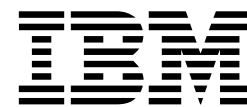


FAStT Storage Manager Version 7.10
for Microsoft® Windows NT® and
Windows® 2000



Installation and Support Guide



FAStT Storage Manager Version 7.10
for Microsoft® Windows NT® and
Windows® 2000



Installation and Support Guide

Note:

Before using this information and the product it supports, be sure to read the general information in Appendix B, “Getting information, help, and service,” on page 91.

Second Edition (May 2001)

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About this book

This book provides information about setting up, installing, configuring, and working with IBM® FAST Storage Manager Version 7.10 in a Microsoft® Windows NT® or Windows® 2000 operating system environment. This *Installation and Support Guide* is for system administrators. Use this guide to:

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

How this book is organized

Chapter 1, “Introduction,” on page 1 provides an overview of IBM FAST Storage Manager Version 7.10 and describes storage-subsystem management methods, configuration types, types of installations, and installation requirements.

Chapter 2, “Preparing for installation,” on page 17 discusses preparing for a network installation including setting up a Microsoft DHCP server, UNIX® BOOTP server, or a NetWare server, and describes other setup tasks.

Chapter 3, “Installing software in a standard configuration,” on page 35 gives the procedure for installing the software in a standard (noncluster) environment.

Chapter 4, “Installing software in a cluster server environment,” on page 51 gives the procedure for installing the software in a cluster server environment.

Chapter 5, “Completing the installation,” on page 73 discusses starting the Enterprise Management window, downloading firmware in NVSRAM, adding devices, creating arrays and logical drives, subsystem management tasks, and the migrate utility.

Chapter 6, “Operating system support,” on page 81 discusses Windows NT and Windows 2000 operating system limitations, using the SM7 devices and Hot Add utility, and other software features.

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

Appendix B, “Getting information, help, and service,” on page 91 provides information about how to obtain help, service, or technical assistance.

Appendix C, “Notices,” on page 95 provides product notices and trademark information.

Notices used in this book

This book contains notices to highlight information as follows:

- **Notes**

These notices provide important tips, guidance, or advice.

- **Important**

These notices provide information that might help you avoid inconvenient or problem situations.

- **Attention**

These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

Related publications

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

- *IBM FAStT Storage Manager Version 7.10 for Windows NT and Windows 2000 Installation and Support Guide (this book)*
- *IBM Netfinity® FAStT Host Adapter Installation and User's Handbook*
- *IBM FAStT200 and FAStT200 HA Storage Servers Installation and User's Guide¹*
- *IBM Netfinity FAStT500 RAID Controller Enclosure Unit Installation Guide*
- *IBM Netfinity FAStT500 RAID Controller Enclosure Unit User's Reference*
- *IBM FAStT Storage Manager Concepts Guide*
- *IBM Netfinity Fibre Channel RAID Controller Unit User's Handbook*

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

- In the U.S. and Puerto Rico, call 1-800-426-7282.
- 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.

1. Printed publications that are shipped with the IBM FAStT200 and FAStT200 High Availability (HA) Storage Servers.

Chapter 1. Introduction

This installation and support guide provides information on preparation, installation, configuration, and starting the IBM FAStT Storage Manager Version 7.10 in a Windows NT or Windows 2000 operating system environment. Before you begin the installation of this product, consult the following documentation:

- README.TXT file - Read this text file first. The README file is located in the root directory of the installation CD or refer to the IBM Web site at <http://www.ibm.com/pc/support> for the latest installation and user information about the storage-management software and hardware components.
- IBM FAStT Storage Manager Concepts Guide - Use this reference document to become familiar with terminology and features of the IBM FAStT Storage Manager Version 7.10 software.

When you finish the entire installation process, refer to the following online Help systems, which contain information common to all operating system environments. For installation information specific to Windows NT or Windows 2000, refer to this book.

- You can access the help systems from the Enterprise Management and Subsystem Management windows in IBM FAStT Storage Manager Version 7.10. Click **Help** on the toolbar, or press F1.
- Enterprise Management window Help - Use this online Help system to learn more about working with the entire management domain.
- Subsystem Management window Help - Use this online Help system to learn more about managing individual storage subsystems.

Terms to know

If you are upgrading from a previous version of the storage-management software, you will find that some of the terms you are familiar with have changed. It is important that you familiarize yourself with the new terminology. Table 1 provides a list of machine type and supported storage-management software. Table 2 on page 2 provides a list of some of the old and new terms. For more information, refer to the *IBM FAStT Storage Manager Concepts Guide*.

Table 1. Machine type and supported storage-management software.

| Product name | Machine type | Model | Product release and firmware version | Supported storage-management software version |
|---|--------------|-------|--------------------------------------|---|
| IBM FAStT200 | 3542 | 1RU | 4.x | 7.02, 7.10 |
| IBM FAStT200 HA | 3542 | 2RU | 4.x | 7.02, 7.10 |
| Netfinity Fibre Channel RAID Controller Unit | 3526 | 1RU | 3.x, 4.x | 6.22, 7.0, 7.01, 7.02, 7.10 |
| Netfinity FAStT500 RAID Controller Enclosure Unit | 3552 | 1RU | 4.x | 7.0, 7.01, 7.02, 7.10 |

Note: Product firmware must be at version 4.x to be compatible with Storage Manager Version 7.10.

Table 2. Old and new terminology.

| Term used in previous versions | New term |
|--|-------------------|
| RAID module | Storage subsystem |
| Drive group | Array |
| Logical unit number (LUN) ¹ | Logical drive |

¹ In Storage Manager 7.10, the term *logical unit number (LUN)* refers to a logical address that is used by the host to access a particular logical drive.

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

Management station

A management station is a system that is used to manage the storage subsystem. This system does not need to be attached to the storage subsystem through the Fibre Channel I/O path.

Host and host computer

The terms *host* and *host computer* are used interchangeably throughout this book. Both terms refer to a system that is directly attached to the storage subsystem through a Fibre Channel I/O path. This system is used to serve data (typically in the form of files) from the storage subsystem.

Note: A system can be both a management station and a host computer at the same time.

Software components

Storage Manager 7.10 contains the following software components for a Windows NT environment:

- Microsoft Virtual Machine
- Client software (SM7client)
- Redundant Disk Array Controller (RDAC) package
- Host-agent package (SM7agent)
- Storage Manager 7 Utility package (SM7util)

Storage Manager 7.10 contains the following software components for a Windows 2000 environment:

- Client software (SM7client)
- Redundant Disk Array Controller (RDAC) package
- Host-agent package (SM7agent)
- Storage Manager 7 Utility package (SM7util)

Client software

The Storage Manager 7.10 client (SM7client) component provides the graphical user interface for managing storage subsystems through the Ethernet network or from the host. The SM7client contains two main components:

- **Enterprise Management.** You can use the Enterprise Management component for adding, removing, and monitoring storage subsystems within the management domain.
- **Subsystem Management.** You can use the Subsystem Management component for managing the components of an individual storage subsystem.

Host-agent package

The Storage Manager 7.10 agent (SM7agent) package contains the host-agent software. You can use the host-agent software to manage storage subsystems through the host Fibre Channel connection. The host-agent software takes requests from a management station that is connected to the host through a network connection and passes the requests to the storage subsystem controllers through the Fibre Channel I/O path. For more information about managing storage subsystems through the host-agent, see “Host-agent (in-band) managed method” on page 4.

Microsoft Virtual Machine

Microsoft Virtual Machine is required to support the Event Monitor option of the SM7client package on a host computer running Windows NT. You must manually install Microsoft Virtual Machine on your management station, host computer, or server as applicable to your configuration.

Redundant Disk Array Controller (RDAC) package

The Redundant Disk Array Controller (RDAC) contains the multi-path device driver that is necessary to provide controller failover support when a component along the Fibre Channel I/O path fails.

Storage Manager 7 Utility software package

Use the Storage Manager 7 Utility (SM7util) software package to register and map new logical drives to the operating system. The Storage Manager 7 Utility is installed on all host computers running Windows NT 4.0 or Windows 2000. The host computers are attached to the storage subsystem through the Fibre Channel connection. The Storage Manager 7 Utility software package contains the following two components:

- **Hot Add utility.** 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 86.
- **SM7devices utility.** You can use the SM7devices utility to associate storage subsystem logical drives with operating system device names. For more information about using SM7devices, see “Using the SM7devices utility” on page 86.

Storage subsystem management methods

The storage-management software provides two methods for managing storage subsystems: the host-agent managed method and the directly managed method. Depending on your specific storage subsystem configurations, you can use either or both methods.

Host-agent (in-band) managed method

When you use the host-agent method, you manage the storage subsystems through the Fibre Channel I/O path to the host. The management information can be processed in the host or passed to the management station through the network connection. See Figure 1 on page 5.

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

- You do not have to run Ethernet cables to the controllers.
- You do not need a DHCP BOOTP server to connect the storage-subsystems to the network.
- You do not need to perform the controller network configuration tasks that are described in Chapter 2, "Preparing for installation," on page 17.
- When adding devices, you have to specify a host name or IP address only for the host instead of for the individual controllers in a storage subsystem. Storage subsystems that are attached to the host are automatically discovered.

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

- You are limited to configuring one fewer logical unit number (LUN) than the maximum number that is allowed by the operating system and the host adapter that you are using.
- If you are upgrading controllers from firmware version 3.x to version 4.x and your host system has already configured its maximum number of LUNs, you must give up a LUN to be used as an access volume.
- The host-agent requires a special logical drive, called an *access volume*, to communicate with the controllers in the storage subsystem.

Important: The access volume uses one of the logical unit numbers (LUNs). Windows NT 4.0 or 2000 operating systems allow a maximum number of LUNs, depending on which Service Pack is installed and which host adapter you are using. If your host already has the maximum number of LUNs configured, either use the directly managed method or give up a LUN for use as the access volume. For more information, see "Number of supported logical drives" on page 15.

Windows 2000 allows a maximum number of LUNs, depending on your host adapter. . For information on your specific configuration, see "Number of supported logical drives" on page 15. Contact an IBM technical-support representative for additional assistance.

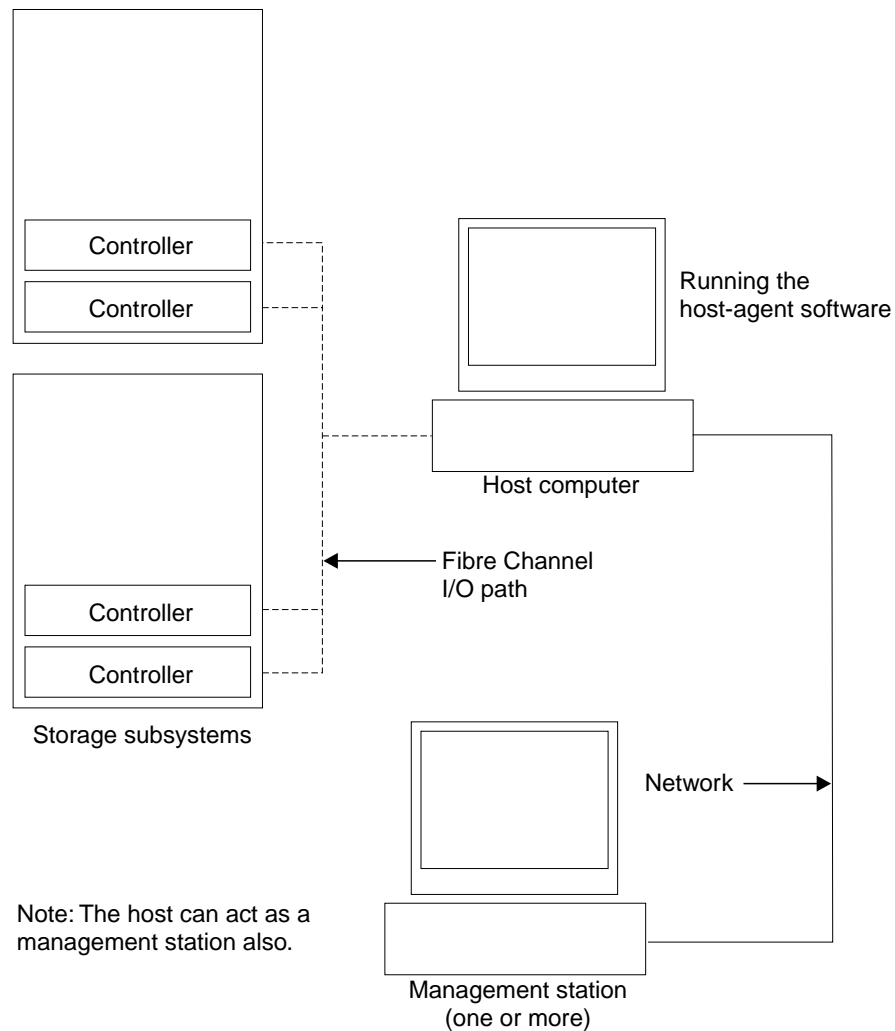


Figure 1. Host-agent (in-band) managed storage subsystems

Direct managed (out-of-band) method

When you use the direct managed method, you manage storage subsystems directly over the network through the Ethernet connection to each controller. To manage the storage subsystem through the Ethernet connections, you must define the IP address and host name for each controller and attach a cable to the Ethernet connectors on each of the storage subsystem controllers. See Figure 2 on page 6.

Managing storage subsystems directly has these advantages:

- The Ethernet connections to the controllers enable a management station running SM7client to manage storage subsystems that are connected to a host running Windows NT, Windows 2000, or other operating systems that are supported by Storage Manager 7.10.
- 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 that are supported by the operating system and the host adapter that you are using.

Managing storage subsystems directly has these disadvantages:

- It requires two Ethernet cables to connect both storage subsystem controllers to a network.
- When adding devices, you must specify an IP address or host name for each controller.
- A DHCP BOOTP server and network preparation tasks are required. For a summary of the preparation tasks, see Table 10 on page 19.

Figure 2 shows a system in which storage subsystems are managed directly.

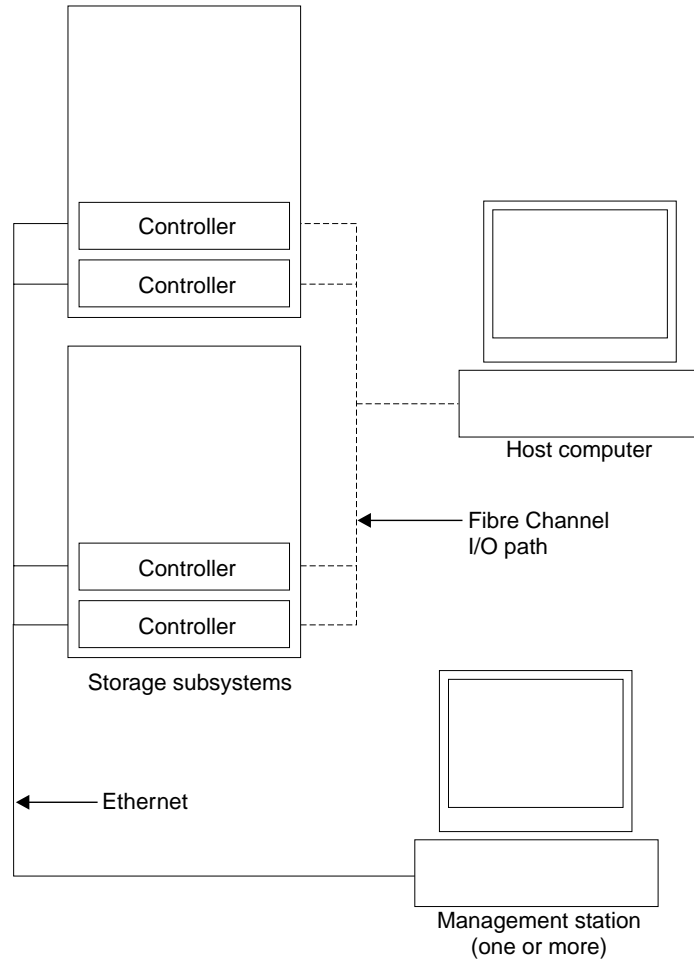


Figure 2. Directly (out-of-band) managed storage subsystems

Configuration types

You can install Storage Manager 7.10 in one of two configurations:

- Standard (noncluster) configuration. See “Standard (noncluster) configuration” on page 7.
- Cluster server configuration. See “Cluster server configuration” on page 8.

Standard (noncluster) configuration

Table 3 shows where the storage-management software components are installed in a standard (noncluster) configuration. Figure 3 on page 8 shows a sample standard (noncluster) configuration.

Table 3. Where to install software components in a standard (noncluster) configuration.

| Software component | Where installed | Notes |
|---|---|--|
| Storage Manager 7.10 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 computer (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 software on one or more management stations, you can choose to manage storage subsystems directly through Ethernet connections to the controllers, over the network to the host computer through the host-agent, or a combination of both methods. • Host computer If you install the SM7client software on the host computer, the host computer does not need to be connected to a network as long as the host-agent software is installed. However, the host computer must have the TCP/IP software installed and you must assign a static IP address to the host. |
| RDAC (SM7RDAC) | Host | The RDAC component is required for controller failover support and for installing and using the host-agent software. Make sure you install RDAC on each host computer connected to the storage subsystem. |
| Storage Manager 7.10 Agent (SM7agent) | Host | Install the SM7agent software to manage storage subsystems with the host computer through the Fibre Channel connections. |
| Storage Manager 7.10 Utility (SM7util) | Host | The Storage Manager 7 Utility software contains important utilities that are necessary for operating the storage-management software. |
| Microsoft Virtual Machine | Host | If you are running on a Windows NT platform, the Microsoft Virtual Machine is a required component for installing and using the software that is contained in the host-agent package and the event monitor. |

The following figure shows an example of a standard (noncluster) configuration.

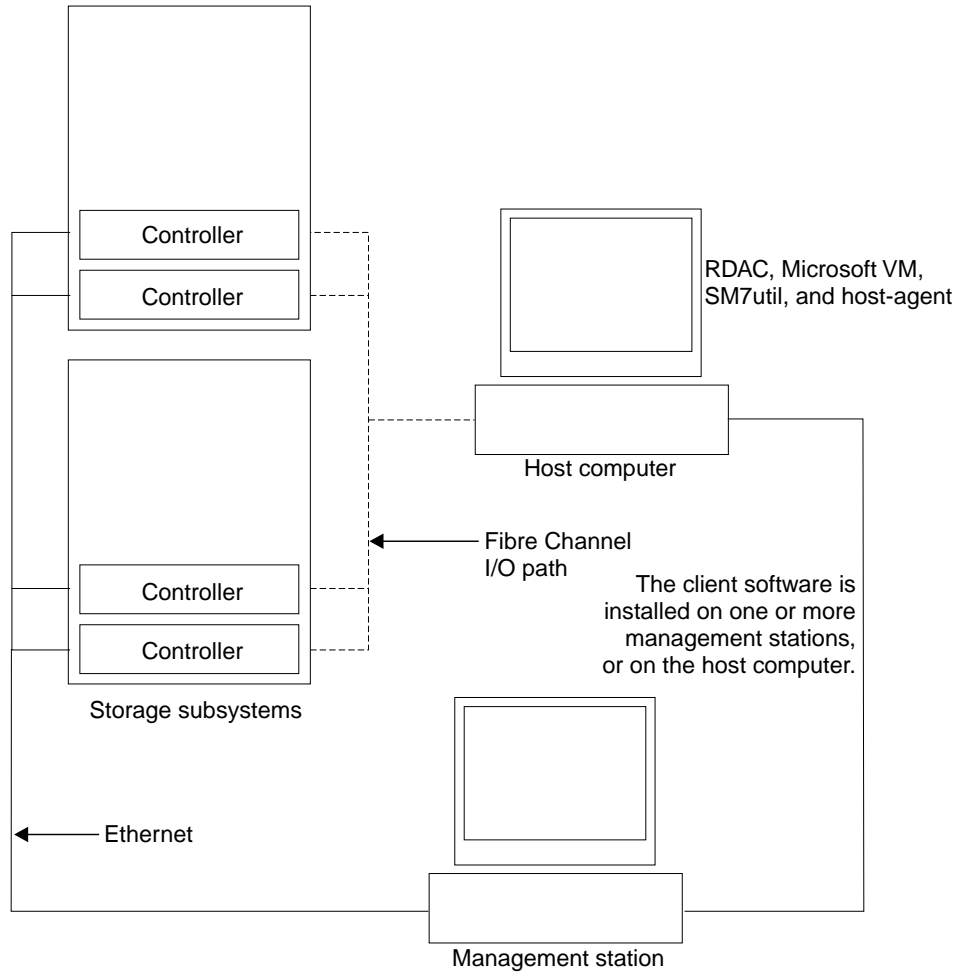


Figure 3. Sample standard (noncluster) configurations

Cluster server configuration

The following table describes the storage-management software components that are installed in a cluster server environment. See Figure 4 on page 10 for a sample cluster configuration.

