http://www.ibm.com/pc/support> to see if a newer version of the software is available. Also, check the Web site for the latest support information.

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.
- 4 Click **Browse**.
The Browse window opens.
- 5 Select the CD-ROM drive.
- 6 Select the \SM7agent directory.
- 7 Select the msjavx86.exe file, and then click **Open**.
- 8 Click **Finish** and follow the instructions on the screen.
When the software is installed, the Setup Complete window opens.
Note: You must restart the host to ensure that all changes take effect.
- 9 Click **Yes** to restart the host.
- 10 Continue with "Installing SM7agent" on page 36.

Installing SM7agent

Use the following procedure to install SM7agent on a host machine connected to one or more storage subsystems.

SM7agent consists of the following components:

- The host-agent software necessary for host-agent management of the storage subsystems
- The SM7devices utility necessary for relating logical drives to operating system device names. For more information, see "Using the SM7devices utility" on page 67.

Important: You cannot install SM7agent unless RDAC is installed. The Microsoft Virtual Machine is also a required component for installing and using SM7agent.

You must install SM7agent even if you do not intend to manage storage subsystems through the host-agent software.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256.
- You installed RDAC and the Microsoft Virtual Machine (VM).
- You close all other programs.

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.

- 4 Click **Browse**.

The Browse window opens.

- 5 Select the CD-ROM drive.

- 6 Select the \SM7agent directory.

- 7 Select the setup.exe file, and then click **Open**.

- 8 Click **Finish**.

The setup program Welcome window opens.

- 9 Click **Next** to begin the installation.

When SM7agent is installed, the Setup Complete window opens.

Note: You must restart the host to ensure that all changes take effect.

- 10 Click **Finish** to restart the host.

Verifying the installation

Use the following procedure to verify that the installation was successful.

- 1 Click **Start** → **Settings** → **Control Panel** → **Services**.

The Services window opens.

- 2 Scroll through the list of services until you find the Netfinity Fibre Channel Storage Manager 7 agent.

- 3 Make sure that the status of the agent service is Started.

Note: If the host-agent does not find controllers connected that have firmware version 4.x installed, the following Service Control Manager message appears:

```
At least one service or driver failed during system
startup. Use Event Viewer to examine the event log for
details.
```

When the host is connected to a storage subsystem with firmware version 4.x installed, the host-agent starts automatically after the system is restarted.

Note: If you are not using the host-agent software to manage storage subsystems, you can stop the host-agent service. Click **Start** → **Settings** → **Control Panel** → **Services**. Select the host-agent from the list of displayed services and click **Startup**. Under Startup Type, click **Manual**, and then click **OK**.

- 4 Go to "Chapter 5. Completing the installation" on page 53.

Chapter 4. Installing software in a cluster server environment

This chapter describes how to install the storage-management software in the multi-host configuration, using Cluster Server software.

Important: Always check for a README file on any installation media. This README file might contain important information that was not available at the time this *Installation and Support Guide* was prepared.

Installation process

Before you begin the installation of Storage Manager 7.x, read "Installing the hardware" on page 40 to make sure that all hardware components are installed correctly for the Cluster Server environment. Then, begin the software installation process with "Installing the storage-management software" on page 42. Continue the process until you have completed "Installing the Cluster Server software" on page 52.

The following figure shows a flowchart of the installation process.

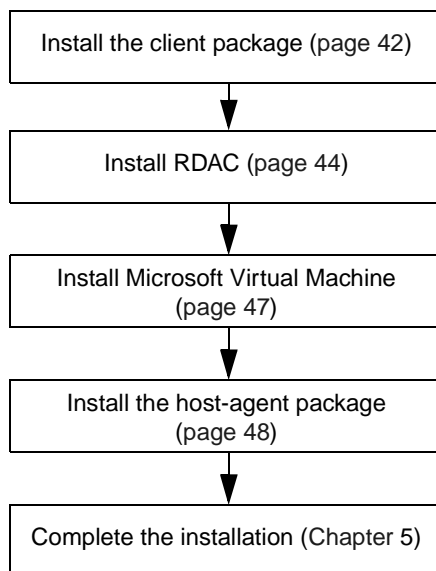


Figure 10. Installation process

Installing the hardware

The hardware installation involves installing host adapters and storage subsystems.

Host adapters

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

- You can install two host adapters in each node to run two cables from each node to both controllers in a storage subsystem. For example, if you are using single-channel host adapters and want the dual-path configuration, you *must* install two host adapters in each node. Figure 11 on page 41 shows Fibre Channel single- and dual-path connection examples.
- Each host adapter and controller must have a unique ID.
- Install the correct device driver for the host adapter. Refer to the README file in the \Host Adapter directory on the Installation CD for the latest information on supported host adapters and device drivers.