Important: Be sure to install all storage-management software components on each server in your cluster.

Table 4. Where to install software components in a cluster configuration.

| Software component | Where installed | Notes |
|---|--|---|
| Storage Manager 7.10 client (SM7client) | <p>You can install the SM7client package on either of the following:</p> <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 software on one or more management stations, you can choose to manage storage subsystems directly through Ethernet connections to the controllers, over the network to the host computer 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), the server does not need to be connected to a network as long as the host-agent software is installed. However, the host computer must have the TCP/IP software installed, and you must assign a static IP address to the cluster server. |
| RDAC (SM7RDAC) | Nodes A and B | RDAC is required for controller failover support and for installing and using the host-agent software. Make sure that you install RDAC on each host computer connected to the storage subsystem. |
| Storage Manager 7.10 agent (SM7agent) | Nodes A and B | Install the SM7agent software to manage storage subsystems with the host computer through the Fibre Channel connections. |
| Storage Manager 7.10 Utility (SM7util) | Nodes A and B | The Storage Manager 7 Utility software package contains important utilities that are necessary for operating the storage-management software. |
| Microsoft Virtual Machine | Nodes A and B | If you are running on a Windows NT platform, Microsoft Virtual Machine is a required component for installing and using the software that is contained in the host-agent package and the event monitor. |

Figure 4 shows an example of a cluster server configuration.

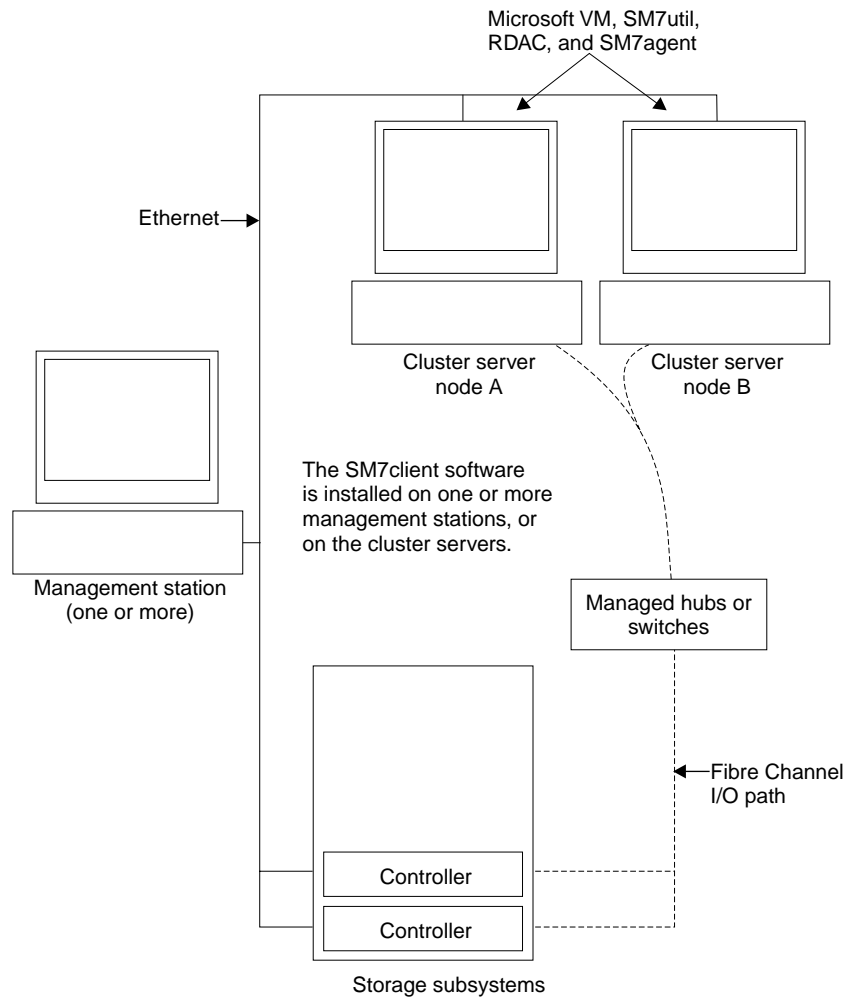


Figure 4. Sample cluster server configuration

Installation types

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

- **New storage subsystem environment.** You are installing new storage subsystems with controllers that are using firmware version 04.01.xx, and that you will manage with Storage Manager 7.10. Go to "Managing new and existing storage subsystems attached to the same host" on page 12.
- **Existing storage subsystem environment.** You are installing the storage management software in an environment with existing storage subsystems. See Table 5 on page 11 for your installation options in an environment with existing storage subsystems.

Table 5. Configurations for existing storage subsystems.

| Existing storage subsystems with | Options |
|---|--|
| <p>Controllers (machine types: 3526, 3542, and 3552) running firmware versions from 4.00.00 through 4.00.03</p> | <p>Option 1</p> <p>To upgrade the firmware to version 04.01.xx, do the following:</p> <ol style="list-style-type: none"> 1. Uninstall the previous version of the storage-management software before installing version 7.10 (refer to “Uninstalling storage-management software components” on page 87). 2. Install Storage Manager 7.10 and upgrade the controller firmware and NVSRAM from versions 4.00.00 through 4.00.03 to version 04.01.xx. 3. You will manage the existing storage subsystems with Storage Manager 7.10. Refer to the README file located in the <i>\operating system\</i> directory on the installation CD for more information. Go to “Managing new and existing storage subsystems attached to the same host” on page 12. <p>Option 2</p> <p>If you continue using your existing version 4.00.00 through 4.00.03 controller firmware, do the following:</p> <ol style="list-style-type: none"> 1. Uninstall the previous version of the storage-management software before installing version 7.10 (refer to “Uninstalling storage-management software components” on page 87). <p>You can manage these existing storage subsystems through Storage Manager 7.10, which includes components that are compatible with these older firmware versions. A description of the functional differences between your existing controller firmware and the controller firmware (04.01.xx) are provided on the installation CD.</p> <ol style="list-style-type: none"> 2. Refer to the README file located in the <i>\operating system\</i> directory on the installation CD for more information. Go to “Managing new and existing storage subsystems attached to the same host” on page 12. |
| <p>Controller (machine type: 3526) running firmware version 3.x</p> | <p>Option 1</p> <p>Upgrade to firmware version 04.01.xx, continue using your current operating system, and install Storage Manager 7.10. For more information, refer to “Using the Migrate Utility” on page 79.</p> <p>Option 2</p> <p>Upgrade the controller firmware to version 04.01.xx (refer to “Using the Migrate Utility” on page 79). Then, upgrade your operating system from Windows NT to Windows 2000 (refer to “Upgrading from Windows NT 4.0 to Windows 2000 in a standard configuration” on page 36 or “Upgrading from Windows NT 4.0 to Windows 2000 in a cluster configuration” on page 70). To manage the storage subsystems with Storage Manager 7.10, go to “Managing new and existing storage subsystems attached to the same host” on page 12.</p> <p>Option 3</p> <p>Install new storage subsystems and attach them to the same host as the existing storage subsystems. These existing and new storage subsystems are referred to as coexisting storage subsystems. See “Managing new and existing storage subsystems attached to the same host” on page 12 for more information.</p> |

Managing new and existing storage subsystems attached to the same host

When installing Storage Manager 7.10, you must determine how you will use any existing storage subsystems. Existing storage subsystems are coexisting storage subsystems when they are attached to the same host as storage subsystems managed with Storage Manager 7.10, and when the coexisting storage subsystem requirements in Table 6 are met.

Table 6. Coexisting storage subsystems requirements.

| Existing storage subsystems | New or upgraded storage subsystems |
|---|--|
| <ul style="list-style-type: none">• Use 3.01.x firmware• Managed with version 6.22 of the storage-management software <p>Note: Firmware and software levels are the minimum levels required for machine type 3526 controllers to coexist with new or upgraded storage subsystems.</p> | <ul style="list-style-type: none">• Use 04.00.x or 04.01.xx firmware• Managed with Storage Manager 7.10 |

Figure 5 on page 13 shows an example of an environment that includes coexisting storage subsystems.

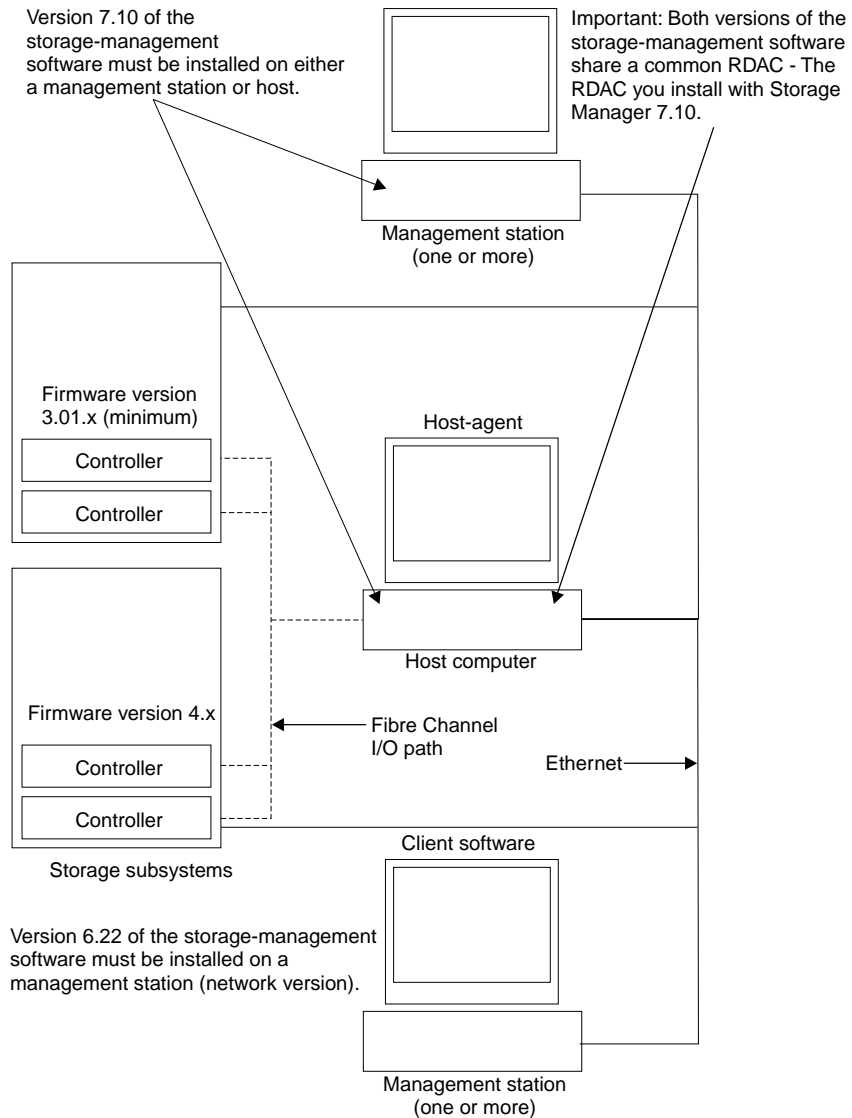


Figure 5. Sample coexistence installation

System requirements

This section provides detailed information about the hardware, software, and operating system requirements for Storage Manager 7.10.

Hardware requirements

Table 7 lists the hardware required for installing Storage Manager 7.10.

Table 7. Hardware requirements for storage manager software.

| Hardware component | Requirements |
|---|--|
| A DHCP BOOTP server (for only directly managed storage subsystems). | <ul style="list-style-type: none"> • Microsoft BOOTP-compatible DHCP server for Windows • UNIX® BOOTP server • NetWare DHCP |

Table 7. Hardware requirements for storage manager software.

| Hardware component | Requirements |
|---|---|
| Storage subsystems (one or more). | <p>Storage subsystems with controllers running firmware version 4.00.00 through 04.01.xx.</p> <p>Note: Make sure that you read “Installation types” on page 10 for information on managing these storage subsystems when existing storage subsystems are physically connected to the same host that you will connect to the new storage subsystems.</p> |
| Fibre Channel (FC) host adapters. | <p>The following Fibre Channel host adapters were tested with the storage-management software:</p> <ul style="list-style-type: none"> • IBM Netfinity FAStT host adapter (part number: 00N6881) • Netfinity Fibre Channel adapter <p>For information on specific host adapter requirements:</p> <ul style="list-style-type: none"> • Refer to the \Host_Adapter directory on the installation CD. • Read the host adapter documentation. • Refer to the IBM Web site at: http://www.ibm.com/pc/support |
| Fibre Channel (FC) fabric switches (if needed for the desired configuration). | <p>The following Fibre Channel fabric switches were tested with the storage management software:</p> <ul style="list-style-type: none"> • IBM 8-port Fibre Channel switch (machine type: 2109-S08) • IBM 16-port Fibre Channel switch (machine type: 2109-S16) <p>For specific Fibre Channel switch setup requirements:</p> <ul style="list-style-type: none"> • Read the switch documentation. • Refer to the IBM Web site at: http://www.ibm.com/storage/fcswitch |
| Fibre Channel (FC) managed hub (if needed for the desired configuration). | <p>The following managed hub was tested with the storage management software:</p> <ul style="list-style-type: none"> • IBM Fibre Channel managed hub (machine type: 3534) <p>For specific Fibre Channel managed hub setup requirements:</p> <ul style="list-style-type: none"> • Read the managed hub documentation. • Refer to the IBM Web site at: http://www.ibm.com/storage/fchub |

Firmware requirements

Storage Manager 7.10 operates only with controller machine types 3526, 3552, or 3542, and firmware version 4.00 through 4.01. If you want to manage controllers with Storage Manager 7.10, you must upgrade the firmware to version 4.00 through 4.01. Refer to “Using the Migrate Utility” on page 79. You must use version 6.22 of the storage-management software to manage storage subsystems with controllers using firmware version 3.x.

Software requirements

Table 8 on page 15 lists the disk space and administrator privileges required for installing version 7.10 of the storage-management software.

Table 8. Installation requirements by software package.

| Package | Disk space requirement | Administrator privilege |
|--------------------------------------|------------------------|-------------------------|
| Client (SM7client) | 35 MB | Not required |
| RDAC (SM7RDAC) | 1 MB | Required |
| Host-agent (SM7agent) | 1 MB | Required |
| Storage Manager 7 UtilityS (SM7util) | 25 MB | Required |

Operating system requirements

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

Management stations and host computers. Install one of the following operating systems:

- Windows 2000 Server
- Windows 2000 Professional
- Windows 2000 Advanced Server (required for a cluster environment).
- Windows NT 4.0 Server
- Windows NT 4.0 Enterprise Edition
- Windows NT 4.0 Workstation

Cluster servers. Install the Windows 2000 Advanced Server or Windows NT 4.0 Enterprise Edition operating system.

If you are upgrading from Windows NT 4.0 to Windows 2000 in a standard (noncluster) configuration, go to “Upgrading from Windows NT 4.0 to Windows 2000 in a standard configuration” on page 36.

If you are upgrading from Windows NT 4.0 to Windows 2000 in a cluster configuration, go to “Upgrading from Windows NT 4.0 to Windows 2000 in a cluster configuration” on page 70.

If you are not upgrading from Windows NT to Windows 2000, go to “Deciding how to manage storage subsystems” on page 17.

Number of supported logical drives

There are limits on how many logical unit numbers (LUNs) you can use to access the logical drives on a single storage subsystem. Supported logical drive limits for Windows NT and Windows 2000 are as follows:

- Windows NT with Service Pack 5 or greater will support 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 is configured correctly.
- Windows 2000 supports up to thirty-two logical drives per storage subsystem (LUNs 0–31) if the host adapter also supports large LUNs and is configured correctly.

- 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 2000 or Windows NT and the host adapter.

Chapter 2. Preparing for installation

This chapter provides information to help you plan and prepare for installing the storage-management software.

Refer to Table 9 for the software component installation based on the operating system of the attached management station, host computer, or cluster server.

Table 9. Software component installation in a Windows environment.

| Operating system | Required software installation sequence | Where to install |
|------------------|--|---|
| Windows NT | <ol style="list-style-type: none"> 1. Microsoft Virtual Machine¹ 2. Client (SM7client) | One or more: <ul style="list-style-type: none"> • Management stations • Attached host computers or • Cluster servers (cluster configuration) |
| | <ol style="list-style-type: none"> 1. Redundant Disk Array Controller package (SM7RDAC) 2. Host-agent package (SM7agent²) 3. Storage Manager 7 Utility (SM7util) | Each attached host computer Important: You must assign static drive letters to existing local drives before installing RDAC to prevent problems during new installations and upgrades. This process requires a minimum of two partitions (the BOOT partition and one other partition). |
| Windows 2000 | Client (SM7client) | One or more: <ul style="list-style-type: none"> • Management stations • Attached host computers or • Cluster servers (cluster configuration) |
| | <ol style="list-style-type: none"> 1. Redundant Disk Array Controller package (RDAC) 2. Host-agent package (SM7agent²) 3. Storage Manager 7 Utility (SM7util) | Each attached host computer |

¹ Required only if you will use the Event Monitor feature or if you manage the attached storage subsystem using the host-agent method.

² Required only if you are managing the storage subsystems using the host-agent method.

Deciding how to manage storage subsystems

If you have not already done so, refer to Chapter 1, "Introduction," on page 1 for information about the following two methods for managing storage subsystems:

- Direct (out-of-band) manage the storage subsystems through an Ethernet connection to each controller on the storage subsystem
- Host-agent (in-band) management through the host-agent software that is installed on the host computer that is 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 6 shows an example of a directly managed storage subsystem network setup. Network A contains the following components:

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

Figure 6 shows an example of a host-agent managed storage subsystem network setup. Network B contains the following components:

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

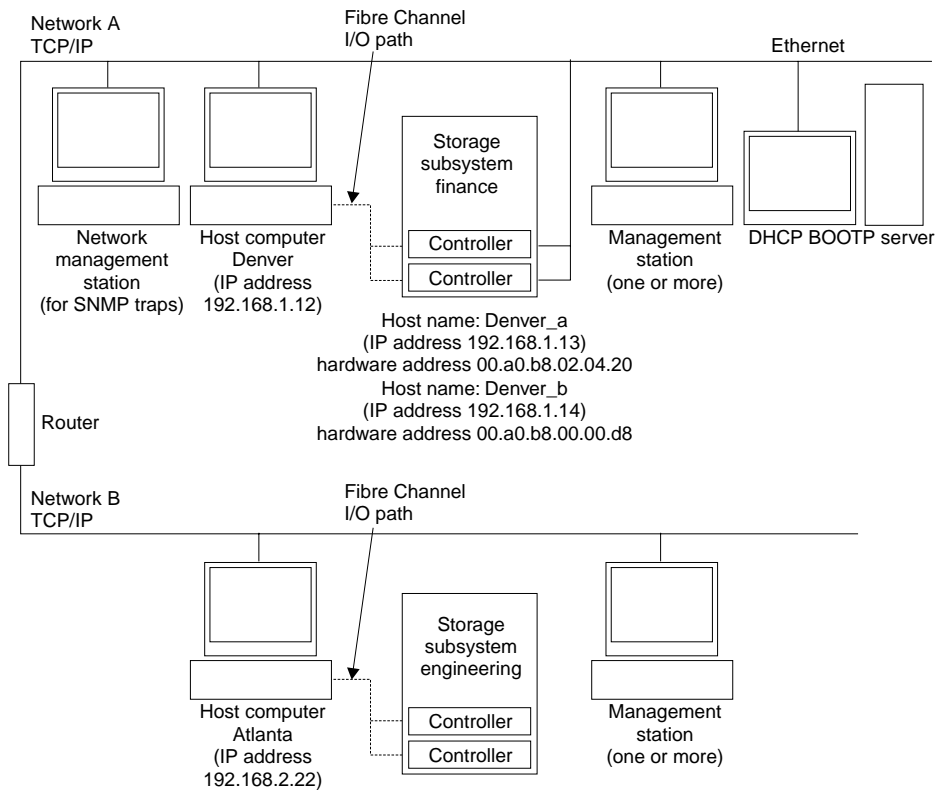


Figure 6. Sample network using directly and host-agent managed storage subsystems

Continue with “Preparing for a network installation” on page 19.

Preparing for a network installation

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 prepare for a network installation, perform the tasks summarized in Table 10. Be sure to refer to the appropriate procedures. Use Table 21 on page 89 as a data sheet to record storage subsystem and controller information. An example of a completed information record is shown in Table 11 on page 20.

Table 10. Network preparation task summary.

| Task to perform | For direct or host-agent? | Why perform this task? | For instructions, refer to |
|--|---------------------------|---|---|
| Step 1 - Install all hardware components (host computers, storage subsystems, cables, and so on) that you want to connect to the network. | Direct and host-agent | To ensure that the network hardware is present. | The installation guide specific to the hardware components. |
| Step 2 - Establish and record a naming convention for the storage subsystems connected to the network. | Direct and host-agent | To add the storage subsystems to the management domain after installing the software. | "Deciding how to name the storage subsystems" on page 21. |
| Step 3 - Determine the hardware Ethernet address for each controller in all storage subsystems connected to the network. | Direct | To set up the DHCP BOOTP server to provide network configuration information to the controllers. | "Identifying the hardware Ethernet MAC address for each controller" on page 21. |
| Step 4 - Obtain IP addresses and host computer names from the network administrator. | Direct and host-agent | For host-agent management, you need the IP addresses and host names of the host on which the host-agent software will run. For direct management, you need the IP addresses of each controller in the storage subsystems to configure the DHCP BOOTP server. The DHCP BOOTP server can then provide network configuration information to the controllers. Also, you use the IP addresses of the controllers to set up the host or DNS table. | "Obtaining IP addresses for hosts and controllers" on page 23. |

Table 10. Network preparation task summary.

| Task to perform | For direct or host-agent? | Why perform this task? | For instructions, refer to |
|--|---------------------------|---|--|
| Step 5 - Set up the DHCP BOOTP server to provide network configuration information for a specific controller. | Direct | To provide network configuration information to the controllers using the DHCP BOOTP server. | "Setting up the DHCP BOOTP server" on page 23. |
| Step 6 - Verify that the TCP/IP software is installed, and set up the host or DNS table. | Direct | Installing the client software on a management station ensures that the management station is configured to reach the controllers over the network. | "Verifying the TCP/IP protocol and setting up the host or DNS table" on page 32. |
| Step 7 - Power on the devices connected to the network. | Direct and host-agent | To ensure that all devices and links are operational. | The installation guide specific to the hardware components. |

Table 11 shows a sample information record for a direct-managed storage subsystem and a host-agent managed storage subsystem.

Table 11. Sample information record.

| Storage subsystem name | Management type | Controllers—Ethernet and IP addresses, and host name | | Host—IP address and host name |
|-------------------------------------|-----------------|--|--|-------------------------------|
| | | Controller A | Controller B | |
| Storage subsystem name: Finance | Direct | Hardware Ethernet address = 00a0b8020420 | Hardware Ethernet address = 00a0b80000d8 | |
| | | IP address = 192.168.1.13 | IP address = 192.168.1.14 | |
| | | Host = Denver_a | Host = Denver_b | |
| Storage subsystem name: Engineering | Host-agent | | | IP address = 192.168.2.22 |
| | | | | Host = Atlanta |

For information about the entries in Table 11, see the following:

- "Deciding how to name the storage subsystems" on page 21.
- "Deciding how to manage storage subsystems" on page 17.
- "Identifying the hardware Ethernet MAC address for each controller" on page 21.
- "Obtaining IP addresses for hosts and controllers" on page 23.

Table 21 on page 89 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 21 to set up the DHCP BOOTP table for the network server and the host or DNS (Domain Name System) table. The information in Table 21 helps you add storage subsystems after initial installation. The column headings show a page reference for detailed instructions about obtaining the information.

Deciding how to name the storage subsystems

As you set up your network, decide on 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 are displayed 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 meanings in the future.
- The software displays storage-subsystem names with the prefix Storage Subsystem. Therefore, if you rename a storage subsystem to Engineering, it is displayed as:

Storage Subsystem Engineering

After you decide on a naming scheme, record the storage subsystem names in the information record (Table 21 on page 89).

If you are directly managing your storage subsystem, go to “Identifying the hardware Ethernet MAC address for each controller”. If you are going to manage your storage subsystem through the host-agent, go to “Obtaining IP addresses for hosts and controllers” on page 23.

Identifying the hardware Ethernet MAC 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 23.

For machine type 3542, the MAC address is at the back of the unit under the controller Gigabit Interface Converter (GBIC) slots (see Figure 7).

Record each Ethernet address in the information record (Table 21 on page 89); then, go to “Obtaining IP addresses for hosts and controllers” on page 23.

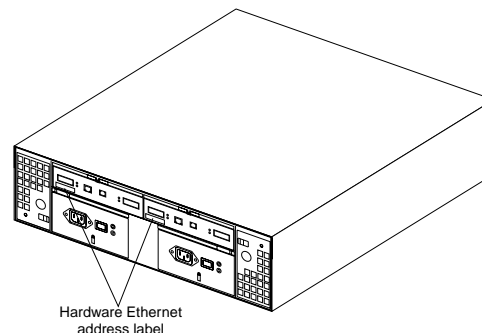


Figure 7. Location of the hardware Ethernet address labels (machine type 3542)

For machine types 3526 and 3552, use the following instructions:

1. Remove the front bezel from the controller unit (machine types 3526 and 3552), as shown in Figure 8. Carefully pull the bottom of the bezel out **1** to release the pins; then slide the bezel down **2**

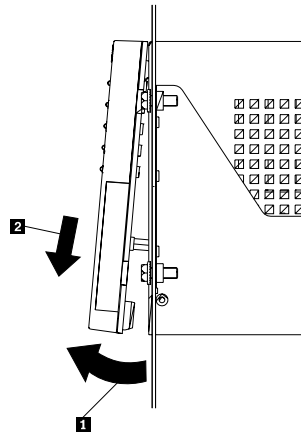


Figure 8. Removing the controller-unit bezel (machine types 3526 and 3552)

2. Unlock and open the levers on the RAID controllers (models 3526 and 3552).

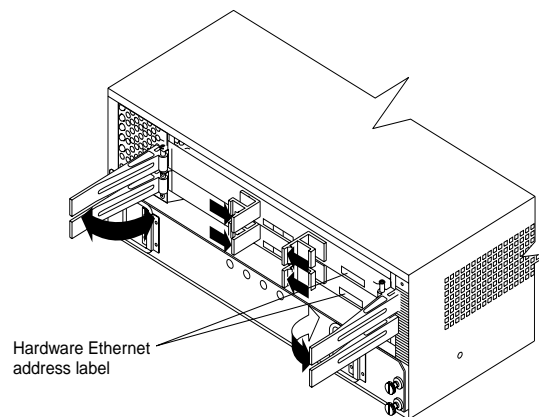


Figure 9. Location of the hardware Ethernet address labels (machine types 3526 and 3552)

3. On the front of each controller, look for a label with the controller hardware Ethernet address, as shown in Figure 9.
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 21 on page 89).
5. Lock the RAID controllers by simultaneously pushing on the levers until they are latched in.
6. To replace the bezel on machine types 3526 and 3552, slide the top edge under the lip on the chassis **1**; then push the bezel bottom until the pins snap into the mounting holes **2**, as shown in Figure 10 on page 23.

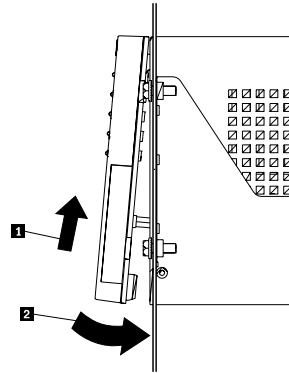


Figure 10. Replacing the controller-unit bezel on models 3526 and 3552

7. Continue with “Obtaining IP addresses for hosts and controllers”.

Obtaining IP addresses for hosts and controllers

| If you | 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 your network administrator) a unique IP address and the 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 21 on page 89). Then, go to “Setting up the DHCP BOOTP server”.
2. Contact your 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 21 on page 89). Then, go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

Setting up the DHCP BOOTP server

If you plan to directly manage storage subsystems through the Ethernet connection to each controller, select the procedure you plan to use for setting up the DHCP BOOTP server:

- When using Microsoft BOOTP-compatible DHCP, go to “Using Microsoft Windows 2000 DHCP as a BOOTP-compatible server” on page 28.
- When using UNIX BOOTP, go to “Using a UNIX BOOTP server” on page 31.
- When using NetWare DHCP as a BOOTP-compatible server, go to “Using NetWare DHCP as a BOOTP-compatible server” on page 30.

If you plan to manage storage subsystems using the host-agent software, go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

Using Microsoft Windows NT 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". If a DHCP Manager is not installed, use the following installation procedure.

Installing the 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 5 or greater to get new DHCP settings or information that is 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 21 on page 89, to set up the DHCP server.

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

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 several sections. The "IP Address Pool" section contains text boxes for "Start Address" (153.79.144.1), "End Address" (153.79.144.50), and "Subnet Mask" (255.255.248.0). To the right is an "Excluded Addresses" list box. Below this is an "Exclusion Range" section with "Start Address" and "End Address" text boxes, and "Add >" and "< Remove" buttons. The "Lease Duration" section has a radio button selected for "Unlimited" and another for "Limited To:". The "Limited To" section has spinners for "3" Day(s), "00" Hour(s), and "00" Minute(s). At the bottom are "Name:" and "Comment:" text boxes, and "OK", "Cancel", and "Help" buttons.

Figure 11. Create scope - (Local) window

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

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

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

- d. Type the subnet mask (obtained from your network administrator).
- e. Set the Lease Duration to **Unlimited**. This makes the DHCP connection permanent.
- f. Type a scope name and comment.
- g. Click **OK**.
- h. When the scope has successfully completed, click **Yes** to activate it.
You return to the DHCP Manager window.

- 3. Use the following procedure to configure global scope options. You can use the scope options to configure settings that are applicable to all controllers. To determine which parameters to apply to the entire group, see Table 10 on page 19.

Note: You can apply options to specific controllers later using step 5 on page 26.

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

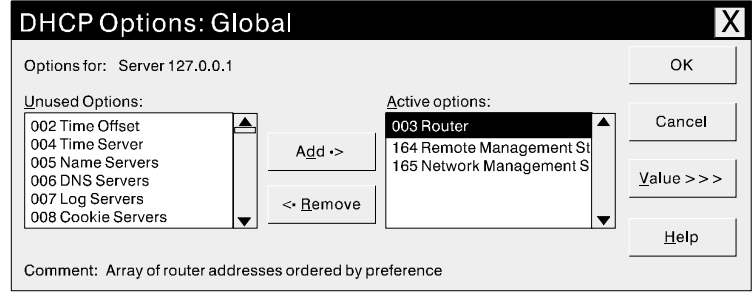


Figure 12. DHCP options window

- b. Select 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.
If **Value** is not selectable, the Edit Array Editor window opens in the lower pane of the window.
- d. If you need to add an IP address, click **Edit Array**.
The IP Address Array Editor window opens.

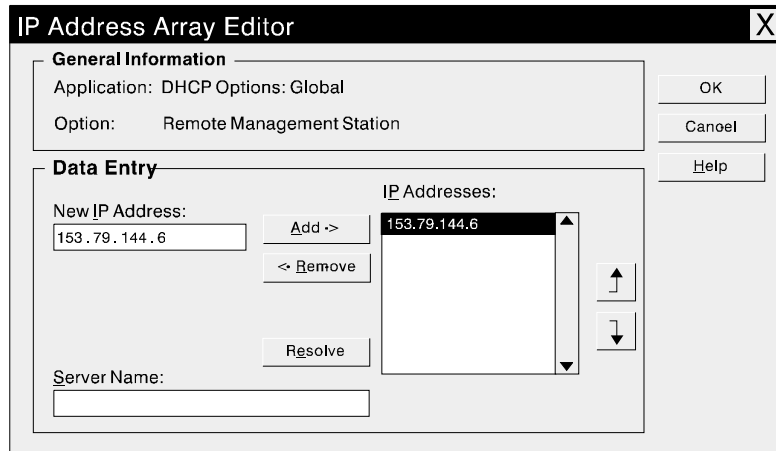


Figure 13. IP address array editor window

Figure 13 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 3g.

- e. Type the unique IP address for the option that 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 3b through step 3g 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 that you created (Table 21 on page 89) to make sure that you include all of the controllers for every storage subsystem on the network.
 - a. Click **Scope** → **Add Reservations**.
 - b. In the **IP Address** field, type the IP address for the first controller on your data sheet.
 - c. In the **Unique Identifier** field, type the controller hardware Ethernet address.
 - d. In the **Client Name** field, type the controller eight-character name.
 - e. Click **Add**.
 - f. Repeat step 4b through step 4e for each controller that is listed in your data sheet. See Table 21 on page 89.
 - g. When you finish typing 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. By creating a controller-specific option, you can associate a controller configuration entry with a specific controller that you 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.

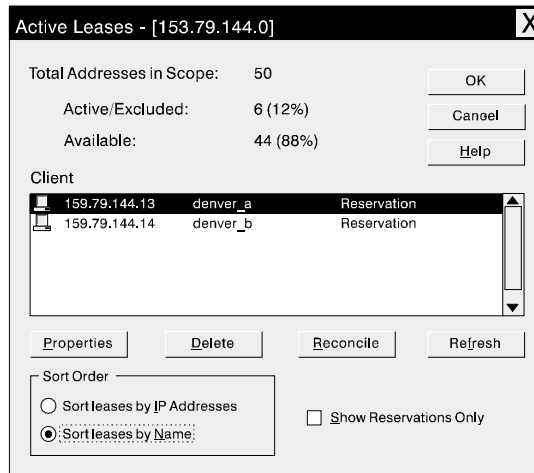


Figure 14. Active Leases window

- b. Select a controller in the list.
- c. Click **Properties**.

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

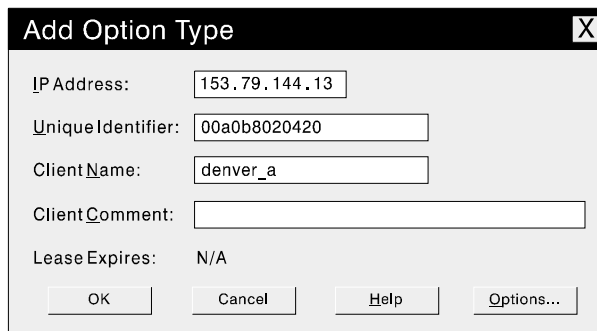


Figure 15. Add option type window

- d. Click **Options**.
The DHCP Options: Reservations window opens.
- e. Select 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. Type the information for the value of the option.
For example, for Host Name, type the host name for the controller from your data sheet (Table 21 on page 89) in the String field. Click **Edit** if the value that you need to add is an IP address for a router.
- h. Repeat step 5e through step 5g until you finish adding specific options for this controller.
- i. Click **OK**.

You return to the Add Option Type window.

- j. Click **OK**.

You return to the Active Leases window.

- k. Repeat step 5b on page 27 through step 5g on page 27 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 “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

Using Microsoft Windows 2000 DHCP as a BOOTP-compatible server

You must use a version of Dynamic Host Configuration Protocol (DHCP) that supports BOOTP static addressing. To use a DHCP server, you must have a DHCP Manager installed. If a DHCP Manager is installed on the system, go to “Setting up a DHCP server”. If a DHCP Manager is not installed, use the following installation procedure:

Installation instructions

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

The Add/Remove window opens.

2. Click the **Add/Remove Component** button.

The Component window opens.

3. Scroll to, highlight, and click **Networking Services**.

4. Click the **Details** button.

5. Under Subcomponents of Networking Services, select the **Dynamic Host Configuration Protocol** check box, and click **OK**.

6. If prompted, type the full path to the Windows 2000 distribution files and click **Continue**.

The required files are copied to your hard disk. The server software can be used after you restart the system.

7. Continue with “Setting up a DHCP server”.

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

Setting up a DHCP server

Use the following procedure to create a scope and to set up the DHCP server. A scope defines a group of controllers by their IP addresses. You must create and configure a scope so that dynamic IP addresses can be assigned to controllers on your network. Refer to the information that you provided in Table 21 on page 89. Before you begin, read through the instructions to determine what information is required, and then, request the information from your network administrator.

Note: The following steps and window example assume that you are configuring a Windows 2000 DHCP server using its DHCP Manager.

1. Click **Start** → **Programs** → **Administrative Tools** → **DHCP**.

The DHCP Manager window opens.

2. Highlight the server you want to configure.

The Add a Scope window opens. Use the following instructions:

- a. Type a scope name and description.

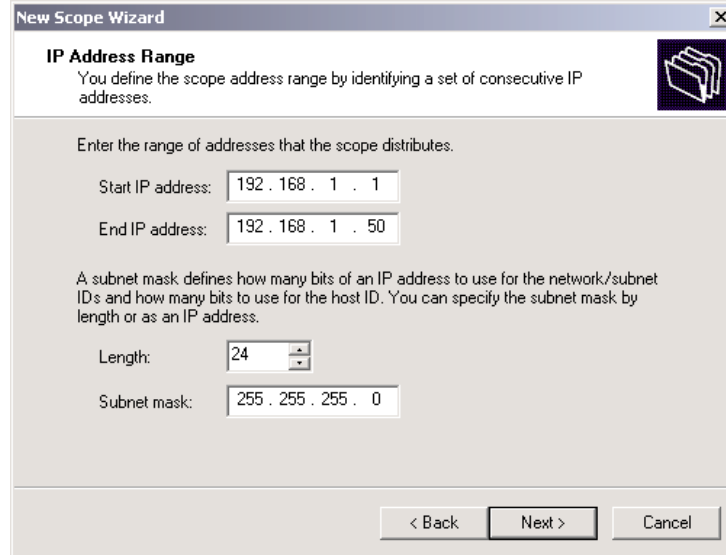


Figure 16. Create scope - (Local) window

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

For example, if you are configuring 50 controllers on a 192.168.1.0 subnet, set the starting address to 192.168.1.1, and set the ending address to 192.168.1.50.