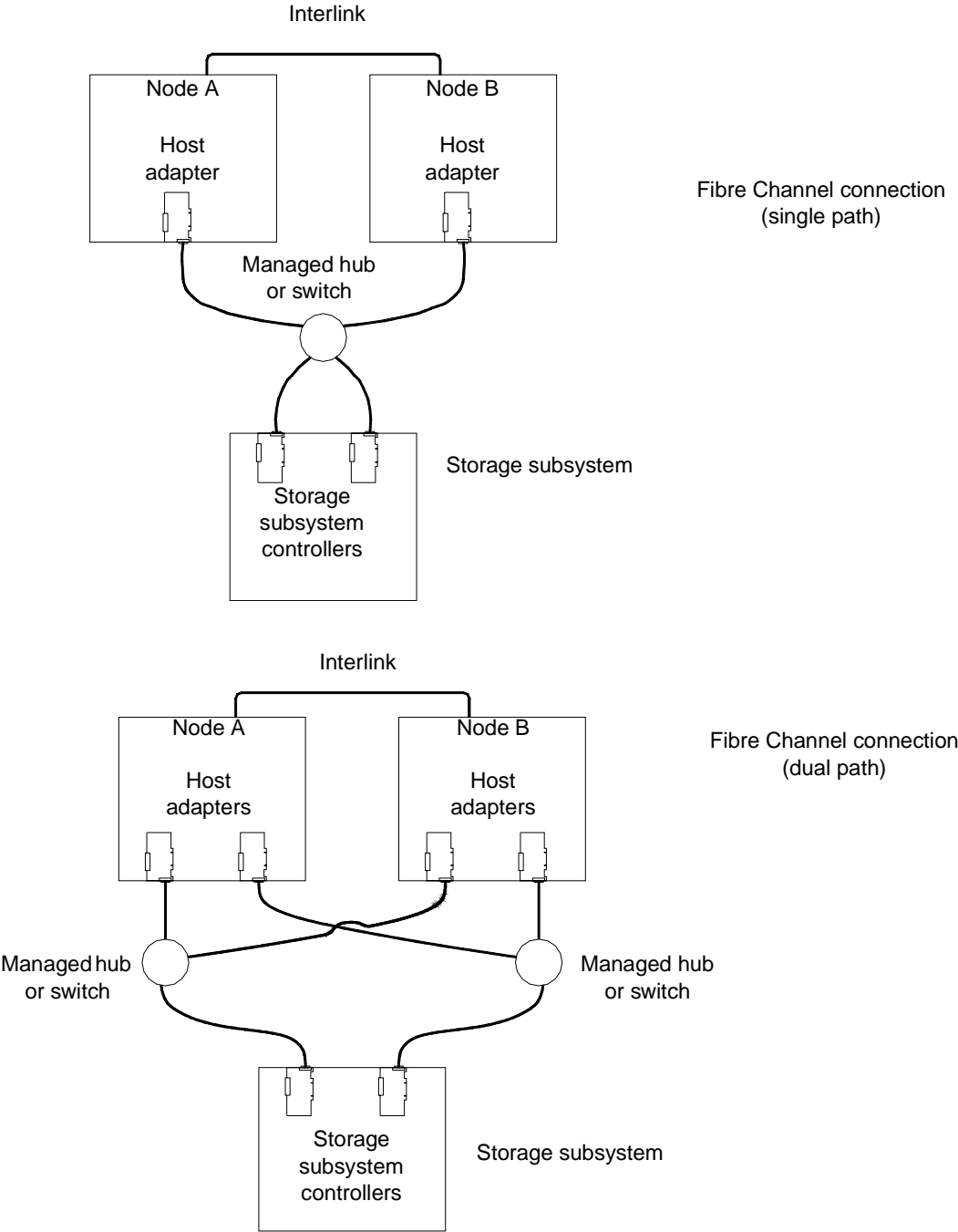
Storage subsystems

Refer to the appropriate hardware documentation to install the storage subsystems. The following considerations apply:

- If you are managing storage subsystems directly, you must install Ethernet cables to both controllers in each storage subsystem.
- Note that unless you are using dual-channel host adapters, you need two host adapters per node to use the dual-path configuration.

Note: Use the dual-path configuration for the fullest RDAC protection, in the event there is a problem with the connection.

The following figure shows Fibre Channel connections using single-path and dual-path configurations.



Note: Other managed hub configurations are possible.

Figure 11. Installing the storage subsystem on a Fibre Channel network
Continue with "Installing the storage-management software" on page 42.

Installing the storage-management software

Important: After you connect the storage subsystems to both nodes, *do not* start Windows NT on both nodes at the same time until you have installed the Cluster Server software on *at least* one node. To suspend the starting of Windows NT, press the spacebar at the operating system (OS) loader screen.

Do not install the Cluster Server software until you are instructed to in this chapter.

Install the following Storage Manager 7.x software using the procedures on the pages that are listed in the following table.

Software component:	Follow the procedure beginning on:
Netfinity Fibre Channel Storage Manager 7 Client	page 42
Netfinity Fibre Channel Storage Manager 7 RDAC driver	page 44
Microsoft Virtual Machine	page 47
Netfinity Fibre Channel Storage Manager 7 Agent	page 48

Installing SM7client

Use the following procedure to install SM7client on a management station configured with Windows NT Server 4.0 Enterprise Edition and Service Pack 4 or 5.

Important: If you want to install SM7client on the cluster server and manage storage subsystems through the I/O path rather than over the network, you must install the TCP/IP-protocol software on the host and assign a static IP address to the host. The host operating system must be Windows NT 4.0 Enterprise Edition with Service Pack 4 or 5.

Before You Begin

Before you install the software, make sure that:

- The management station has at least 20 MB of available disk space.

- The video monitor is set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors.
- You close all other programs.

Installation instructions

- 1** Insert the Installation CD into the CD-ROM drive.
- 2** Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.

The Add/Remove Programs Properties window opens.

- 3** Click **Install** and follow the instructions on the screen.

- 4** Click **Browse**.

The Browse window opens.

- 5** Select the CD-ROM drive.

- 6** Select the \SM7client directory.

- 7** Select the setup.exe file, and then click **Open**.

- 8** Click **Finish**.

The setup program Welcome window opens.

- 9** Click **Next** to begin the installation.

The Choose Destination Location window opens.

- 10** Click **Browse** if you want to change the destination location.

- 11** Click **Next**.