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

- c. Type the subnet mask (obtained from your network administrator).
- d. Using the Add Exclusions window, enter IP addresses that need to be excluded from the beginning and ending addresses that you just entered in step 2b, and then click **Add**.
- e. Set the Lease Duration (obtained from your network administrator).
- f. To configure the DHCP options, do the following:

Note: Be sure that you configure the DHCP options now. If you want to configure the options later, go to the DHCP window, and open the directory structure for the scope that you created in step 2 on page 28. Right-click **Scope Options** → **Configure Options** and follow the instructions.

- 1) Add an IP address for a router.
- 2) Add the domain name and DNS servers.
- 3) Enter the server name and IP address in the WINS Servers window.
- 4) When the scope has successfully completed, click **Yes** to activate it.

You return to the DHCP Manager window.

3. Open the directory structure below the scope you created.
 - a. Right-click **Reservation**, click **New Reservation**, and follow the instructions.

Important: At the bottom of the New Reservations window, make a selection under Supported Type.

- The New Reservation window opens.
- b. Enter a Reservation name, IP address, MAC address, and description.
 - c. In the support type box, select both options (**DHCP** and **BOOTP**).
 - d. Click **Add**.
 - e. Repeat step 3b through step 3d until you have added the reservations for all of the controllers.
 - f. When you enter the information for all of the controllers, click **Close**.
4. When you finish setting up the DHCP server, you must restart the DHCP server and then restart the storage subsystem before any modifications in the DHCP will take effect.
 5. Go to "Verifying the TCP/IP protocol and setting up the host or DNS table" on page 32.

Using NetWare DHCP as a BOOTP-compatible server

The Dynamic Host Configuration Protocol (DHCP) enables TCP/IP-based client workstations to receive local and network configuration information automatically when the TCP/IP transport is loaded. When a DHCP client workstation starts, it broadcasts a DHCP request for its IP address and network configuration. When the DHCP server receives the message, it checks its database to determine which configuration information to return. The DHCP server replies by sending a DHCP reply message that includes all TCP/IP configuration information required by the specific client that sent the request.

This section provides procedures for setting up the NetWare DHCP service. Prior to the installation of the DNS DHCP service, you must complete the following three tasks:

- Extend the NDS schema and create the default DNS DHCP objects.
- Install the Novell Client on the machine that is going to run the DNS DHCP Management Console.
- Install the DNS DHCP Management Console and NetWare Administrator snap-in files.

Extending the schema using the NetWare installation process

Perform the following steps to extend the NDS schema and create the three default DNS DHCP objects using the NetWare 5 installation program at the server console:

1. Select the NetWare GUI screen at the server console.
2. Click **Novell** → **Install**.
The Install Products window opens.
3. Select **Add** and follow the on-screen instructions.
The Source Path window opens.
4. Enter the path to the Install directory in the Source Path window and click **OK**. You can use the Browse button to find the NetWare 5.1 installation files.
5. Select the Novell DNS DHCP Services box in the Additional Products and Services window.
6. Authenticate yourself to NDS as a user with rights to extend the NDS schema. You must have supervisor rights to the root of the NDS tree.
7. Type your fully distinguished name in the User Name field and type your password in the Password field.

8. Click **OK**.
9. Enter the NDS context where you want to create the DNS DHCP locator, DNSDHCP GROUP group, and RootServerInfo Zone objects. When finished, click **Next**.
10. In the Summary Window, Click **Finish**.
11. The Complete window opens. Click **Yes** to restart the server.

Installing the DNS DHCP Management Console

You must install the DNS DHCP Management Console and NetWare Administrator snap-in files before you can see and manage the new NDS DHCP objects in the NDS tree. Perform the following steps to install the management files.

Note: Perform the Novell Client installation on your client workstation before installing the DNS DHCP Management Console.

1. Run the SYS:PUBLIC\DNSDHCP\SETUP.EXE program from a client workstation.
2. Install the DNS/DHCP Management Console on the local hard disk.
3. Install the NetWare Administrator snap-in files in the SYS:PUBLIC\WIN32 directory.
4. Restart the workstation.

Configuring the NetWare DNS DHCP service

You must assign a NetWare server as a DHCP server, configure several NDS objects, and initialize the DNS DHCP service before you can use BOOTP services on the network. Consult your Novell NetWare 5.1 documentation for a more detailed explanation of how to configure the DHCP parameters.

Go to “Verifying the TCP/IP protocol and setting up the host or DNS table” on page 32.

Using a UNIX BOOTP server

Table 12 and Table 21 on page 89 provide information for setting up the BOOTP table and making the required entries to support the controllers in the storage subsystems. Use a text editor to edit the bootptab file in the /etc directory.

Table 12. Required entries for setting up the UNIX BOOTP server.

| Entry | Description | Sample format in BOOTP server |
|------------------------------|--|--|
| Subnet mask | Mask that is used to route packets to defined subnets. | dot notation (sm=255.255.255.0) |
| Router | IP address of the host computer that routes packets to networks. | dot notation (gw=192.168.1.1) |
| Host name for the controller | Host name that is associated with the controller (refer to Table 21 on page 89). | host name (Denver_a) |
| IP address | IP address of the controller (refer to Table 21 on page 89). | dot notation (ip=192.168.1.13) |
| Ethernet address | The Ethernet address of the controller hardware (refer to Table 21 on page 89). | hexadecimal notation (ha=00a0b8020420) |

Note: The RMS and NMS entries used in previous versions of the storage management software, are not required when using Storage Manager 7.10 to manage storage subsystems with controllers running firmware version 4.x.

Example for editing a UNIX BOOTP table

The following example of a BOOTP table assumes that you are configuring a UNIX BOOTP server, such as a server on Network A, as shown in Figure 6 on page 18. 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=192.168.1.1:\
```

```
hn:
```

```
denver_a:\
```

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

```
ip=192.168.1.13:\
```

```
ha=00a0b8020420:
```

```
denver_b:\
```

```
tc=s4.default:\
```

```
ip=192.168.1.14:\
```

```
ha=00a0b80000d8:
```

When you finish setting up the BOOTP table, perform the following:

1. If the storage subsystem power is on, power down the subsystem, and then, power up the storage subsystems.

You must restart the storage subsystems for the parameters in the BOOTP table to take effect.

2. Continue with "Verifying the TCP/IP protocol and setting up the host or DNS table".

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

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.

For Windows NT:

1. Click **Network Neighborhood**.
2. Select **Properties**.

The Network window opens.

3. Click the **Protocols** tab. If the TCP/IP protocol entry does not appear in the Network Products box, click **Add** and the Select Network Protocol window opens. Follow the online procedure to install the TCP/IP protocol.
4. Update either the host table or DNS table to specify a host name to associate with an IP address. If you do not have a DNS (or WINS), edit the two host tables found in the following directories (your directory will be different if the operating system is not installed on the root).

To set up the host tables for the controllers connected to Network A (Figure 6 on page 18). Open the hosts file that is located in the \etc\ directory (refer to the example below) and use a text editor to update the hosts file to create the following IP address and controller name entries. See the hosts file example below.

Copyright (c) 1993-1999 Microsoft Corp.

This is a sample HOSTS file used by Microsoft TC/PIP for Windows.

This file contains the mappings of IP addresses to host names. Each entry should be kept on an individual line. The IP address should be placed in the first column followed by the corresponding host name. The IP address and the host name should be separated by at least one space.

Additionally, comments (such as these) might be inserted on individual lines or following the machine name denoted by a '#' symbol.

For example:

```
102.54.94.97          rhino.acme.com          # source server
38.25.63.10          x.acme.com              # x client host

127.0.0.1            local host
192.168.1.13        denver_a
192.168.1.14        denver_b
```

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

c:\winnt\system32\drivers\etc\imhosts

Important: Potential security risks occur when you open ports to your network.

5. If you want to manage storage subsystems through a firewall, continue with "Enabling ports for operation through a firewall" on page 34. Otherwise, go to "Determining your storage-management software installation process" on page 34.

For Windows 2000:

1. Click **Network Neighborhood**.
2. Select **Properties**.
The Network and Dial-up Connections window opens.
3. Right-click on a defined network connection.
4. Select **Properties**.
Make sure that the Internet Protocol TCP/IP box under the 'Components checked are used by this connection' is checked. If not, check the Internet Protocol TCP/IP box and click **Install** and follow the online instructions.
5. Update either the host table or DNS table to specify a host name to associate with an IP address. If you do not have a DNS (or WINS), edit the two host tables found in the following directories (your directory will be different if the operating system is not installed on the root).

To set up the host tables for the controllers connected to Network A (Figure 6 on page 18), open the hosts file that is located in the \etc\ directory (refer to the

example below), and use a text editor to update the hosts file to create the following IP address and controller name entries. See the hosts file example below.

Copyright (c) 1993-1999 Microsoft Corp.

This is a sample HOSTS file used by Microsoft TC/PIP for Windows.

This file contains the mappings of IP addresses to host names. Each entry should be kept on an individual line. The IP address should be placed in the first column followed by the corresponding host name. The IP address and the host name should be separated by at least one space.

Additionally, comments (such as these) might be inserted on individual lines or following the machine name denoted by a '#' symbol.

For example:

```
102.54.94.97          rhino.acme.com      # source server
38.25.63.10          x.acme.com          # x client host