- 12** When the installation is complete, click **Finish**.

Verifying the installation

Use the following procedure to verify that the installation was successful.

- 1** Click **Start** → **Programs**.
- 2** Verify that Netfinity Fibre Channel Storage Manager 7 client appears in the list of programs.
- 3** Go to "Installing RDAC".

Installing RDAC

Use the following procedure to install RDAC on a host machine connected to one or more storage subsystems.

RDAC consists of the following components:

- The multipath device driver necessary for controller failover support
- The Hot Add utility for dynamically adding logical drives to the operating system (see "Using the Hot Add utility" on page 67)

Important: You must install RDAC before installing the SM7agent package.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors.
- You close all other programs.

Assigning drive letters

The installation procedure loads the RDAC device driver before the native Windows NT class device driver. This is necessary to enable RDAC functionality. However, this means that the system recognizes the storage subsystem logical drives before it recognizes any local drives, and assigns drive letters accordingly.

Note: *Before* you install this software, you *must* have “sticky” drive letters assigned to the existing local drives.

Use the following procedure to determine if you need to assign sticky drive letters and to assign them, if necessary.

- 1 Power off the storage subsystem to prevent Disk Administrator (WINDISK) from locking up while you are assigning drive letters or installing the RDAC device driver.

- 2 Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and to check the number of partitions.

If you have <i>two</i> or more partitions:	If you have only <i>one</i> partition:
Go to Step 3.	Go to Step 4.

- 3 If you have *at least two* partitions (the boot partition and one other partition) and *both* of the following conditions apply, go to "Installation instructions". Otherwise, go to Step 4.
 - The last partition you created was created with Disk Administrator.
 - The partition has a drive letter assigned and has a status of Unknown or has a file system on it (that is, it has a status other than Unformatted).
- 4 Use the following procedure to create a new partition.

Important: If you have no room for a second partition on the local system, you can use a storage subsystem logical drive for the second partition. The storage subsystem must have at least one logical drive configured on it. You can access the logical drive without installing the storage-management software. Connect the storage subsystem and power on the system; then, restart the system. Configured logical drives appear in the Disk Administrator and you can create a second partition on a logical drive using Step a through Step c. You can delete or modify the logical drive later without causing the boot partition drive letter to be reassigned.

- a Select a drive containing free disk space.
 - b Click **Partition** → **Create**. The partition is created (a drive letter is assigned and the partition status is Unformatted).
 - c Click **Partition** → **Commit Changes Now**. The partition status changes to Unknown, and sticky drive letters are assigned to all existing partitions.
- 5 Continue with "Installation instructions".

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.

4 Click Browse.

The Browse window opens.

5 Select the CD-ROM drive.

6 Select the \RDAC directory.

7 Select the setup.exe file, and then click Open.

8 Click Finish.

The setup program Welcome window opens.

9 Click Next to begin the installation.

When RDAC is installed, the Setup Complete window opens.

Note: You must restart the host to ensure that all changes take effect.

10 Click No, I will restart my computer later; then, click Finish.

11 Click Start → Shutdown.

The Shut Down Windows window opens.

12 Click Shutdown to shut down the server.

13 Power on the storage subsystem.

14 After the storage subsystem is powered on completely, power on the host to ensure that the changes take effect.

Verifying the installation

Use the following procedure to verify that the installation was successful.

1 Click Start → Settings → Control Panel → Devices.

The Devices window opens.

2 Scroll through the list of devices until you find symarray.

3 Make sure that the status of the symarray device is Started.

4 Continue with "Installing Microsoft Virtual Machine (VM)" on page 47.

Installing Microsoft Virtual Machine (VM)

Use the following procedure to install Microsoft Virtual Machine (VM) on a host machine connected to one or more storage subsystems.

Important: You must install the Microsoft Virtual Machine (VM) before installing SM7agent.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors.
- You close all other programs.

Important: The Netfinity FAStT Storage Manager 7.x Installation CD contains a version of Microsoft VM that was tested with the storage-management software. Before you install this version, go to the Web site at <http://www.ibm.com/pc/support> to see if a newer version of the software is available. Also, check the Web site for the latest support information.

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.
- 4 Click **Browse**.
The Browse window opens.
- 5 Select the CD-ROM drive.
- 6 Select the \SM7agent directory.

7 Select the msjavx86.exe file, and then click **Open**.

8 Click **Finish** and follow the instructions on the screen.

When the software is installed, the Setup Complete window opens.

Note: You must restart the host to ensure that all changes take effect.

9 Click **Yes** to restart the host.

10 Continue with "Installing SM7agent" on page 48.

Installing SM7agent

Use the following procedure to install SM7agent on a host machine connected to one or more storage subsystems.

SM7agent consists of the following components:

- The host-agent software necessary for host-agent management of the storage subsystems
- The SM7devices utility necessary for relating logical drives to operating system device names. For more information, see "Using the SM7devices utility" on page 67.

Important: You cannot install SM7agent unless RDAC is installed. The Microsoft Virtual Machine is also a required component for installing and using SM7agent.

You must install SM7agent even if you do not intend to manage storage subsystems through the host-agent software.

Before you begin

Before you install the software, make sure that:

- You have Administrator privileges on the host machine.
- The host machine is configured with Windows NT 4.0 and Service Pack 4 or 5.
- The host machine has at least 1 MB of available disk space.
- The video monitor is set to a minimum screen resolution of 640 x 480 pixels and a palette of 256.
- You installed RDAC and the Microsoft Virtual Machine (VM).
- You close all other programs.