127.0.0.1            local host
192.168.1.13         denver_a
192.168.1.14         denver_b
```

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

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

Important: Potential security risks occur when you open ports to your network.

6. If you want to manage storage subsystems through a firewall, continue with "Enabling ports for operation through a firewall". Otherwise, go to "Determining your storage-management software installation process".

Enabling ports for operation through a firewall

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

Determining your storage-management software installation process

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 35. |
| Install the software in a cluster server environment | Chapter 4, "Installing software in a cluster server environment," on page 51. |

Chapter 3. Installing software in a standard configuration

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

Important: Always check for a README file on any installation media. This README file might contain important information that was not available when this *Installation and Support Guide* was prepared. To ensure proper installation, make sure you have read the entire contents of Chapter 1, including all supporting documentation listed in Chapter 1, "Introduction," on page 1. In addition, you must complete all preparation tasks described in Chapter 2, "Preparing for installation," on page 17.

Pre-installation process

There are two configurations in which you can install the storage-management software:

- You do *not* have existing storage subsystems. In this situation, you are installing new storage subsystems with machine type 3526, 3542, or 3552 controllers using firmware version 04.01.xx and will manage these new storage subsystems using Storage Manager 7.10. For this configuration, go to "New installation process" on page 37.
- You do have existing storage subsystems with machine type 3526, 3542, or 3552 controllers. In this situation, you can do one of the following:
 - Upgrade the controller firmware on the existing storage subsystems to version 04.01.xx and manage them with Storage Manager 7.10.
 - If you have firmware version 3.01.x, continue to manage the storage subsystems with version 6.22 of the storage-management software. You can manage these storage subsystems in coexistence with new storage subsystems that you are managing with Storage Manager 7.10. To determine if you have coexisting storage subsystems, see "Managing new and existing storage subsystems attached to the same host" on page 12.
 - You can manage the storage subsystem with the IBM FASTT Storage Manager 7.10 at controller firmware version 4.00.x.

Use Table 13 on page 36 to determine an installation process.

Table 13. Determining your installation process in a standard (noncluster) configuration.

| Current environment | Planned environment | Action |
|---|--|---|
| No existing storage subsystems | New storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager 7.10. | Go to "New installation process" on page 37. |
| (machine type 3526) Existing storage subsystems with controllers that have firmware version 3.x, and Storage Manager version 6.22 running on a Windows NT 4.0 operating system. | Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager 7.10 for Windows 2000. | To upgrade controller firmware from 3.x to 04.01.xx, refer to "Using the Migrate Utility" on page 79. Note: You must upgrade controller firmware from version 3.x to 4.x before upgrading the operating system from Windows NT to Windows 2000. |
| (machine types 3526, 3542, and 3552) Existing storage subsystems with controllers that have firmware versions 4.00.00 through 04.00.03 running on a Windows NT 4.0 operating system. | Upgrade from Windows NT to Windows 2000. Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager 7.10 for Windows 2000. | Go to "Upgrading from Windows NT 4.0 to Windows 2000 in a standard configuration". |
| (machine types 3526, 3542, and 3552) Existing storage subsystems with controllers that have firmware versions 4.00.00 through 04.00.03 running on a Windows 2000 or NT 4.0 operating system. | Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager 7.10. | <ol style="list-style-type: none"> 1. Uninstall Storage Manager version 7.00, 7.01, or 7.02 using the procedure that comes with the version of storage-management software you are currently running. 2. Go to "New installation process" on page 37. 3. Update the controller firmware to version 04.01.xx and then, update the NVSRAM using the storage-management software online help. |

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

Important: You cannot upgrade from Windows NT to Windows 2000 if your storage subsystem is the startup (boot) device.

Important: Controllers *must* be running firmware 4.x prior to upgrade.

Attention: To avoid possible data loss, you must follow the instructions to uninstall any previous versions of the storage-management software (refer to "Uninstalling storage-management software components" on page 87).

Follow these steps to upgrade from Windows NT 4.0 to Windows 2000:

Note: All storage-management configuration information is deleted during the uninstallation process. A complete reinstallation of the storage-management software is required.

1. Be sure that the storage subsystem contains no system-dependent files or directories, such as paging files.
2. Uninstall Storage Manager 7.10 (refer to “Uninstalling storage-management software components” on page 87). Otherwise, use the procedure that comes with the version of the storage-management software that you are currently running.

Note: The storage manager components uninstallation order is SM7agent, SM7util, RDAC, and SM7client.

3. Use the instructions from Microsoft to upgrade to Windows 2000.
4. Install Storage Manager 7.10 as a new installation using the instructions beginning at “New installation process”.

New installation process

If you are installing the storage-management software on a Windows NT platform, begin the installation with “Microsoft Virtual Machine installation for Windows NT” on page 39. Continue the process until you have completed “Installing the Storage Manager 7 Utility software on a Windows NT platform” on page 44. Refer to Figure 17 for more information about the software installation sequence.

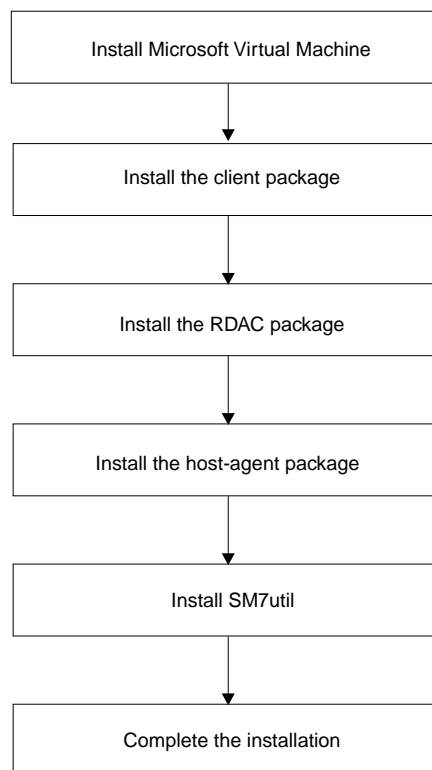


Figure 17. New installation process for Windows NT

If you are installing the storage-management software on a Windows 2000 platform, begin the installation with “Installing the SM7client package on a Windows 2000 platform” on page 45. Continue the process until you have completed “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 48. Refer to Figure 18 for more information about the software installation sequence.

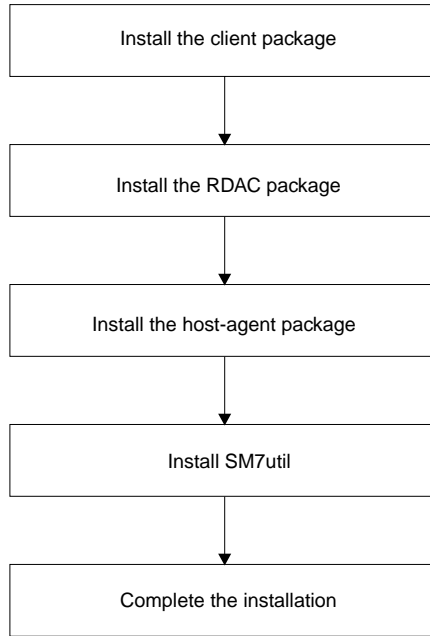


Figure 18. New installation process for Windows 2000

Management station software installation

Refer to the following installation instructions if you are installing software on a management station that is running one of the following operating systems:

- Windows NT 4.0
- Windows 2000

A management station is a remote system that is connected to a host computer through the Ethernet network. However, a management station also can be a host computer connected to the storage subsystem through the Fibre Channel I/O path. Refer to Table 14 on page 39 for management-station software requirements.

Table 14. Management-station software requirements.

| Software | Platform | Requirement |
|---------------------------|--|--|
| Microsoft Virtual Machine | Windows NT 4.0 | Required for all management stations and host computers if: <ul style="list-style-type: none"> You enable the Event Monitor on the storage subsystem or You will use the host-agent method to manage the storage subsystem <p>Note: Install Microsoft Virtual Machine on all management stations and host computers before installing any other required packages on the devices.</p> |
| | Windows 2000 | Not required |
| SM7client | <ul style="list-style-type: none"> Windows 2000 Windows NT 4.0 | Required on all management stations <p>Note: If you are running on a Windows 2000 platform, you can install the SM7client software using the SM7client installation procedure provided in this installation and support guide.</p> |

Microsoft Virtual Machine installation for Windows NT

The Microsoft Virtual Machine is required to support the Event Monitor option of the SM7client package on a management station that is running Windows NT. Although a later version of Microsoft Virtual Machine might be available, the version used in the current release of the storage-management software is compatible with the SM7client Event Monitor software.

Installation instructions

Use the following procedure to install Microsoft Virtual Machine on management stations, servers, and host computers running the Windows NT operating system:

1. Close all other programs before installing this software.
2. Ensure that the IBM FASTT Storage Manager Version 7.10 installation CD is in the CD-ROM drive.
3. Click **Start** → **Run**.
4. Click **Browse**.
The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\MSVM\NT folder, and then, click **Open**.
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.
9. Click **No**, do not restart the system at this time.
10. Continue with "Installing the SM7client package on a Windows NT platform" on page 40.

Installing the SM7client package on a Windows NT platform

This section provides instructions for installing the SM7client on management stations, host computers, or cluster servers that are running on a Windows NT platform.

Use the procedure in this section to install the client software on a Windows NT 4.0 management station, host, or cluster server attached to the storage subsystem.

Installation instructions

Before you install the software, make sure that:

- Microsoft Virtual Machine software has been installed on the device before proceeding (refer to “Microsoft Virtual Machine installation for Windows NT” on page 39)
- The management station has at least 35 MB of available disk space.
- The display properties are set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors or more.
- You close all other programs.

Attention: To avoid system problems, do not install any of the storage-management components on a second Windows NT management station until instructed to do so in the installation procedures.

To install the SM7client package:

1. Insert the IBM FASTT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7client folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The InstallShield opens.
8. Click **OK**.
The Welcome window opens.
9. Click **Next** to begin the installation.
10. The Event Monitor window opens. At the prompt, click **Yes** if you want to install Event Monitor.
Note: Be sure that Microsoft Virtual Machine is installed before you install Event Monitor.
The Choose Destination Location window opens.
11. Click **Browse** to change the destination location.
12. Click **Next** to start the installation.
13. Click **Finish**.

Verifying the SM7client installation

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

1. Click **Start** → **Programs**.
2. Verify that IBM FASSt Storage Manager 7 Client appears in the Program list. If the IBM FASSt Storage Manager 7 Client appears, go to step 3. Otherwise, repeat step 1 on page 40 through step 12 on page 40. If the IBM FASSt Storage Manager 7 Client still does not appear, a failure has occurred. Contact your IBM technical-support representative.
3. If you are installing SM7client on a host computer, go to “Installing RDAC on a Windows NT platform”. Otherwise, go to Chapter 5, “Completing the installation,” on page 73.

Installing RDAC on a Windows NT platform

Host computers running Windows NT require the RDAC software to ensure redundancy. Use the following instructions to manually assign drive letters. If necessary, install the RDAC software on each attached host computer that is running Windows NT.

Important: You must assign static drive letters to existing local drives before installing RDAC to prevent problems during new installations and upgrades. After RDAC is installed, the RDAC utility installs the RDAC driver before the Windows NT class driver. If static drive letters are not assigned, the system will detect storage subsystem volumes before it will detect local drives. The system will assign drive letters to the storage subsystem volumes first. If this occurs and you have software applications using drive letters that are assigned to local drives, application errors will result.

Assigning static drive letters

Before you begin:

1. If you have a host computer that is running Windows NT and you want to manage the attached storage subsystem through the host-agent method, you must enable the Event Monitor and make sure Microsoft Virtual Machine is installed. Refer to “Microsoft Virtual Machine installation for Windows NT” on page 39 and “Installing the SM7client package on a Windows NT platform” on page 40 before proceeding to step 2.

Important: To avoid system problems, you must install Microsoft Virtual Machine and SM7client software on the host before installing any additional storage-management software.

2. Determine how many partitions you have. Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and check the number of partitions.
3. If you have at least two partitions, use Table 15 to determine the next step. Otherwise, go to step 4.

Table 15. RDAC partition requirements.

| Requirement | Status | Action |
|--|---------------------------------------|---|
| <ul style="list-style-type: none"> • One partition is the boot partition. • The last partition has been created with Disk Administrator or Disk Management. • The partition has an assigned drive letter and either an unknown status or a status other than Unformatted. | One or more requirements are not met. | Go to step 4. |
| | All requirements are met | Go to “Installation instructions” on page 42. |

4. Create a new partition on your local system or on a storage subsystem using the following procedure:
 - Note:** The storage subsystem must have at least one configured volume. To access the volume, connect the storage subsystem to the host and restart the system. In Windows NT, configured logical drives will appear in Disk Administrator.
 - a. Select a drive with free space, and then click **Partition** → **Create**. The partition is created with a status of Unformatted and a drive letter is assigned. You can delete or change the logical drive at a later time without causing reassignment of the boot partition.
 - b. Click **Partition** → **Commit Changes Now**. The partition status changes to Unknown and static drive letters are assigned to all existing partitions.
 - c. Continue with "Installation instructions".

Installation instructions

Before you install the RDAC software package, make sure that:

- You have Administrator privileges on the host computer.
 - The host computer has at least 1 MB of available disk space.
 - You close all other programs.
1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
 2. Click **Start** → **Run**.
 3. Click **Browse**.

The Browse window opens.
 4. Select the CD-ROM drive.
 5. Select the \Win32\SM7RDAC\NT folder, and then click **Open**.
 6. Select the setup.exe file, and then, click **Open**.
 7. Click **OK**.

The InstallShield opens.
 8. Click **OK**.

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

When RDAC is installed, the Setup Complete window opens.
 10. Click **Yes** to restart the host or server.

Verifying the RDAC installation

Use the following procedure to verify that the RDAC package installation was successful:

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

1. Click **Start** → **Settings** → **Control Panel** → **Devices**. When the Devices window opens, scroll to symarray.
 - If symarray appears with a device status of Started, go to step 2 on page 43
 - If symarray does not appear, an error might have occurred. Repeat step 1 through step 10. in the " Installation instructions". If the failure persists, call your IBM technical-support representative. Otherwise, go to step 2 on page 43.

2. If you are managing the storage subsystems using the host-agent method, continue with “Installing the SM7agent software package on a Windows NT platform”. If you are managing your storage subsystems directly, go to “Installing the Storage Manager 7 Utility software on a Windows NT platform” on page 44.

Installing the SM7agent software package on a Windows NT platform

This section provides instructions for installing the SM7agent software on host computers. Be sure that the SM7agent software is installed if you want to manage the storage subsystem using the host-agent method.

Installation instructions

Use the following procedure to install the SM7agent on each attached Windows host computer that will be host-agent managed.

1. Before installing SM7agent, do the following:
 - Make sure you have installed Microsoft Virtual Machine (refer to “Microsoft Virtual Machine installation for Windows NT” on page 39).
 - Make sure that you have installed RDAC on each attached host. Refer to “Installing RDAC on a Windows NT platform” on page 41.
2. Close all other programs.
3. Ensure that the IBM FAStT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
4. Click **Start** → **Run**.
5. Click **Browse**.
The Browse window opens.
6. Select the CD-ROM drive.
7. Select the \Win32\SM7agent folder, and then, click **Open**.
8. Select the setup.exe file, and then, click **Open**.
The Welcome window opens.
9. Click **Next** to begin the installation.
When the SM7agent is installed, the Setup Complete window opens. Make sure that all storage subsystems are connected to the host computer or server and are powered on.
10. Click **Finish**.

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

Verifying the SM7agent installation

Use the following procedure to verify that the IBM FAStT Storage Manager 7 Agent installation was successful.

1. Do one of the following:
 - Click **Start** → **Settings** → **Control Panel** → **Services**. When the Services window opens, scroll through the services list to IBM FAStT Storage Manager 7 Agent.
 - If IBM FAStT Storage Manager 7 Agent appears with a startup type of Started, close all other programs.

- If IBM FAStT Storage Manager 7 Agent does not appear with a startup type of Started, click **SM7agent** → **Start**. If the status changes to Started, go to step 2. Otherwise, an error might have occurred. Contact an IBM technical-support representative.
2. As applicable, go to “Installation instructions” on page 43 and repeat step 2 through step 10 to install the IBM FAStT Storage Manager 7 Agent on each attached host computer that is running Windows NT 4.0.
 3. If you plan to use the host-agent software to manage one or more storage subsystems, go to “Installing the Storage Manager 7 Utility software on a Windows NT platform”.
 4. If you do not plan to use the host-agent software to manage one or more storage subsystems, disable the host-agent service using the following procedure:
 - a. Click **Start** → **Programs** → **Administrative Tools** → **Manage**.
The Computer Management window opens.
 - b. Click **Services**.
 - c. From the list of displayed services, right-click the IBM FAStT Storage Manager 7.
 - d. Click **Properties** → **Startup Type** → click **Manual**.
 - e. Click **OK**.
 5. Continue with “Installing the Storage Manager 7 Utility software on a Windows NT platform”.

Installing the Storage Manager 7 Utility software on a Windows NT platform

This section provides instructions for installing the Storage Manager 7 Utility software on attached hosts that are running Windows NT. The Storage Manager 7 Utility software contains utilities that will register and map new logical drives to the operating systems. The Storage Manager 7 Utility software must be installed on host computers that are attached to the storage subsystem through a Fibre Channel connection.

Important: Make sure you have installed the RDAC software on the same host where you are installing the Storage Manager 7 Utility software. For more information, refer to “Installing RDAC on a Windows NT platform” on page 41.

Installation instructions

Use the following procedure to install the Storage Manager 7 Utility software on each attached Windows host computer.

1. Close all other programs and ensure that the IBM FAStT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7util folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.
The Welcome window opens.
7. Click **Next** to begin the installation.

After installing the Storage Manager 7 Utility software, the Operation Complete window opens. If the system detects the installation of another version of Storage Manager 7 Utility, a window opens indicating that the installation will be updated and your personal configuration files will be saved. Click **Yes** to continue.

8. Click **Finish**.
9. Go to Chapter 5, "Completing the installation," on page 73.

Installing the SM7client package on a Windows 2000 platform

Use the procedure in this section to install the SM7client on each management station or host computer that is configured with Windows 2000.

Important: When you install SM7client on a stand-alone host and manage storage subsystems through the Fibre Channel I/O path rather than through the network, you must install the TCP/IP software on the host and assign a static IP address to the host. The host operating system must be running Windows 2000 Server or Windows 2000 Professional.

Installation instructions

Before you install the software, make sure that:

- The management station has at least 35 MB of available disk space.
- The display properties are set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors or more.
- You close all other programs.

To install the SM7client package:

1. Insert the IBM FAS/T Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7client folder, and then click **Open**.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The InstallShield opens.
8. Click **Open**.
The Welcome window opens.
9. Click **Next** to begin the installation.
10. The Event Monitor window opens. At the prompt, click **Yes** to install the Event Monitor.
The Choose Destination Location window opens.
11. Click **Browse** if you want to change the destination location.
12. Click **Next** to start the installation.
13. Click **Finish**.

Verifying the SM7client installation

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

1. Click **Start** → **Programs**.
2. Verify that IBM FAStT Storage Manager 7 Client appears in the list of programs.
3. If you are installing the SM7client on a host computer, go to “Installing the RDAC package on a Windows 2000 platform”. Otherwise, go to Chapter 5, “Completing the installation,” on page 73.

Installing the RDAC package on a Windows 2000 platform

Use the following procedure to install the RDAC package on a host computer that is connected to one or more storage subsystems.

RDAC contains the multipath device driver that is necessary for controller failover support.

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

Note: If you are installing the RDAC software on an existing configuration, continue with “Installation instructions”.

Installation instructions

Before you install the software, make sure that:

- You have Administrator privileges on the host computer.
- The host computer is configured with Windows 2000 Server or Windows 2000 Professional.
- The host computer has at least 1 MB of available disk space.
- You close all other programs.

Install the RDAC package:

1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7RDAC\W2K directory.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The InstallShield opens.
8. Click **OK**.
The setup program Welcome window opens.
9. Click **Next** to begin the installation.
After installing RDAC, the Setup Complete window opens.
10. Click **Yes** to restart your computer.
11. Continue with “Verifying the RDAC installation”.

Verifying the RDAC installation

Use the following procedure to verify that the RDAC package installation was successful:

1. Right-click **My Computer**.
2. Click **Manage**.
The Open Computer Management window appears. Go to the System Tools\System Information\Software Environment\Drivers directory.
3. Scroll through the list of device drivers until you find rdacfltr.
4. Verify that rdacfltr is displayed with the state type Running and status OK. If it is not, reinstall RDAC.
5. If you are managing the storage subsystems using the host-agent method, continue with “Installing the SM7agent package on a Windows 2000 platform”. If you are managing your storage subsystems directly, go to “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 48.

Installing the SM7agent package on a Windows 2000 platform

Use the following procedure to install IBM FAStT Storage Manager 7 Agent on each host computer connected to one or more storage subsystems. The IBM FAStT Storage Manager 7 Agent consists of the host-agent software that is necessary for host-agent management of the storage subsystems.

Important: You cannot install SM7agent unless RDAC is installed on each attached host. If you have not done so, refer to “Installing the RDAC package on a Windows 2000 platform” on page 46.

Installation instructions

Before you install the software, make sure that:

- You have Administrator privileges on the host computer.
- The host computer is configured with Windows 2000 Server or Windows 2000 Professional.
- The host computer has at least 1 MB of available disk space.
- The display properties are set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors or more.
- You installed RDAC.
- You close all other programs.

Install the SM7agent:

1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7agent folder.
6. Select the setup.exe file, and then, click **Open**.
The Welcome window opens.

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

When the SM7agent is installed, the Setup Complete window opens. Make sure that all storage subsystems are connected to the host computer or server and are powered on.

8. Click **Finish**.

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

Verifying the SM7agent installation

Use the following procedure to verify that the IBM FAStT Storage Manager 7 Agent installation was successful:

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

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
2. Scroll through the list of services until you find the IBM FAStT Storage Manager 7 agent.
3. Verify that IBM FAStT Storage Manager 7 Agent is displayed with the startup type Automatic and status Started. If it is not, reinstall IBM FAStT Storage Manager 7 Agent.
4. If you plan to use the host-agent software to manage one or more storage subsystems, go to “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform”.
5. If you do not plan to use the host-agent software to manage one or more storage subsystems, disable the host-agent service using the following procedure:
 - a. Click **Start** → **Programs** → **Administrative Tools** → **Computer Management**.
The Computer Management window opens.
 - b. Click **Services**.
 - c. From the list of displayed services, right-click the IBM FAStT Storage Manager 7.
 - d. Click **Properties** → **Startup Type** → click **Manual**.
 - e. Click **OK**.
6. Continue with “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform”.

Installing the Storage Manager 7 Utility software package on a Windows 2000 platform

This section provides instructions for installing the Storage Manager 7 Utility software package on attached hosts that are running Windows 2000. The Storage Manager 7 Utility software package contains utilities that will register and map new logical drives to the operating systems. The Storage Manager 7 Utility software package must be installed on host computers that are attached to the storage subsystem through a Fibre Channel connection.

Important: Make sure you have installed the RDAC software on the same host where you are installing the Storage Manager 7 Utility software package. For more information, refer to “Installing the RDAC package on a Windows 2000 platform” on page 46.

Installation instructions

Use the following procedure to install the Storage Manager 7 Utility software on each attached Windows host.

1. Close all other programs and ensure that the IBM FAStT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7util folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.

The Browse window opens.

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

After the Storage Manager 7 Utility software installation, the Operation Complete window opens. If the system detects the installation of another version of Storage Manager 7 Utility software, a window opens indicating that the installation will be updated and your personal configuration files will be saved. Click **Yes** to continue.

8. Click **Finish**.
9. Go to Chapter 5, "Completing the installation," on page 73.

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. The installation process you will use depends on your storage subsystem environment. Refer to Table 16 on page 53 to determine your installation process.

Important: Always check for a README file on any installation media. This README file might contain important information that was not available when this *Installation and Support Guide* was prepared. To ensure proper installation, make sure you have read the entire contents of Chapter 1, including all supporting documentation listed in Chapter 1, "Introduction," on page 1. In addition, you must complete all preparation tasks described in Chapter 2, "Preparing for installation," on page 17.

Attention: To prevent system problems, do not install the storage-management software on a second management station or host until you have completed all applicable procedures. Do not install the host software on a second host in a cluster environment, until you have installed and configured all storage-management software on the first host, including Microsoft cluster server installation.

Installing the hardware

The hardware installation involves installing host adapters and storage subsystems. Before you begin the installation of Storage Manager 7.10, make sure that all hardware components are installed correctly for the cluster server configuration. Then, use Table 16 on page 53 to determine an installation process.

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 19 on page 52 shows Fibre Channel single- and dual-path connection examples.
- In a multinode system, be sure to set each host adapter with a unique hard loop ID for diagnostic purposes. Refer to the host adapter documentation for setting the hard loop ID.
- Install the correct device driver for the host adapter. Refer to the README file in the \Host_Adapter directory on the IBM FASTT Storage Manager CD for 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 connect Ethernet cables to both controllers in each storage subsystem.
- You need two host adapters per node to use the dual-path configuration.

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

The following figure shows Fibre Channel connections using single-path and dual-path configurations for fully redundant and partially redundant environments. For

more information, refer to the hardware documentation that comes with your controller unit or storage server.

Note: The interlink is used as the clustering heartbeat path.

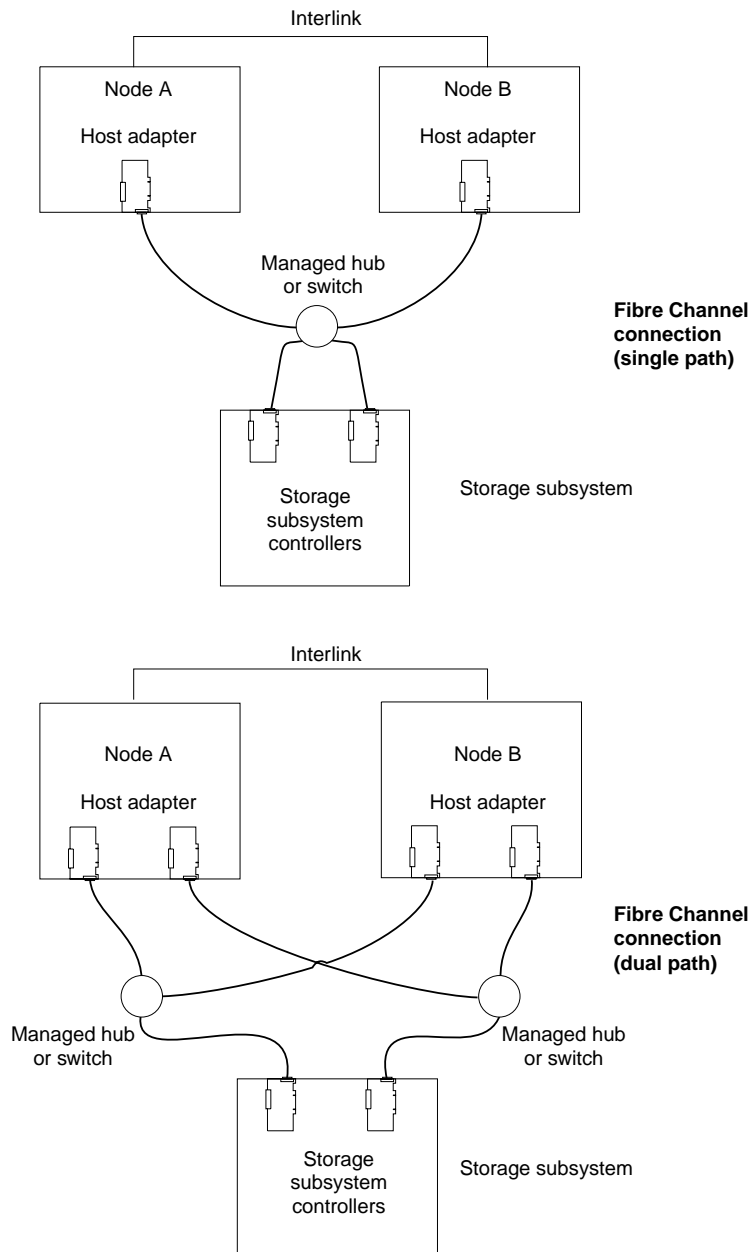


Figure 19. Installing the storage subsystem on a Fibre Channel network

Note: Other managed hub configurations are possible.

Pre-installation process

There are two configurations in which you can install the storage-management software:

- You do not have existing storage subsystems.
- You do have existing storage subsystems.

Table 16. Determining your installation process in a cluster server configuration.

| Current environment | Planned environment | Action |
|--|--|--|
| No existing storage subsystems | New storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager Version 7.10. | Go to “New installation process” on page 54. |
| (machine type 3526) Existing storage subsystems with controllers that have firmware version 3.x, and Storage Manager version 6.22 running on a Windows NT 4.0 operating system. | Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager Version 7.10 for Windows 2000. | To upgrade controller firmware from 3.x to 04.01.xx, refer to “Using the Migrate Utility” on page 79. Note: You must upgrade controller firmware from version 3.x to 04.01.xx before upgrading the operating system from Windows NT to Windows 2000. |
| (machine types 3526, 3542, and 3552) Existing storage subsystems with controllers that have firmware versions 4.00.00 through 04.00.03 running a NT 4.0 operating system. | Upgrade from Windows NT to Windows 2000. Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager Version 7.10 for Windows 2000. | Go to “Upgrading from Windows NT 4.0 to Windows 2000 in a cluster configuration” on page 70. |
| (machine types 3526, 3542, and 3552) Existing storage subsystems with controllers that have firmware versions 4.00.00 through 04.00.03 running a NT 4.0 or Windows 2000 operating system. | Upgrade storage subsystems with controllers that will use version 04.01.xx firmware and will be managed with Storage Manager Version 7.10. Refer to “Upgrading from a previous version of the storage-management software in a cluster server configuration” on page 68. | <ol style="list-style-type: none"> 1. Uninstall Storage Manager version 7.01 or 7.02 using the procedure that comes with the version of storage-management software you are currently running. 2. Install the storage-management software. Go to “New installation process” on page 54. 3. Update the controller firmware to version 04.01.xx and then, update the NVSRAM using the storage-management software online help. 4. For more information, go to “Upgrading from a previous version of the storage-management software in a cluster server configuration” on page 68. |

New installation process

Before you begin an installation with existing storage subsystems, refer to your hardware installation documentation for the specific configuration. A specific configuration might be required for your hardware to support operating the storage-management software in a cluster configuration.

If you are installing the storage-management software on a Windows NT platform, begin the installation with “Microsoft Virtual Machine installation for Windows NT” on page 56. Continue the process until you have completed “Installing the Storage Manager 7 Utility software package on a Windows NT platform” on page 61 (you must start the installation with node A).

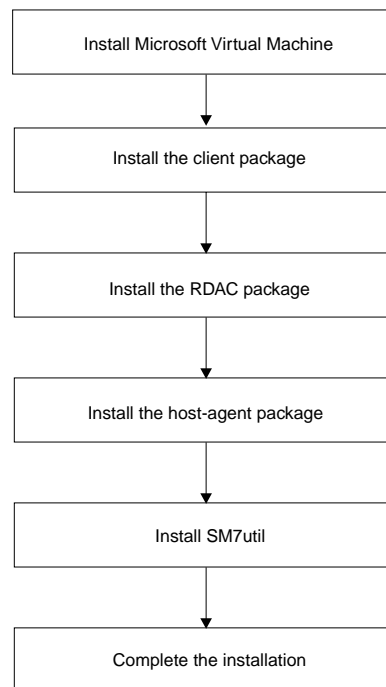


Figure 20. Process for a new Windows NT installation

If you are installing the storage-management software on a Windows 2000 platform, begin the installation with “Installing the SM7client package on a Windows 2000 platform” on page 62. Continue the process until you have completed “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 65 (you must start the installation with node A).

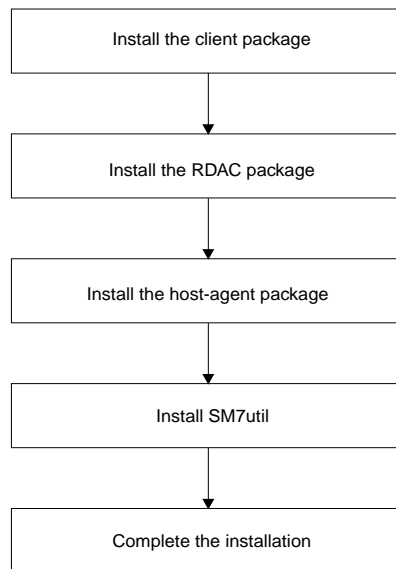


Figure 21. Process for a new Windows 2000 installation

Management-station software installation

Refer to the following installation instructions if you are installing software on a management station that is running one of the following operating systems:

- Windows NT
- Windows 2000

A management station is a remote system that is connected to an Ethernet network. However, a management station also can be a host computer connected to the storage subsystem through the Fibre Channel I/O path.

Refer to Table 17 for the management-station software requirements.

Table 17. Management-station software requirements.

| Software | Platform | Requirement |
|---------------------------|--|---|
| Microsoft Virtual Machine | Windows NT | Required for all management stations and host computers if: <ul style="list-style-type: none"> • You enable the Event Monitor on the storage subsystem or • You will use the host-agent method to manage the storage subsystem Note: Install Microsoft Virtual Machine on all management stations and host computers before installing any other required or optional packages on the devices. |
| | Windows 2000 | Not required |
| SM7client | <ul style="list-style-type: none"> • Windows 2000 • Windows NT | Required on all management stations Note: If you are running on a Windows 2000 platform, you can install the SM7client software using the SM7client installation procedure provided in this installation and support guide. |

Microsoft Virtual Machine installation for Windows NT

The Microsoft Virtual Machine is required to support the Event Monitor option of the SM7client package on a management station that is running Windows NT. Although a later version of Microsoft Virtual Machine might be available, the version used in the current release of the storage management software has been verified to be compatible with the SM7client Event Monitor software.

Installation instructions

Use the following procedure to install Microsoft Virtual Machine on management stations, servers, and host computers running on Windows NT:

1. Close all other programs before installing this software.
2. Ensure that the IBM FASTT Storage Manager Version 7.10 installation CD is in the CD-ROM drive.
3. Click **Start** → **Run**.
4. Click **Browse**.
The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\MSVM\NT folder, and then, click **Open**.
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.
9. Click **No**, do not restart the system at this time.
10. Continue with "Installing the SM7client on a Windows NT platform".

Installing the SM7client on a Windows NT platform

This section provides instructions for installing the SM7client on management stations, host computers, or cluster servers that are running on a Windows NT platform.

If you are installing the SM7client on a Windows NT device, ensure that the Microsoft Virtual Machine software is installed on the device before proceeding. (Refer to "Microsoft Virtual Machine installation for Windows NT".)

Installation instructions

Before you install the software, make sure that:

- The management station has at least 35 MB of available disk space.
- The display properties are set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors or more.
- You close all other programs.

Attention: To avoid system problems, do not install any of the storage-management components on a second Windows management station until instructed to do so in the installation procedures.

To install the SM7client package:

1. Insert the IBM FASTT Storage Manager version 7.10 installation CD into the CD-ROM drive.

2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7client folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The InstallShield opens.
8. Click **OK**.
The Welcome window opens.
9. Click **Next** to begin the installation.
10. The Event Monitor window opens. At the prompt, click **Yes** if you want to install Event Monitor.
Note: Be sure that Microsoft Virtual Machine is installed before you install Event Monitor.
The Choose Destination Location window opens.
11. Click **Browse** to change the destination location.
12. Click **Next** to start the installation.
13. Click **Finish**.

Verifying the SM7client installation

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

1. Click **Start** → **Programs**.
2. Verify that IBM FAStT Storage Manager 7 Client appears in the Program list. If the IBM FAStT Storage Manager 7 Client appears, go to step 3. Otherwise, go to “Installation instructions” on page 56 and repeat step 1 through step 13. If the IBM FAStT Storage Manager 7 Client still does not appear, a failure has occurred. Contact your IBM technical-support representative.
3. If you are installing SM7client on a host computer, continue with “Installing RDAC on a Windows NT platform”. Otherwise, go to Chapter 5, “Completing the installation,” on page 73.

Installing RDAC on a Windows NT platform

Host computers running Windows NT require the RDAC software to ensure redundancy. Use the following instructions to manually assign drive letters. If necessary, install the RDAC software on each attached host computer that is running Windows NT or on one or more cluster servers that are running Windows NT.

Important: You must assign static drive letters to existing local drives before installing RDAC to prevent problems during new installations and upgrades. After RDAC is installed, the RDAC utility installs the RDAC driver before the Windows NT class driver. If static drive letters are not assigned, the system will detect storage subsystem volumes before it will detect local drives. The system will assign drive letters to the storage subsystem volumes first. If this occurs and you have software applications using drive letters that are assigned to local drives, application errors will result.

Assigning static drive letters

Before you begin:

1. If you have a host computer that is running Windows NT and you want to manage the attached storage subsystem through the host-agent method, you must enable the Event Monitor and make sure Microsoft Virtual Machine is installed. Refer to “Microsoft Virtual Machine installation for Windows NT” on page 56 and “Installing the SM7client on a Windows NT platform” on page 56 before proceeding.

Important: To avoid system problems, you must install Microsoft Virtual Machine and SM7client software on the host before installing any additional storage-management software.

2. Determine how many partitions you have. Click **Start** → **Programs** → **Administrative Tools** → **Disk Administrator** to view the disk configuration and check the number of partitions.
3. If you have at least two partitions, use Table 18 to determine the next step. Otherwise, go to step 4.

Table 18. RDAC partition requirements.

| Requirement | Status | Action |
|--|---------------------------------------|------------------------------------|
| <ul style="list-style-type: none">• One partition is the boot partition.• The last partition has been created with Disk Administrator or Disk Management. | One or more requirements are not met. | Go to step 4. |
| <ul style="list-style-type: none">• The partition has an assigned drive letter and either an unknown status or a status other than Unformatted. | All requirements are met. | Go to “Installation instructions”. |

4. Create a new partition on your local system or on a storage subsystem using the following procedure:
 - Note:** The storage subsystem must have at least one configured volume. To access the volume, connect the storage subsystem to the host and restart the system. In Windows NT, configured logical drives will appear in Disk Administrator.
 - a. Select a drive with free space, and then click **Partition** → **Create**. The partition is created with a status of Unformatted, and a drive letter is assigned. You can delete or change the logical drive at a later time without causing reassignment of the boot partition.
 - b. Click **Partition** → **Commit Changes Now**. The partition status changes to Unknown, and static drive letters are assigned to all existing partitions.
 - c. Continue with “Installation instructions”.

Installation instructions

Before you install the RDAC software package, make sure that:

- You have Administrator privileges on the host computer.
 - The host computer has at least 1 MB of available disk space.
 - You close all other programs.
1. Close all other programs before proceeding.
 2. Insert the IBM FASTT Storage Manager version 7.10 installation CD into the CD-ROM drive.
 3. Click **Start** → **Run**.

4. Click **Browse**.
The Browse window opens.
5. Select the CD-ROM drive.
6. Select the \Win32\SM7RDAC\NT folder, and then, click **Open**.
7. Select the setup.exe file, and then, click **Open**.
8. Click **OK**.
The InstallShield opens.
9. Click **OK**.
The Welcome window opens.
10. Click **Next** to begin the installation.
When RDAC is installed, the Setup Complete window opens.
11. Click **Yes** to restart the host or server.

Verifying the RDAC installation

Use the following procedure to verify that the RDAC package installation was successful:

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

1. Click **Start** → **Settings** → **Control Panel** → **Devices**. When the Devices window opens, scroll to symarray.
 - If symarray appears with a device status of Started, go to step 2.
 - If symarray does not appear, an error might have occurred. Go to “Installation instructions” on page 58 and repeat step 1 through step 11. If the failure persists, call your IBM technical-support representative. Otherwise, go to step 2.

Important: To prevent system problems in a cluster environment, do not install any of the storage-management software components on a second Windows device until instructed to do so in this installation and support guide.
2. If you are managing the storage subsystems using the host-agent method, continue with “Installing the SM7agent software on a Windows NT platform”. If you are managing your storage subsystems directly, go to “Installing the Storage Manager 7 Utility software package on a Windows NT platform” on page 61.

Installing the SM7agent software on a Windows NT platform

This section provides instructions for installing the SM7agent software on hosts or cluster servers. You must install the SM7agent software if you are planning to manage the storage subsystem through a host-agent managed server.

Installation instructions

Use the following procedure to install the SM7agent on each attached Windows host computer or on a cluster server that will be host-agent managed:

1. Before you install SM7agent, do the following:
 - Make sure you have installed Microsoft Virtual Machine (refer to “Microsoft Virtual Machine installation for Windows NT” on page 56).
 - Make sure you have installed RDAC on each attached host. Refer to “Installing RDAC on a Windows NT platform” on page 57.

2. Close all other programs.
3. Make sure that the IBM FASTT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
4. Click **Start** → **Run**.
5. Click **Browse**.
The Browse window opens.
6. Select the CD-ROM drive.
7. Select the \Win32\SM7agent folder, and then, click **Open**.
8. Select the setup.exe file, and then, click **Open**.
The Welcome window opens.
9. Click **Next** to begin the installation.
When the SM7agent is installed, the Setup Complete window opens. Make sure that all storage subsystems are connected to the host computer or server and are powered on.
10. Click **Finish**.
Important: You must restart the host computer to ensure that all changes take effect.

Verifying the SM7agent installation

Use the following procedure to verify that the SM7agent installation was successful:

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

1. Make sure that all storage subsystems are connected to the host computer or server and are powered on.
2. Verify the SM7agent operation by doing one of the following:
 - a. Do one of the following:
 - Click **Start** → **Settings** → **Control Panel** → **Services**. When the Services window opens, scroll through the services list to IBM FASTT Storage Manager 7 Agent.
 - If IBM FASTT Storage Manager 7 Agent appears with a startup type of Started, go to “Installing the SM7agent software on a Windows NT platform” on page 59 and close all other programs.
 - If IBM FASTT Storage Manager 7 Agent does not appear with a startup type of Started, click **SM7agent** → **Start**. If the status changes to Started, continue with step 2b. Otherwise, an error might have occurred. Contact an IBM technical-support representative.
 - b. As applicable, go to “Installing the SM7agent software on a Windows NT platform” on page 59 and repeat step 2. through step 12 to install the IBM FASTT Storage Manager 7 Agent on each attached host computer or cluster server that is running Windows.
 - c. If you plan to use the host-agent software to manage one or more storage subsystems, go to “Installing the Storage Manager 7 Utility software package on a Windows NT platform” on page 61.
 - d. If you do not plan to use the host-agent software to manage one or more storage subsystems, disable the host-agent service using the following procedure:
 - 1) Click **Start** → **Programs** → **Administrative Tools** → **Manage**.
The Computer Management window opens.

- 2) Click **Services**.
 - 3) From the list of displayed services, right-click the IBM FAStT Storage Manager 7.
 - 4) Click **Properties** → **Startup Type** → click **Manual**.
 - 5) Click **OK**.
- e. Go to “Installing the Storage Manager 7 Utility software package on a Windows NT platform”.

Installing the Storage Manager 7 Utility software package on a Windows NT platform

This section provides instructions for installing the Storage Manager 7 Utility software on attached hosts or cluster servers that are running Windows NT. The Storage Manager 7 Utility software contains utilities that will register and map new logical drives to the operating systems. The Storage Manager 7 Utility software must be installed on host computers that are attached to the storage subsystem through a Fibre Channel connection.

Important: Make sure you have installed the RDAC software on the same host where you are installing the Storage Manager 7 Utility software (refer to “Installing RDAC on a Windows NT platform” on page 57). To prevent system problems in a cluster environment, do not install any storage-management software components on a second Windows host until instructed to do so in the installation procedures.

Installation instructions

Use the following procedure to install the Storage Manager 7 Utility software on each attached Windows host or on one or more attached cluster servers.

1. Close all other programs and ensure that the IBM FAStT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.

The Browse window opens.

4. Select the CD-ROM drive.
5. Select the \Win32\SM7util folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.

The Welcome window opens.

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

After the Storage Manager 7 Utility software installation, the Operation Complete window opens. If the system detects the installation of another version of Storage Manager 7 Utility software, a window opens indicating that the installation will be updated and your personal configuration files will be saved. Click **Yes** to continue.

8. Click **Finish**.
9. Go to “Setting up the storage subsystems” on page 66.

Installing the SM7client package on a Windows 2000 platform

Use the procedure in this section to install the SM7client on each management station, host computer, or cluster server that is configured with Windows 2000.

Important: When you install SM7client on a stand-alone host and manage storage subsystems through the Fibre Channel I/O path rather than through the network, you must install the TCP/IP software on the host and assign a static IP address to the host. The host operating system must be running Windows 2000 Server, Windows 2000 Professional, or Windows 2000 Advanced Server (that is required for a cluster environment).

Installation instructions

Before you install the software, make sure that:

- The management station has at least 35 MB of available disk space.
- The display properties are set to a minimum screen resolution of 800 x 600 pixels and a palette of 256 colors or more.
- You close all other programs.

Install the SM7client:

1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7client folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The installShield opens.
8. Click **Open**.
The Welcome window opens.
9. Click **Next** to begin the installation.
10. The Event Monitor window opens. At the prompt, click **Yes** to install the Event Monitor.
The Choose Destination Location window opens.
11. Click **Browse** if you want to change the destination location.
12. Click **Next** to start the installation.
13. Click **Finish**.

Verifying the SM7client installation

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

1. Click **Start** → **Programs**.
2. Verify that IBM FAStT Storage Manager 7 Client appears in the list of programs.
3. If you are installing the SM7client on a host computer, go to “Installing the RDAC package on a Windows 2000 platform” on page 63. Otherwise, go to Chapter 5, “Completing the installation,” on page 73.

Installing the RDAC package on a Windows 2000 platform

Use the following procedure to install the RDAC package on a host computer that is connected to one or more storage subsystems.

RDAC contains the multipath device driver that is necessary for controller failover support.

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

Installation instructions

Before you install the software, make sure that:

- You have Administrator privileges on the host computer.
- The host computer is configured with Windows 2000 Server, Windows 2000 Professional, or Windows 2000 Advanced Server.
- The host computer has at least 1 MB of available disk space.
- You close all other programs.

Install the RDAC package:

1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7RDAC\W2K directory.
6. Select the setup.exe file, and then, click **Open**.
7. Click **OK**.
The InstallShield opens.
8. Click **OK**.
The setup program Welcome window opens.
9. Click **Next** to begin the installation.
After installing RDAC, the Setup Complete window opens.
10. Click **Yes** to restart your computer.
11. Continue with "Verifying the RDAC installation".

Verifying the RDAC installation

Use the following procedure to verify that the RDAC package installation was successful:

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

1. Right-click **My Computer**.
2. Click **Manage**.
The Open Computer Management window appears. Go to the System Tools\System Information\Software Environment\Drivers directory.
3. Scroll through the list of device drivers until you find rdacfltr.

4. Verify that rdacfltr is displayed with the state type Running and status OK. If it is not, reinstall RDAC.
5. If you are managing the storage subsystems using the host-agent method, continue with “Installing the SM7agent package on a Windows 2000 platform”. If you are managing your storage subsystems directly, go to “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 65.

Installing the SM7agent package on a Windows 2000 platform

Use the following procedure to install IBM FAStT Storage Manager 7 Agent on each host computer connected to one or more storage subsystems. The IBM FAStT Storage Manager 7 Agent consists of the host-agent software that is necessary for host-agent management of the storage subsystems.

Important: You cannot install SM7agent unless RDAC is installed on each attached host. If you have not done so, refer to “Installing the RDAC package on a Windows 2000 platform” on page 63.

Installation instructions

Before you install the software, make sure that:

- You have Administrator privileges on the host computer.
- The host computer is configured with Windows 2000 Server, Windows 2000 Professional, or Windows 2000 Advanced Server (required for a cluster environment).
- The host computer has at least 1 MB of available disk space.
- The display properties are set to a minimum screen resolution of 640 x 480 pixels and a palette of 256 colors or more.
- You installed RDAC.
- You close all other programs.

Install the SM7agent:

1. Insert the IBM FAStT Storage Manager version 7.10 installation CD into the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.
4. Select the CD-ROM drive.
5. Select the \Win32\SM7agent folder.
6. Select the setup.exe file, and then, click **Open**.
The Welcome window opens.
7. Click **Next** to begin the installation.
When SM7agent is installed, the Setup Complete window opens.
8. Click **Finish**.
9. Power on the storage subsystem and restart the server.

Verifying the SM7agent installation

Use the following procedure to verify that the IBM FAStT Storage Manager 7 Agent installation was successful:

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

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
2. Scroll through the list of services until you find the IBM FAStT Storage Manager 7 agent.
3. Verify that IBM FAStT Storage Manager 7 Agent is displayed with the startup type Automatic and status Started. If it is not, reinstall IBM FAStT Storage Manager 7 Agent.
4. If you plan to use the host-agent software to manage one or more storage subsystems, go to “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform”.
5. If you do not plan to use the host-agent software to manage one or more storage subsystems, disable the host-agent service using the following procedure:
 - a. Click **Start** → **Programs** → **Administrative Tools** → **Manage**.
The Computer Management window opens.
 - b. Click **Services**.
 - c. From the list of displayed services, right-click the IBM FAStT Storage Manager 7.
 - d. Click **Properties** → **Startup Type** → click **Manual**.
 - e. Click **OK**.
6. Continue with “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform”.

Installing the Storage Manager 7 Utility software package on a Windows 2000 platform

This section provides instructions for installing the Storage Manager 7 Utility software on attached hosts or cluster servers that are running Windows 2000. The Storage Manager 7 Utility software contains utilities that will register and map new logical drives to the operating systems. The Storage Manager 7 Utility software must be installed on host computers that are attached to the storage subsystem through a Fibre Channel connection.

Important: Make sure you have installed the RDAC software on the same host where you are installing the Storage Manager 7 Utility software. For more information, refer to “Installing the RDAC package on a Windows 2000 platform” on page 63. To prevent system problems in a cluster environment, do not install any storage-management software components on a second Windows host until instructed to do so in the installation procedures.

Installation instructions

Use the following procedure to install the Storage Manager 7 Utility software on each attached Windows host or on one or more attached cluster servers.

1. Close all other programs and ensure that the IBM FAStT Storage Manager version 7.10 installation CD is in the CD-ROM drive.
2. Click **Start** → **Run**.
3. Click **Browse**.
The Browse window opens.

4. Select the CD-ROM drive.
5. Select the \Win32\SM7util folder, and then, click **Open**.
6. Select the setup.exe file, and then, click **Open**.

The Welcome window opens.

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

After you install the Storage Manager 7 Utility software, the Operation Complete window opens. If the system detects the installation of another version of Storage Manager 7 Utility software, a window opens indicating that the installation will be updated and your personal configuration files will be saved. Click **Yes** to continue.

8. Click **Finish**.
9. Go to "Setting up the storage subsystems".

Continuing the installation

If you installed the storage-management software on node A, go to "Setting up the storage subsystems". If you installed the storage-management software on node B, go to "Verifying drive letters on node B" on page 67.

Setting up the storage subsystems

Use the procedures in Chapter 5, "Completing the installation," on page 73 to perform the following tasks:

1. Start the IBM FAStT Storage Manager 7.10 and perform an Initial Automatic Discovery of storage subsystems on the local subnetwork. Refer to "Starting Enterprise Management" on page 73.
2. Add other devices to the management domain as necessary. For more information, refer to "Adding devices" on page 74.
3. Open a Subsystem Management window for each storage subsystem. Download firmware version 04.01.xx and then, download NVSRAM for the storage subsystems (machine type 3526, 3442, or 3552).
4. Create all of your planned arrays and logical drives on each storage subsystem that is connected to your cluster, refer to "Creating arrays and logical drives" on page 78.
5. After you complete the procedures in Chapter 5, "Completing the installation," on page 73, continue with step 6.
6. If you installed the storage-management software on node A, go to "Shutting down node A". If you installed the storage-management software on node B, go to "Verifying drive letters on node B" on page 67.

Shutting down node A

1. To shut down node A (server) from Cluster Administrator, click **Start** → **Shut Down**.
2. If you are running Windows 2000, return to "Installing the SM7client package on a Windows 2000 platform" on page 62. If you are running Windows NT, go to "Microsoft Virtual Machine installation for Windows NT" on page 56 and repeat the installation procedures to install the necessary software components on node B.

Verifying drive letters on node B

Use the following procedure to verify the drive letters for a cluster configuration with a Windows platform.

Important: Do not perform this procedure unless you have installed the necessary storage-management software components on both cluster servers or hosts. Before proceeding, shut down the Windows operating system on Node A, but leave the device running.

1. Do one of the following:
 - **For Windows NT:** Use the Windows NT Disk Administrator to verify that the drive letters are assigned to the configured logical drives. Logical drives for Node B must be the same as those assigned to Node A.
 - **For Windows 2000:** Click **Start** → **Programs** → **Administrative Tools** → **Computer Management** → **Storage** → **Disk Management** 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. To shut down node B from Cluster Administrator, click **Start** → **Shut Down**.
2. Continue with “Installing the cluster server software”.

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 that 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** → **Cluster Administration**.
 - b. In the Cluster or Server Name field, type either the name of the cluster or the name or IP address of one of the nodes.

- c. If the installation is successful, the computer names of both nodes appear on the left side of the Cluster Administrator window.
- d. Make sure that the cluster disk groups can be moved between cluster nodes.
4. If both node names do not appear on the left side of the Cluster Administrator window, reinstall the cluster server software. Otherwise, continue with step 5.
5. Go to “Stopping the host-agent service” on page 79.

Upgrading from a previous version of the storage-management software in a cluster server configuration