Installation instructions

- 1 Insert the Installation CD into the CD-ROM drive.
- 2 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.
The Add/Remove Programs Properties window opens.
- 3 Click **Install** and follow the instructions on the screen.
- 4 Click **Browse**.
The Browse window opens.
- 5 Select the CD-ROM drive.
- 6 Select the \SM7agent directory.
- 7 Select the setup.exe file, and then click **Open**.
- 8 Click **Finish**.
The setup program Welcome window opens.
- 9 Click **Next** to begin the installation.
When SM7agent is installed, the Setup Complete window opens.
Note: You must restart the host to ensure that all changes take effect.
- 10 Click **Finish** to restart the host.

Verifying the installation

Use the following procedure to verify that the installation was successful.

- 1 Click **Start** → **Settings** → **Control Panel** → **Services**.
The Services window opens.
- 2 Scroll through the list of services until you find the Netfinity Fibre Channel Storage Manager 7 agent.

3 Make sure that the status of the agent service is Started.

Note: If the host-agent does not find controllers connected that have firmware version 4.x installed, the following Service Control Manager message appears:

At least one service or driver failed during system startup. Use Event Viewer to examine the event log for details.

When the host is connected to a storage subsystem with firmware version 4.x installed, the host-agent starts automatically after the system is restarted.

Note: If you are not using the host-agent software to manage storage subsystems, you can stop the host-agent service. Click **Start** → **Settings** → **Control Panel** → **Services**. Select the host-agent from the list of displayed services and click **Startup**. Under Startup Type, click **Manual**, and then click **OK**.

What's next?

Did you just install the storage management software on Node A or Node B?

Node A	Node B
Go to "Setting up the storage subsystems" on page 50.	Go to "Verifying drive letters" on page 51.

Setting up the storage subsystems

Use the procedures in "Chapter 5. Completing the installation" on page 53 to perform the following tasks:

- 1 Start Enterprise Management and perform an Initial Automatic Discovery of storage subsystems on the local subnetwork.
- 2 Add other devices to the management domain as necessary. For more information, see "Adding devices" on page 56.
- 3 Make sure that the status of each storage subsystem is Optimal.
- 4 Open a Subsystem Management window for each storage subsystem and configure the storage subsystem as much as possible. You do not have to completely configure the storage subsystems. However, any changes you make later must be made known to Node B. For more information, see "Starting Subsystem Management" on page 57.
- 5 Modify configuration settings in NVSRAM. For more information, see "Modifying configuration settings in NVSRAM" on page 59.

- 6 After you have completed the procedures in "Chapter 5. Completing the installation" on page 53, return here and answer the following question.

Did you install the storage-management software on Node A or Node B?

Node A	Node B
Go to "Shutting down Node A" on page 51.	Go to "Verifying drive letters" on page 51.

Shutting down Node A

- 1 Shut down Windows NT, but leave Node A running (do *not* turn off the node).
- 2 Return to "Installing SM7client" on page 42 and repeat the installation procedures to install the necessary software components on Node B.

Verifying drive letters

- 1 Use the Windows NT Disk Administrator to verify that the drive letters assigned to the configured logical drives are the same as those assigned to Node A.
- 2 Continue with "Shutting down Node B".

Shutting down Node B

- 1 Shut down Windows NT, but leave Node B running (do *not* turn off the node).
- 2 Continue with the next section, "Installing the Cluster Server software" on page 52.

Installing the Cluster Server software

Use the following procedure to install the Cluster Server software on Nodes A and B.

Important: Before you install the Cluster Server software, make sure you have installed the storage-management software on both nodes of the Cluster Server.

1 Install the Cluster Server software on Node A, as follows:

a Refer to the appropriate Microsoft Cluster Server (MSCS) documentation for the correct procedure to install the Cluster Server software.

Note: During installation, specify that you want to **Form A New Cluster**.

b After the system restarts, leave Node A up and running.

2 Install the Cluster Server software on Node B, as follows:

a Refer to the appropriate MSCS documentation for the correct procedure to install the Cluster Server software.

Note: During installation, specify that you want to **Join The Existing Cluster**.

b After the system restarts, leave Node B up and running.

Important: When the installation of the MSCS is complete, be sure to reinstall the latest supported service pack.

3 Verify the software installation, as follows:

a On either node (A or B), click **Start** → **Programs** → **Administrative Tools (Common)**.

b Click **Cluster Administrator**.

c In the **Cluster or Server Name** field, enter either the name of the cluster or the name or IP address of one of the nodes.

d If the installation is successful, the computer names of both nodes appear on the left side of the Cluster Administrator window.

4 If both node names appear, go to "Completing final tasks" on page 61. Otherwise, reinstall the Cluster Server software.

Chapter 5. Completing the installation

This chapter contains procedures for starting Enterprise Management and Subsystem Management and for completing the installation tasks.

Starting Enterprise Management

The Enterprise Management window is the first window to appear when you start the software. Use the Enterprise Management window to:

- Add and discover the storage subsystems you want to manage.
- Provide a comprehensive view of all storage subsystems in your management domain.
- Perform batch storage subsystem management tasks using the Script Editor.

Use the following procedure to start the Enterprise Management window:

- 1** Click **Start** → **Programs**.
- 2** Click **Netfinity Fibre Channel Storage Manager 7 client**.

The client software starts, displaying the Enterprise Management window and the Confirm Initial Automatic Discovery window, as shown in Figure 12 on page 54.