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

Choose from one of the following two procedures.

- **Performing a scheduled upgrade:** A scheduled upgrade requires scheduling downtime on your cluster server to upgrade the controller firmware and storage-management software.
Important: The scheduled upgrade is the preferred procedure for upgrading a cluster server configuration.
- **Performing a rolling upgrade:** A rolling upgrade requires upgrading the controller firmware or operating system in node A and then, node B and storage-management software so that the services and resources offered by the cluster are available, while the node that is being upgraded is not available.

Important: After the storage subsystem controller firmware has been upgraded to version 04.01.xx, you will not be able to communicate with the controller until you have upgraded to Storage Manager 7.10 software on your management station and host computer. Previously installed versions of the storage-management client or host-agent software will not recognize controllers running version 04.01.xx firmware.

Performing a scheduled upgrade from storage-management software version 7.0, 7.01, or 7.02 to Storage Manager 7.10

Complete the following steps to upgrade from storage-management software version 7.0, 7.01, or 7.02 to Storage Manager 7.10:

1. Before installing the storage-management software, do the following:
 - a. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
 - b. From the list of displayed services, right-click the cluster server. Then, click **Manual**.
 - c. Stop the cluster server on all nodes in the cluster configuration.
2. Shut down all but node A in the cluster configuration.
3. Uninstall the components from the previous version of the storage-management software from node A. To uninstall the storage-management software for Storage Manager version 7.10, refer to “Uninstalling storage-management software components” on page 87. Otherwise, use the uninstallation procedure that comes with the version of the storage-management software that you are running.
4. Verify that the IBM host adapter driver versions are current. If they are not current, refer to the README file located in the \Host_Adapter directory on the installation CD to upgrade the driver versions before continuing.

5. To install the Storage Manager 7.10 SM7client package, refer to the procedure in “Installing the SM7client package on a Windows 2000 platform” on page 62 or “Microsoft Virtual Machine installation for Windows NT” on page 56.
6. To install the Storage Manager 7.10 RDAC package, refer to the procedure in “Installing the RDAC package on a Windows 2000 platform” on page 63 or “Installing RDAC on a Windows NT platform” on page 57.
7. To install the Storage Manager 7.10 SM7agent package, refer to the procedure in “Installing the SM7agent package on a Windows 2000 platform” on page 64 or “Installing the SM7agent software on a Windows NT platform” on page 59.
8. To install the Storage Manager 7.10 Storage Manager 7 Utility software package, refer to the procedure in “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 65 or “Installing the Storage Manager 7 Utility software package on a Windows NT platform” on page 61.
9. Shut down node A.
10. On node B, repeat step 3 on page 68 through step 7; then, repeat step 9.
11. All nodes should be shut down. Start up one node at a time and complete the following:
 - a. Click **Start** → **Programs** → **Administrative Tools** → **Services**. The Services window opens.
 - b. From the list of displayed services, right-click the cluster server. Click **Automatic** to change the cluster server startup option.
 - c. Start the cluster server on node B.

Performing a rolling upgrade from storage-management software version 7.0, 7.01, or 7.02 to Storage Manager 7.10.

You will need to perform a rolling upgrade to avoid losing access to a cluster. A rolling upgrade is performed so that the services and resources offered by the cluster are always available, even though the node being upgraded is not available.

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

- Put those resources offline before the upgrade; then, put them back online after the upgrade or,
- Use a different upgrade method.

Complete the following steps to perform a rolling upgrade from storage-management software version 7.0, 7.01, or 7.02 to Storage Manager 7.10:

1. From node A, open Cluster Administrator.
2. Select node A, and click **File** → **Pause Node** to pause the node.
3. Double-click the Active Groups folder in the right pane of the Cluster Administrator window.
4. Select each group listed, and move your selection to node B.
5. From node A, to uninstall the storage-management software for Storage Manager version 7.10, refer to “Uninstalling storage-management software components” on page 87. Otherwise, use the uninstallation procedure that comes with the version of the storage-management software that you are running.
6. Verify that the IBM host adapter driver versions are current. If they are not at the current versions, refer to the README file located in the \Host_Adapter directory on the installation CD to upgrade the driver versions before continuing.

7. To install the Storage Manager 7.10 SM7client package, refer to the procedure in “Installing the SM7client package on a Windows 2000 platform” on page 62 or “Microsoft Virtual Machine installation for Windows NT” on page 56.
8. To install the Storage Manager 7.10 RDAC package, refer to the procedure in “Installing the RDAC package on a Windows 2000 platform” on page 63 or “Installing RDAC on a Windows NT platform” on page 57.
9. To install the Storage Manager 7.10 SM7agent package, refer to the procedure in “Installing the SM7agent package on a Windows 2000 platform” on page 64 or “Installing the SM7agent software on a Windows NT platform” on page 59.
10. To install the Storage Manager 7.10 Storage Manager 7 Utility software package, refer to the procedure in “Installing the Storage Manager 7 Utility software package on a Windows 2000 platform” on page 65 or “Installing the Storage Manager 7 Utility software package on a Windows NT platform” on page 61.
11. Run Cluster Administrator, and resume the node by clicking **File** → **Resume Node**.
12. Repeat step 1 on page 68 through step 9 on page 69 and repeat step 11 on page 69 for node B.

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

Note: To avoid losing access to a cluster, you must perform a rolling upgrade. After you perform a rolling upgrade, the services and resources offered by the cluster are always available, even though the upgraded nodes are not available.

If you have applications installed in the cluster environment that do not support a rolling upgrade, you must do the following:

- Take those resources offline before the upgrade, and then put them back online afterward, or
- Use a scheduled upgrade method.

Follow these steps to upgrade from Windows NT 4.0 Enterprise Edition to Windows 2000 Advanced Server:

1. After you install the cluster server, reinstall the latest Service Pack for NT 4.0 (Service Pack 5.0 or later).
2. On node A, open Cluster Administrator.
3. Highlight node A, and then pause the node (click **File** → **Pause Node**).
4. Double-click on the Active Groups folder in the right pane of Cluster Administrator.
5. Make sure that all of the groups fail-over to node B successfully.
6. Uninstall all storage-management software components from node A. Uninstall the storage-management software for version 7.10 using the uninstallation procedure in “Uninstalling storage-management software components” on page 87. Otherwise, use the procedure that comes with the version of the storage-management software that you are currently running.

Note: The storage manager components uninstallation order is SM7agent, SM7util, RDAC, and SM7client.
7. Follow the instructions from Microsoft to upgrade node A from Windows NT to Windows 2000 Advanced Servers.

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

8. Verify that the host adapter (HBA) driver versions are correct. If they are not the certified version, use the README file in the \Host_Adapter directory on the installation CD to upgrade the driver versions before continuing.
9. Verify that node A was successfully upgraded to Windows 2000 Advanced Server.
10. Install RDAC for Windows 2000 onto node A.
11. Install Storage Manager Version 7.10 for Windows 2000 components (SM7client, SM7agent, and SM7util).
12. Run Cluster Administrator, and resume the node (click **File** → **Resume Node**).
13. Repeat steps 1 through 12 on node B.

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 open when you start the software. Use the Enterprise Management window to:

- Add and discover the storage subsystems that 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 **IBM FASt Storage Manager 7 client**.

The client software starts, displaying the Enterprise Management window and the Confirm Initial Automatic Discovery window, as shown in Figure 22.

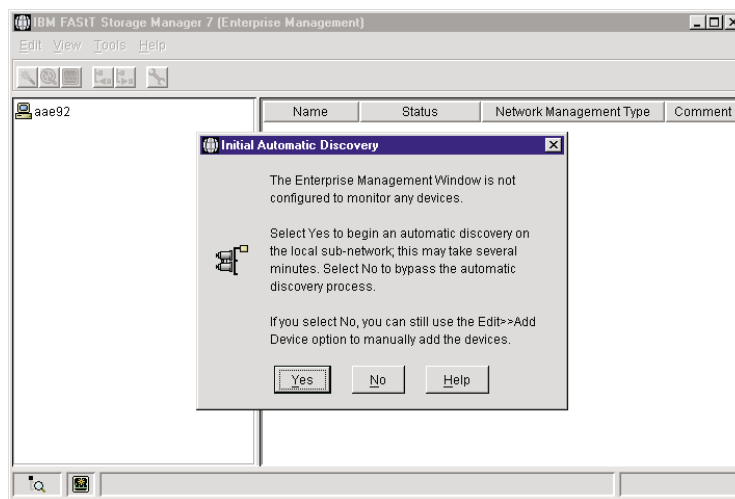


Figure 22. Confirm Initial Automatic Discovery window

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** menu option to add hosts and storage subsystems. For more information, refer to "Adding devices" on page 74.

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 through 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 23.

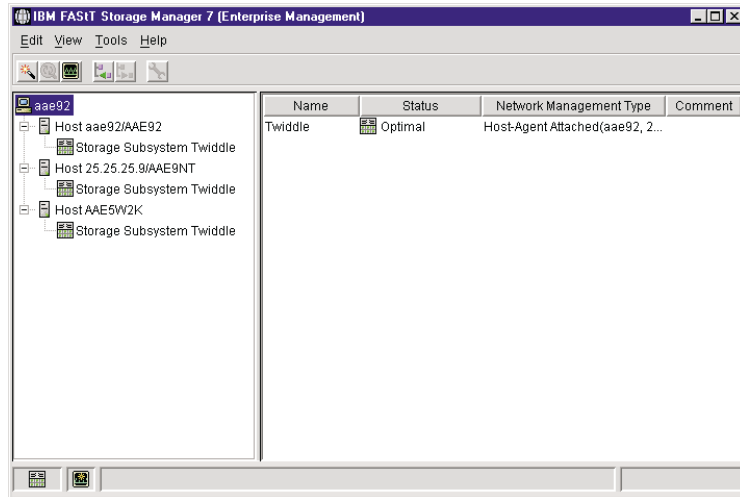


Figure 23. Enterprise Management window

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 online Help 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.

A storage subsystem might be duplicated in the device tree after an automatic discovery, if the storage subsystem is directly managed but is attached to a host with the host-agent software installed and running. In this configuration, you can remove the duplicate storage-management icon from the device tree using the remove device option in the Enterprise Management window.

Continue with “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. After the host-agent service has restarted, the new storage subsystem is detected. For more information, refer to “Stopping the host-agent service” on page 79. Then, go to the Enterprise Management window and click **Tools** → **Rescan** to add the new storage subsystems to the management domain.

Continue with “Setting up alert notifications”.

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 (refer to “Setting up the NMS for SNMP notification” for more information)
- Notification to designated e-mail addresses
- Notification to designated alphanumeric pagers (when a vendor software package is used to convert e-mail messages)

Note: If you do not install Event Monitor, you must monitor storage subsystems within the management domain. The Enterprise Management window must remain open (you can minimize the window). If you close the window, you will not receive alert notifications. Refer to the Enterprise Management window Help for 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 need to set up your designated NMS only *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.

To set up alert notification using SNMP traps, you first must copy a management information base (MIB) file to the designated network management station (NMS). Use the following procedure to set up the MIB on the storage management station. You need to set up the designated management station only once.

1. Make sure the installation CD is inserted into the CD-ROM drive on your designated network management station.
2. From the installation CD, copy the SM7_10.MIB file from the SM7mib directory to the NMS.
3. Follow the steps required by your NMS to compile the MIB. (For details, contact your network administrator or see the documentation specific to the storage management product you are using.)
4. Go to “Configuring alert destinations” on page 76.

Configuring alert destinations

After you have added devices to the management domain, set up alert notification options to report critical events on the storage subsystems. The following alert notification options are available. For more information on notification options, refer to the *IBM FASTT Storage Manage 7.10 Concepts Guide*.

- Alert notifications sent to a designated network management station (NMS) using Simple Network Management Protocol (SNMP) traps.
- Alert notifications sent to a designated e-mail address. Refer to the Enterprise Management Window Help for specific procedures.
- Alert notifications sent to a designated alphanumeric pager when software not provided on the IBM FASTT Storage Manager installation CD is used to convert e-mail messages. Refer to the Enterprise Management window Help for specific procedures.

Important: If you do not install Event Monitor, you must monitor storage subsystems within the management domain. The Enterprise Management window must remain open (you can minimize the window). If you close the window, you will not receive alert notifications. Refer to the Enterprise Management window Help for information on alert notification options.

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

Go to "Starting the subsystem management".

Starting Subsystem Management

The Subsystem Management window enables you to manage selected subsystems.

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 24 on page 77.

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

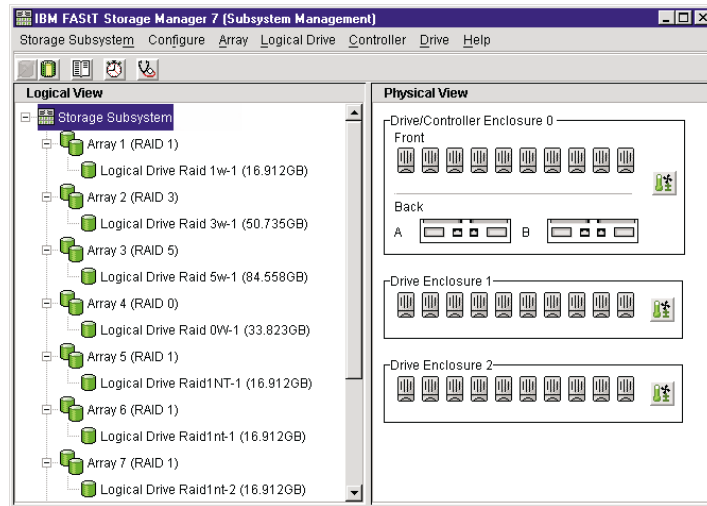


Figure 24. Subsystem Management window

3. Go to “Renaming storage subsystems”.

Renaming storage subsystems

When you start the storage management software for the first time, the storage subsystems are unnamed. Use the following procedure to rename the storage subsystems:

1. Use the Subsystem Management window to rename each storage subsystem from <unnamed> to your specific name (refer to Table 21 on page 89). For more information, refer to the topic on renaming storage subsystems in the Array Management window Help.
2. Continue with “Downloading firmware and NVSRAM”.

Downloading firmware and NVSRAM

Important: You must download firmware version 04.01.xx before you download NVSRAM.

To download firmware version 04.01.xx, do the following:

1. Open the Subsystem Management window.
2. Click **Storage Subsystem** → **Download** → **Firmware**.
Follow the online instructions.

To download NVSRAM, do the following:

1. Open the Subsystem Management window.
2. Click **Storage Subsystem** → **Download** → **NVSRAM**.
Follow the online instructions.
3. Continue with “Creating arrays and logical drives” on page 78.

Creating arrays and logical drives

To create an array or logical drive, perform the following procedure:

1. Create all of your planned arrays and logical drives on this storage subsystem by clicking the **Configure** → **Create Array/Logical Drive**.
2. Repeat the arrays/logical drive configuration for each storage subsystem connected to your cluster.
Note: If you make any other logical drive additions or deletions, you must make them known to node B in a cluster configuration.
3. Continue with “Changing host type”.

Changing host type

If you have partitioning enabled, do the following to check or change your host type:

1. From the Subsystem Management window, select your host from the left pane.
2. From the Subsystem Management window, select **Configure** → **View Logical LUN Mapping**.
3. From the Subsystem Management window left pane, select the host port you want to configure and from the tool bar, click **Configure** → **Topology** → **Change host type**.

If you do not have partitioning enabled, do the following to check or change your host type:

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

1. From the Subsystem Management window, select your host in the left pane.
2. Click **Configure** → **Change Host Type**.

Continue with “Heterogeneous hosts overview”.

Heterogeneous hosts overview

The heterogeneous hosts feature enables hosts running different operating systems to access a single storage subsystem. Previous releases of IBM FASTT Storage Manager enabled only hosts running the same operating system to access a single storage subsystem.

Host computers can be running completely different operating systems (for example, Solaris and Windows NT) or variants of the same operating system (for example, Windows NT running in a cluster environment or Windows NT running in a noncluster environment). When a host type is specified in the Define New Host Port window, the heterogeneous hosts feature enables the controllers in the storage subsystem to tailor their behavior (such as LUN reporting and error conditions) to the needs of the operating system or variant of the host sending the information.

Important: The heterogeneous hosts feature is available only with storage partitioning enabled.

In a heterogeneous environment, you must set each host type to the appropriate operating system during host-port definition so that the firmware on each controller can respond correctly for the operating system for that host.

To start the heterogeneous host configuration, do the following:

1. From the Subsystem Management window, click **Configure** → **Storage Partition**.
2. Refer to the Subsystem Management window online help.
3. Continue with “Performing other storage subsystem management tasks”.

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 subsystems
- Using the Performance Monitor
- Creating storage partitions (if applicable) and heterogeneous hosts

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

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

Stopping the host-agent service

If you want to manage storage subsystems using only the direct method, use the following procedure to stop the host-agent service.

Note: You can manage storage subsystems using both the direct and host-agent management methods. If you want to manage the storage subsystem using the host-agent method or a combination of direct or host-agent managed, do not stop the host-agent service.

1. Click **Start** → **Programs** → **Administrative Tools** → **Services**.
2. Click **FAStT 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 81.

Using the Migrate Utility

This section provides a Migrate Utility overview. The IBM FAStT Storage Manager 7 Migrate package contains the software necessary to upgrade existing storage subsystems that are using IBM Netfinity Storage Manager 6.22 for Windows NT. The Migrate utility is available from the IBM Web site at <http://www.ibm.com/pc/support>.

IBM FASTT Storage Manager 7.10 supports storage subsystems that use a 04.01.xx controller firmware version. To enable all of the features of IBM FASTT Storage Manager 7.10, you must be running controller firmware version 04.01.xx.

If you have a previous installation that uses machine type 3526 controllers, use the IBM FASTT Storage Manager 7 Migrate package to upgrade the controller firmware and configuration settings.

Chapter 6. Operating system support

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

Windows NT limitations

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

Table 19 explains the limitations that apply when you use the FAStT Storage Manager Version 7.10 with Windows NT.

Table 19. Windows NT limitations and notes.

| Limitation | Workaround |
|---|--|
| Clicking a vertical scroll arrow (either up or down) causes the scroll box to move all the way to the opposite end of the scroll bar. | This is a known defect in the Java Runtime Environment. Click the scroll box and slide it until you reach the desired position in the Help window. |
| Logical drive migration (removing a set of drives configured with logical drives from one storage subsystem to insert in another storage subsystem) is not supported because it could cause loss of configuration and data. | 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 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 customer replaceable unit (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. |

Windows 2000 limitations

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 20 explains the limitations that apply when using Storage Manager 7.10 with Windows 2000.

Table 20. Windows 2000 limitations and notes.

| Limitation | Workaround |
|---|--|
| <p>After trying to add a host device to the management domain of more than five clients, the host-agent managed storage subsystems attached to that host become unresponsive.</p> | <p>A single instance of the host-agent software can communicate with only five or fewer clients.</p> |
| <p>There are limits to how much drive space capacity you can have in a single array. When using 73.4 GB drives, the maximum number of drives that can be configured in a single logical drive group is 29.</p> | <p>None.</p> |
| <p>Password information is stored on a reserved area of each drive on the storage subsystem. Each drive stores a mirrored copy of the password data. With no drives in the storage subsystem, the storage-management software does not find the password data when you attempt password-protected operations.</p> | <p>Add one of the drives to the storage subsystem and reattempt the operation.</p> |
| <p>Array migration is not supported because it could cause loss of configuration and data.</p> <p>Array migration consists of removing a set of drives configured with arrays from one storage subsystem and inserting them into another storage subsystem.</p> | <p>Call an IBM technical-support representative.</p> |
| <p>A stand-alone (non-networked) configuration, in which the Windows 2000 host does not have the TCP/IP software installed, is not supported.</p> | <p>Install the TCP/IP software on the Windows 2000 host and assign the host a static IP address.</p> |
| <p>If you configure a new storage subsystem with a single controller, you must place the controller in the top slot (slot A) for machine types 3552 and 3526 or in the left slot for machine type 3542. 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.</p> | <p>None.</p> |
| <p>A controller failover occurs in an active/active controller pair, and ownership of arrays transfers from the failed preferred owner to the other controller of the pair. The failed controller is replaced and brought online. The array ownership is not automatically transferred back to the preferred controller owner.</p> | <p>Immediately after replacing the controller, click Storage subsystem → Redistribute Arrays in the Subsystem Management window to redistribute arrays back to their preferred controller owners.</p> <p>For more information, refer to the Subsystem Management window online Help.</p> |

Table 20. Windows 2000 limitations and notes.

| Limitation | Workaround |
|---|---|
| <p>After installing the host-agent software, the error message:</p> <p>Service Error 100</p> <p>is displayed on the host.</p> | <p>Causes include:</p> <p>The host-agent software does not find any controllers with firmware version 4.x.</p> <p>Controllers with firmware version 4.x have the access volume disabled with NVSRAM configuration settings.</p> <p>The NVSRAM on controllers in a storage subsystem you are attempting to manage contains an access volume logical unit number that is already in use by another logical drive.</p> <p>The NVSRAM on controllers in a storage subsystem you are attempting to manage contains an access volume logical unit number that is not supported by the operating system and installed patches. For example, the access volume is configured at LUN 32, but the operating system and service packs support only eight LUNs.</p> |

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 a subsystem with a specific RAID level to meet application needs for data availability and Fibre Channel I/O performance. A logical drive is recognized by the operating system as one drive.

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

Standard (noncluster) configuration for Windows NT

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 86 and “Using the SM7devices utility” on page 86.

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 that are associated with the logical drives. Restart the system to remove the configuration information.

Attention: If you do *not* use Disk Administrator first, registry information will be damaged.

Cluster server configuration for Windows NT

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

1. Using the IBM FAStT Storage Manager 7 client, create arrays and assign them to the appropriate host group by using storage partitioning.
2. Stop the cluster service in node A. Make sure that all of the cluster groups and resources failover to node B.
3. Use the following steps to disable cluster service and the cluster disk driver in node A.
 - a. Restart node A.
 - b. From the Control Panel window, click **Services**.
The Services window opens and a list appears.
 - c. Scroll to and highlight Cluster Server.
 - d. Click **Startup**.
The Services window opens.
 - e. Change the Startup Area Setting to disabled, and then, click **OK**.
 - f. Click **Start** → **Settings** → **Control Panel**.
The Control Panel window opens.
 - g. Click **Devices**.
The Devices window opens.
 - h. Scroll to and highlight Cluster Disk, and then, click **Startup**.
The Devices window opens.
 - i. Select **Disabled** and then, **OK**.
4. After node A has restarted, use Disk Management to create and format your operating system partitions.
5. Enable cluster service and the cluster disk driver in node A. Make sure that the start-up type is set to system for cluster disk driver and automatic for cluster service. Restart node A.
6. After node A has restarted, make sure that the cluster service has started and the cluster groups and resources have failed back correctly.
7. Stop the cluster service in node B.
8. Disable cluster service and the cluster disk driver in node B. Then, Restart node B.
9. After node B has restarted, use Disk Management to reassign the drive letters to match the ones that were assigned to a given disk in node A.
10. Enable cluster service and the cluster disk driver in node B. Restart node B.
11. After node B has restarted, make sure that the cluster service started and the cluster groups and resources failed back correctly.
12. Stop the cluster service in node A, and then, restart node A.
13. After node A has restarted and cluster service has started, use cluster administrator to create your physical disk resources.

Standard (noncluster) configuration for Windows 2000

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

You can use the SM7devices utility to identify logical drives by their associated operating system device names.

1. Use the storage-management software to create a new logical drive. For specific instructions, refer to the Subsystem Management online Help.
2. Add logical drives to the host computer:
 - a. Click **Start** → **Programs** → **Administrator Tools** → **Computer Management Storage** → **Disk Management**.
 - b. In System Tools, click **Device Manager**.
 - c. Right-click **Disk Drives** to scan for hardware changes.
3. Click **Start** → **Programs** → **Administrator Tools** → **Computer Management** → **Storage** → **Disk Management** (local) to format the new logical drive on the host.

Attention: Before either deleting logical drives with the storage-management software or clicking **Configure** → **Reset Configuration**, stop all input and output activity to the affected storage subsystem. Then, use Disk Management to delete any partitions and to remove assigned drive letters associated with the logical drives. If you do *not* use Disk Management first, registry information will be damaged. Restart the system to remove the configuration information.

Cluster server configuration for Windows 2000

To add logical drives in a Windows 2000 cluster server environment, use the following procedure:

1. Using the IBM FASTT Storage Manager 7 client, create arrays and assign them to the appropriate host group by using storage partitioning.
2. Stop the cluster service in node A. Make sure that all of the cluster groups and resources failover to node B.
3. Use the following steps to disable cluster service and the cluster disk driver in node A.
 - a. Restart node A.
 - b. From the Computer Management window, double-click **Services and Applications** and then, click **Services**.
 - c. Click **Cluster Service**.
 - d. In the right pane, click properties.
The Cluster Service Properties windows opens.
 - e. Change the Startup Area Setting to disabled, and then click **OK**.
 - f. From the Computer Management window, double-click **System Tools**, and then, click **Device Manager**.
 - g. From the View Menu, click **Device Manager** → **View** → **Show Hidden Devices**.
In the right pane, Non-plug and Play device drivers appear in the list.
 - h. Click **Non-plug and Play device drivers** to expand the list. In the list, right-click **Cluster Disk Driver** and then, click **Disable**.
When prompted to confirm your request to disable the cluster disk driver, click **Yes**.
 - i. The system will prompt you to restart your computer, click **Yes**.
4. After node A has restarted, use Disk Management to create and format your operating system partitions.

5. Enable cluster service and the cluster disk driver in node A. Make sure that the start-up type is set to automatic for cluster servers. Restart node A.
6. After node A has restarted, make sure that the cluster service has started and the cluster groups and resources have failed back correctly.
7. Stop the cluster service in node B.
8. Disable cluster service and the cluster disk driver in node B. Restart node B.
9. After node B has restarted, use Disk Management to reassign the drive letters to match the ones that were assigned to a given disk in node A.
10. Enable cluster service and the cluster disk driver in node B. Restart node B.
11. After node B has restarted, make sure that the cluster service started and the cluster groups and resources failed back correctly.
12. Stop the cluster service in node A, and then, restart node A.
13. After node A has restarted and cluster service has started, use cluster administrator to create your physical disk resources.

Using the Hot Add utility

The RDAC software includes a utility called Hot Add that you can use to add new logical drives dynamically without restarting the system. The utility registers the new logical drives with the operating system so that you can use Disk Administrator to create partitions, add device names, and so on. The Hot Add utility is installed as part of the Storage Manager 7 Utility software package.

After you finish creating the logical drives on a particular storage subsystem, go to the host that is attached to that storage subsystem, and perform the following steps to use 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 Storage Manager 7 Utility software includes a utility called SM7devices that you can use to view the storage subsystem logical drive that is associated with a particular operating system device name. This utility is helpful when you want to create drive letters or partitions for the logical drive using Disk Administrator.

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

1. From a DOS command prompt, change to the \Program Files\SM7utils 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 Subsystem Finance, Logical Drive CREDIT, LUN 1, WWN <600a0b70006028600000000392060eb>]
```