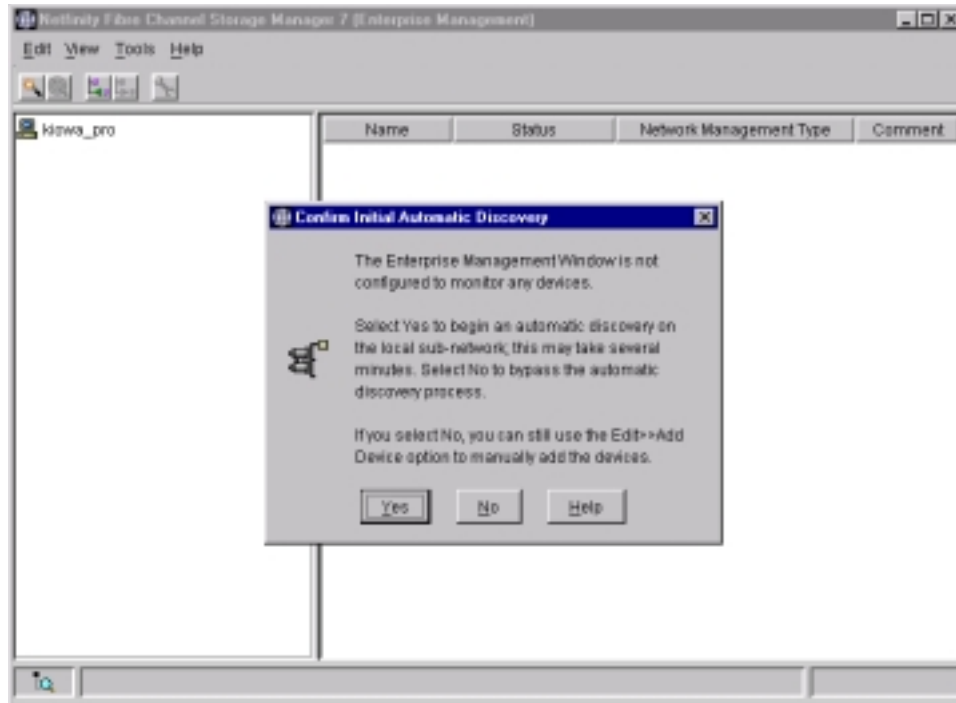


Figure 12. Confirm Initial Automatic Discovery window

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

If you do not want to perform the initial automatic discovery, click **No**. You can use the **Edit** → **Add Device** pull-down menu option to add hosts and storage subsystems. For more information, see "Adding devices" on page 56.

- 3 Click Yes to begin an initial automatic discovery of hosts and storage subsystems attached to the local subnetwork on which the management station is installed.

The software sends a broadcast message across the local subnetwork where the management station is installed. It discovers host-agent managed storage subsystems if the hosts that provide network management connections to the storage subsystems respond to the broadcast. The software discovers directly managed storage subsystems if the controllers in those storage subsystems respond to the broadcast message.

Important: It can take up to a minute for the Enterprise Management window to refresh after an initial automatic discovery.

If you need to stop the automatic discovery operation, close the Enterprise Management window.

When the initial automatic discovery is complete, you can see all hosts and storage subsystems attached to the local subnetwork, as shown in Figure 13.

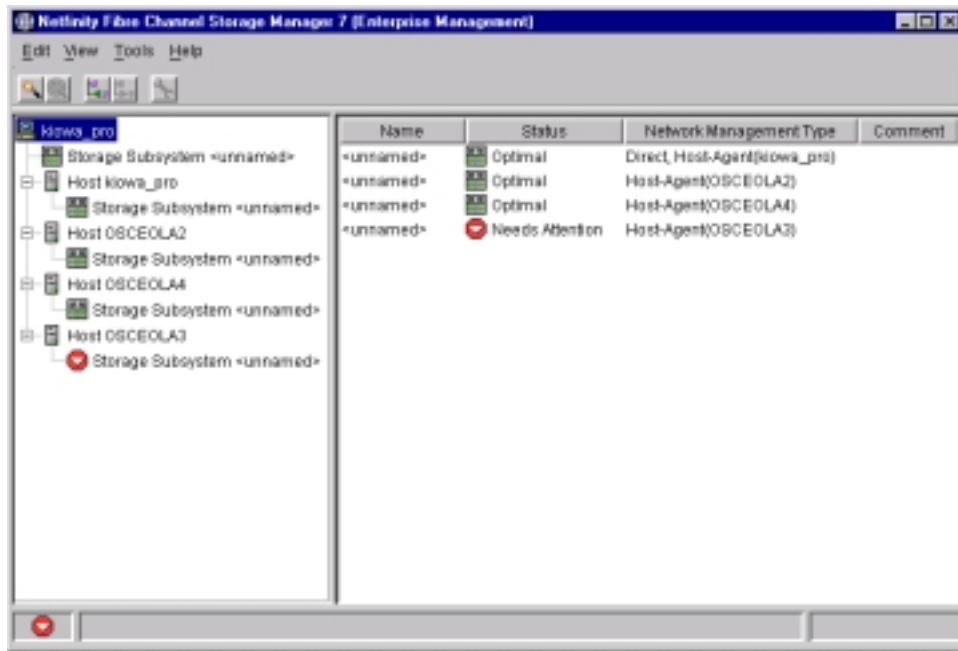


Figure 13. Enterprise Management window

If you do not see all hosts and storage subsystems, do the following:

- Check the hardware and connections for possible problems (refer to the hardware documentation for specific procedures).
- Refer to the Enterprise Management Help topic about discovering storage subsystems.
- Make sure that the device is on the local subnetwork. If it is not, you must use the Add Device option.

Note: If any device shows a status of Unresponsive, use the software to remove the device from the management domain and then add it again. Refer to the Enterprise Management online Help for instructions on removing and adding devices.