Where PHYSICALDRIVE x = Disk x in Disk Administrator

Storage Subsystem x = the storage subsystem name

Logical Drive x = the logical drive name

LUN x = the logical unit number associated with the logical drive

WWN x = the worldwide name for the logical drive

Stopping and starting the host-agent software

Use the procedure in the following sections to stop and start the host-agent software installed on the host.

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

Stopping the host-agent software

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

1. Click **Start** → **Settings** → **Control Panel** → **Services**.
The Services window opens.
2. Click **Storage Manager 7 Agent**.
3. Click **Stop**.

Starting the host-agent software

The host-agent software automatically starts after you restart the host. However, you must start the software manually if you stop it to add storage subsystems.

To start the host-agent software:

1. Click **Start** → **Settings** → **Control Panel** → **Services**.
The Services window opens.
2. Click **Storage Manager 7 Agent**.
3. Click **Start**.

Uninstalling storage-management software components

Use the following procedure if you need to uninstall one or more of the components of Storage Manager 7.10. If you are uninstalling components released with an earlier version of the storage-management software, use the procedure that comes with the version of the storage-management software that you are currently running.

Important: Do not uninstall the RDAC component unless instructed by an IBM technical-support representative. The host-agent package requires RDAC to function properly. If you uninstall RDAC in a coexistence environment, you will lose Fibre Channel I/O path failover support for both the version 7.01 and version 7.10 systems.

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

Note: The storage manager components uninstallation order is SM7agent, SM7util, RDAC, and SM7client.

The Add/Remove Programs Properties window opens.

2. Select the component you want to uninstall from the list of programs (for example, IBM FASTT Storage Manager 7 Client).

3. Click **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 A. Storage subsystem/controller information record

Table 21 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 that is recorded in Table 21 to set up the BOOTP table for the network server and the host or Domain Name System (DNS) table. The information in Table 21 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, refer to Table 11 on page 20.

Table 21. Storage subsystem information record and controller information record.

| Storage subsystem name (refer to page 21) | Management type (refer to page 17) | Controllers—Ethernet and IP addresses, and host name (refer to pages 21 and 23) | | Host—IP address and host name (refer to page 23) |
|--|---------------------------------------|--|--|---|
| Storage subsystem name: | | | | |
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| Storage subsystem name: | | | | |
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| Storage subsystem name: | | | | |
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| Storage subsystem name: | | | | |
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| Storage subsystem name: | | | | |
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Appendix B. Getting information, help, and service

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

Getting information

Information about your IBM server product and preinstalled software, if any, is available in the documentation that comes with your server. That documentation includes printed books, online books, README files, and help files. In addition, information about IBM products is available on the World Wide Web and through the IBM Automated Fax System.

Using the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM products and support. The address for the IBM Personal Computing home page is <http://www.ibm.com/pc/>.

You can find support information for your IBM products at <http://www.ibm.com/pc/support/>.

If you click **Profile** from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products.

You also can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi>.

Getting information by fax

If you have a touch-tone telephone and access to a fax machine, in the U.S. and Canada, you can receive, by fax, marketing and technical information on many topics, including hardware, operating systems, and local area networks (LANs).

You can call the IBM Automated Fax System 24 hours a day, 7 days a week. Follow the recorded instructions, and the requested information will be sent to your fax machine. In the U.S. and Canada, to access the IBM Automated Fax System, call 1-800-426-3395.

Getting help and service

If you have a problem with your server product you will find a wide variety of sources available to help you.

Using the documentation and diagnostic programs

Many problems can be solved without outside assistance. If you experience a problem with your server product, the first place to start is the troubleshooting information in your IBM documentation. If you suspect a software problem, see the documentation,

including README files and online help, that comes with the operating system or application program.

Most IBM server products come with a set of diagnostic programs that you can use to help you identify hardware problems. See the troubleshooting information in your IBM documentation for instructions on using the diagnostic programs.

The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support/> and follow the instructions.

Calling for service

If you have tried to correct the problem yourself and still need help, during the warranty period, you can get help and information by telephone through the IBM HelpCenter®. The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make selected Engineering Changes (ECs) available that apply to your hardware.

The following items are not covered:

- Replacement or use of non-IBM parts or nonwarranted IBM parts. All warranted parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Configuration of BIOS as part of an installation or upgrade.
- Changes, modifications, or upgrades to device drivers.
- Installation and maintenance of network operating systems (NOS).
- Installation and maintenance of application programs.

Refer to your IBM hardware warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

In the U.S. and Canada, these services are available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9:00 a.m. to 6:00 p.m.

Note: Response time will vary depending on the number and complexity of incoming calls.

In addition, you are eligible for IBM Start Up Support for 90 days after installation. This service provides assistance for:

- Setting up your network operating system
- Installing and configuring interface adapters
- Installing and configuring network adapters

Please have the following information ready when you call:

- Machine type and model
- Serial numbers of your IBM hardware products

- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

Phone numbers are subject to change without notice. For the most up-to-date phone numbers, go to <http://www.ibm.com/pc/support/> and click **Support Phone List**.

| Country | | Telephone number |
|------------------------|-------------------------|------------------|
| Austria | Österreich | 01-24 592 5901 |
| Belgium - Dutch | Belgie | 02-210 9820 |
| Belgium - French | Belgique | 02-210 9800 |
| Canada | Toronto only | 416-383-3344 |
| Canada | Canada - all other | 1-800-565-3344 |
| Denmark | Danmark | 45 20 82 00 |
| Finland | Suomi | 09-22 931 840 |
| France | France | 02 38 55 74 50 |
| Germany | Deutschland | 07032-1549 201 |
| Ireland | Ireland | 01-815 9202 |
| Italy | Italia | 02-482 9202 |
| Luxembourg | Luxembourg | 298-977 5063 |
| Netherlands | Nederland | 020-514 5770 |
| Norway | Norge | 23 05 32 40 |
| Portugal | Portugal | 21-791 51 47 |
| Spain | España | 91-662 49 16 |
| Sweden | Sverige | 08-477 4420 |
| Switzerland | Schweiz/Suisse/Svizzera | 0848-80 52 52 |
| United Kingdom | United Kingdom | 01475-555 055 |
| U.S.A. and Puerto Rico | U.S.A. and Puerto Rico | 1-800-772-2227 |

In all other countries, contact your IBM reseller or IBM marketing representative.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country.

For more information about these services, contact your IBM marketing representative.

Appendix C. Notices

This publication was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

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