Adding devices

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

Important: If you are managing storage subsystems through the host-agent software and you physically add new storage subsystems, you must stop and restart the host-agent service so it can recognize the new storage subsystems (see "Stopping the host-agent service" on page 61). Then, go to the Enterprise Management window and click **Tools** → **Rescan** to add the new storage subsystems to the management domain.

Monitoring storage subsystems

To monitor the condition of storage subsystems in your management domain, you must start Enterprise Management. For more information about monitoring storage subsystems, refer to the Enterprise Management online Help.

Setting up alert notifications

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

- Notification to a designated network management station (NMS) using Simple Network Management Protocol (SNMP) traps (see "Setting up the NMS for SNMP notification" on page 57 for more information)
- Notification to designated e-mail addresses
- Notification to designated alphanumeric pagers (when a third party software package is used to convert e-mail messages)

Note: Refer to the Enterprise Management online Help for more information on alert notification options.

Setting up the NMS for SNMP notification

If you choose to set up alert notification using SNMP traps, you must first copy a management information base (MIB) file to the designated network management station. Use this procedure to set up the MIB on the network management station.

Important: You only need to set up your designated NMS *one* time.

- 1 Copy the Arrayman.mib file from the SM7mib directory on the Installation CD to the network management station.
- 2 Follow the steps required by your specific network management station to compile the MIB.

Note: For details on the required steps, consult your network administrator or the documentation specific to the NMS product you are using.

Configuring alert destinations

Configure SNMP trap destinations and e-mail destinations for alert notifications using Enterprise Management. Refer to the Enterprise Management online Help for specific procedures.

Starting Subsystem Management

Use the Subsystem Management window to manage (configure, monitor, recover, and tune) the logical and physical components that make up a storage subsystem. The Subsystem Management window is specific to an individual storage subsystem.

Use the following procedure to open a Subsystem Management window for a selected storage subsystem:

- 1 In the Enterprise Management window, select a storage subsystem.
- 2 Click **Tools** → **Manage Device**.

The software displays the Subsystem Management window for the selected storage subsystem, as shown in Figure 14 on page 58.

Note: Using the open Subsystem Management window, you can manage only the selected storage subsystem. However, you can open multiple Subsystem Management windows to manage other storage subsystems.

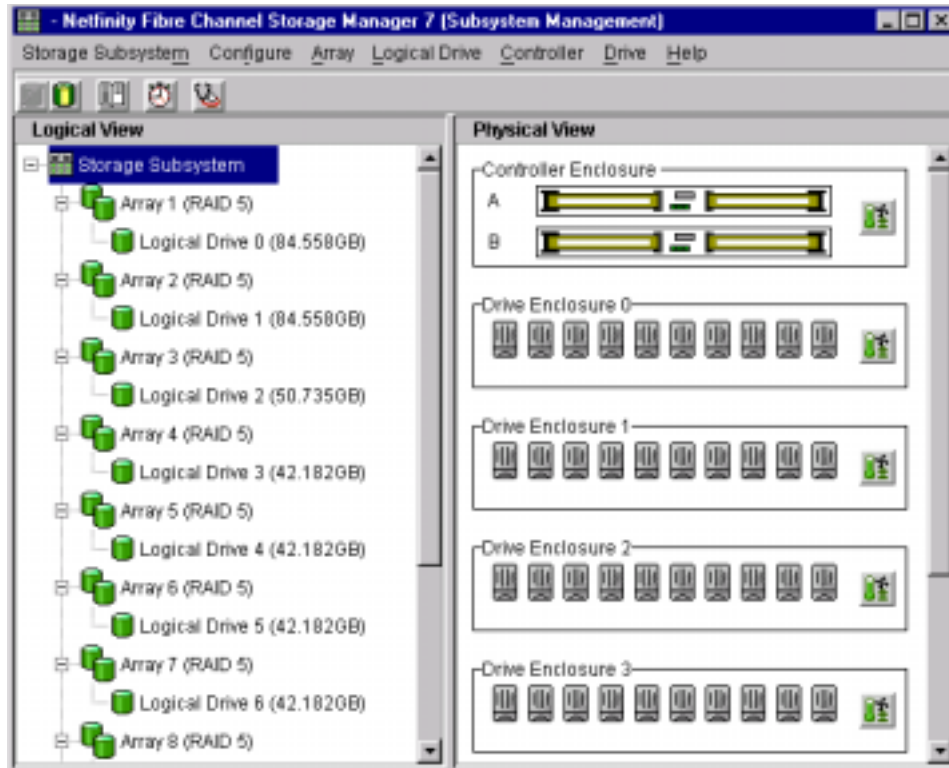


Figure 14. Subsystem Management window

Renaming storage subsystems

When you start Storage Manager 7.x for the first time, the storage subsystems are unnamed. You must use the Subsystem Management window to rename each storage subsystem from <unnamed> to the name you want. Refer to the names you entered in the information record you created using Table 6 on page 16. Then, refer to the renaming storage subsystems topic in the Subsystem Management online Help. The Help topic provides detailed instructions for renaming storage subsystems.

Performing other storage subsystem management tasks

The storage subsystem management tasks you can perform include the following:

- Locating a storage subsystem
- Viewing a storage subsystem profile
- Entering or changing a storage subsystem password
- Creating and managing logical drives and arrays

- Using the Performance Monitor
- Creating storage partitions (if applicable)

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

Modifying configuration settings in NVSRAM

Depending on the management method (host-agent or direct) and configuration (cluster or non-cluster) that you selected, you might need to run scripts to modify configuration settings stored in NVSRAM on each storage subsystem you are managing with Storage Manager 7.x.

Use the following procedure to modify the appropriate configuration settings.

- 1 Insert the Installation CD into the CD-ROM drive on the management station.
- 2 Go to the \Scripts directory and read the README file in that directory.
- 3 Highlight a storage subsystem in the Enterprise Management window and click **Tools** → **Execute Script**.

4 Did you install the storage management-software in a standard (non cluster) configuration?

Yes	No
<p>1 Run the scripts necessary for your configuration (refer to the readme file in the \Scripts directory).</p> <p>2 Go to "Completing final tasks" on page 61.</p>	<p>Run the script to enable clustering. If you are not managing storage subsystems directly, you must run the script to disable networking.</p> <p>To load and execute the enable clustering script:</p> <p>1 Click File → Load Script. The Load Script window opens.</p> <p>2 To enable clustering, select the appropriate script from the \Scripts directory on the Installation CD.</p> <p>3 Click Open to load the script.</p> <p>4 Click Tools → Execute Only. Wait until the <code>Script Execution Complete</code> message displays.</p> <p>To load and execute the disable networking script:</p> <p>1 Click File → Load Script. The Load Script window opens.</p> <p>2 To disable networking, select the appropriate script from the \Scripts directory on the Installation CD.</p> <p>3 Click Open to load the script.</p> <p>4 Click Tools → Execute Only. Wait until the <code>Script Execution Complete</code> message displays.</p> <p>5 Go to Step 5 on page 60.</p>

5 Repeat the procedures in the table in Step 4 for each storage subsystem that you are managing with the storage-management software.

6 After you modify the appropriate configuration settings on each storage subsystem, answer the question in "Setting up the storage subsystems" on page 50.

Completing final tasks

If you want to manage storage subsystems using the direct method, go to "Stopping the host-agent service". Otherwise, go to "Chapter 6. Operating system support" on page 63.

Stopping the host-agent service

Use the following procedure to stop the host-agent service:

- 1 Click **Start** → **Settings** → **Control Panel** → **Services**.
- 2 Click **Netfinity Fibre Channel Storage Manager 7 Agent** service.
- 3 Click **Stop**.
- 4 Click **Startup**.
The Service window opens.
- 5 Under Startup Type, click **Manual**.
- 6 Click **OK**.
- 7 Click **Close** to close the Services window, and then close the Control Panel.
- 8 Go to "Chapter 6. Operating system support" on page 63.

Chapter 6. Operating system support

This chapter contains information related to operating the storage-management software with Windows NT.

Understanding the Windows NT restrictions

Important: Always check for a README file on any installation media. This README file might contain important information that was not available at the time this *Installation and Support Guide* was prepared.

Table 8 explains the restrictions that apply when using the Netfinity FAStT Storage Manager 7.x with Windows NT.

Table 8: Windows NT restrictions and notes

Restriction	Workaround
You cannot print topics from the online Help systems.	The Help systems were developed with JavaHelp™ 1.0, which does not support printing. Printable versions of the Help systems are available on the installation CD in Adobe Acrobat Portable Document Format (PDF).
Clicking on the vertical scroll arrows (either up or down) causes the scroll box to move all the way to the opposite end of the scroll bar.	This is a known defect in the JavaHelp 1.0 technology in the Windows environment. Click the scroll box and slide it until you reach the desired position in the Help window.
If you are managing storage subsystems with the host-agent software, do not download an NVSRAM configuration file with the Access Volume Disabled attribute. Doing so deletes the Access Volume on host-agent managed storage subsystems, causing those storage subsystems to become inaccessible.	If you download NVSRAM files to a host-agent managed storage subsystem using the Storage Subsystem → Download → NVSRAM option, select an NVSRAM file in the NVSRAM Download File Selection area, and then check the File Information to make sure that the file does not contain the Access Volume Disabled attribute. Important: If you accidentally delete the Access Volume, call for service.

Table 8: Windows NT restrictions and notes (continued)

Restriction	Workaround
Logical drive migration (removing a set of drives configured with logical drives from one storage subsystem to insert in another storage subsystem) is not supported because it could cause loss of configuration.	Call for service.
If you manage storage subsystems through the host-agent software and use the storage management software to download controller firmware, the download process can take up to 10 minutes to complete.	None.
If you configure a new storage subsystem with a single controller, you must place the controller in the top slot (slot A). The controller firmware cannot recognize or communicate with a single controller until slot A is populated. This restriction does not apply to storage subsystems that were originally configured with two controllers.	None.
A public loop configuration (managed hubs attached to switches) is not supported.	None.
If you remove a fan or power supply CRU from a storage subsystem while the system is running, the storage management software does not report an error message and the component is not reported as missing. Note: Fan and power supply CRU failures are reported.	Replace the missing fan or power supply CRUs immediately to ensure redundancy. Make sure that the fan or power supply CRU is properly seated in the controller unit.

Number of logical drives supported

The supported logical drive limits are as follows:

- Windows NT with Service Pack 4 supports up to 8 logical drives per storage subsystem (LUNs 0–7).
- Windows NT with Service Pack 5 supports up to 32 logical drives per storage subsystem (LUNs 0–31) if the host adapter also supports large LUNs and it configured correctly.
- Host adapters support a maximum number of logical drives. Refer to the host adapter documentation for specific information.

- The host-agent management method uses a special logical drive, called an Access Volume, to communicate with the controllers on the storage subsystem. The Access Volume uses one of the allowable logical drives. Therefore, managing storage subsystems with the host-agent software limits you to one less LUN than the maximum number supported by Windows NT and the host adapter.

Creating logical drives

A *logical drive* is a logical object that is the basic structure you create to store data on the storage subsystem. A logical drive is configured across an array with a specific RAID level to meet application needs for data availability and I/O performance. A logical drive is recognized by the OS as one drive.

You can add or delete logical drives in a standard (non-cluster) configuration and in a cluster server environment.

Standard (non-cluster) configuration

When you create new logical drives with the storage-management software, you must add the new logical drives to Windows NT. Refer to the Windows NT documentation for details about adding a drive. Remember that each logical drive (not array) is recognized by Windows NT as *one* drive. After creating logical drives, run the Hot Add and SM7devices utilities that are provided with the storage management software. The Hot Add utility adds newly created logical drives to the operating system, and the SM7devices utility identifies logical drives by their associated operating system device names. For information about using these utilities, see "Using the Hot Add utility" on page 67 and "Using the SM7devices utility" on page 67.

Before either 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 use Disk Administrator to delete any partitions and to unassign drive letters associated with the logical drives. If you do *not* use Disk Administrator first, registry information will be damaged.

Cluster server environment

When you create logical drives on one node in a cluster server environment, you must assign the same drive letter on the other node as well. After creating logical drives, run the Hot Add and SM7devices utilities that are provided with the storage-management software. The Hot Add utility adds newly created logical drives to the operating system, and the SM7devices utility identifies logical drives by their associated operating system device names. For information about using these utilities, see "Using the Hot Add utility" on page 67 and "Using the SM7devices utility" on page 67.

Use the following procedure to add logical drives in a cluster server environment:

- 1 Use the storage-management software to create a new logical drive. For specific instructions, refer to the Subsystem Management online Help.
- 2 Use the Hot Add utility to add the logical drive on Node A.
- 3 Use Disk Administrator on Node A to format the new logical drive.
- 4 Use the Hot Add utility to add the logical drive on Node B.
- 5 Use Disk Administrator on Node B to assign the same drive letter to the new logical drive as the one it has on Node A.
- 6 Start the Cluster Administrator on Node B and use it to stop the cluster service.
- 7 Click **Node B** → **File Stop** → **Cluster Service**.
- 8 In Cluster Administrator, click **Node B**, and then click **File** → **Evict Cluster Node**.
- 9 Restart Node A.
- 10 On Node A, use Cluster Administrator either to create a new array or select an existing array to which you can add the new logical drive.
- 11 Highlight the array and click **File** → **New** → **Resource**.
- 12 Name the new resource and click **Physical Disk** as the resource type.
- 13 Click **Next**.
- 14 Click **Node A** as the disk resource owner, and then click **Next**.
- 15 Specify any dependencies (other resources that Cluster Administrator must bring online) before this new disk resource is brought online.
- 16 Select the new disk from the drive parameter list, and then click **Finish**.
- 17 Uninstall the Cluster Server software from Node B.
- 18 Re-install the Cluster Server software on Node B and join the existing cluster that includes Node A.

Important: Edit the properties of the new disk to allow Node B to be a possible owner of the resource. You can redistribute the cluster resources between Nodes A and B and edit the properties of all cluster resources to include Node B. Move any cluster resources belonging to Node B from Node A back to Node B.

Using the Hot Add utility

The RDAC software includes a utility called Hot Add that enables you to add new logical drives dynamically without restarting your system. The utility registers the new logical drives with the operating system so you can use Disk Administrator to create partitions, add device names, and so on. The Hot Add utility is installed as part of the RDAC package.

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

- 1 From a DOS command prompt, type:

```
hot_add
```

- 2 Press Enter.

The new logical drives are available through the Disk Administrator.

Using the SM7devices utility

The SM7agent software includes a utility called SM7devices that enables you to view the storage subsystem logical drive that is associated with a particular operating system device name. This capability is helpful when you want to create drive letters or partitions for the logical drive using Disk Administrator.

After you finish creating the logical drives on a particular storage subsystem, go to the host attached to that storage subsystem and perform the following steps to use SM7devices:

- 1 From a DOS command prompt, change to the \Program Files\SM7agent directory.

- 2 Type:

```
SM7devices
```

3 Press Enter.

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

```
\\.\PHYSICALDRIVE0 [Storage Subsystem Finance, Logical  
Drive DEBIT, LUN 0, WWN  
<600a0b800006028600000000382060eb>]  
\\.\PHYSICALDRIVE1 [Storage Array Finance, Volume CREDIT,  
LUN 1, WWN <600a0b70006028600000000392060eb>]
```

where PHYSICALDRIVE x = Diskx in Disk Administrator
Storage Subsystem = the storage subsystem name
logical drive = the logical drive name
LUN = the logical unit number associated with the logical drive
WWN = the world wide name for the logical drive

Uninstalling storage-management software components

Use the following procedure if you need to uninstall one or more of the components of Netfinity FAStT Storage Manager 7.x.

Important: *Do not* uninstall the RDAC component unless instructed by a service representative. The host-agent package requires RDAC to function properly.

1 Click **Start** → **Settings** → **Control Panel** → **Add/Remove Programs**.

The Add/Remove Programs Properties window opens.

2 Select the component you want to uninstall from the list of programs.

For example, Netfinity Fibre Channel Storage Manager 7 Client.

3 Select **Add/Remove**.

The Confirm File Deletion window opens.

4 Click **Yes** to start the uninstallation process.

5 When the uninstallation is completed, click **OK**.

Appendix. Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Subject to IBM's valid intellectual property or other legally protectable rights, any functionally equivalent product, program, or service may be used instead of the IBM product, program, or service. The evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the responsibility of the user.

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