

IBM TotalStorage™ Network Attached Storage 200
Models 201 and 226



User's Reference

Release 2.5

Note

Before using this information and the product it supports, be sure to read the general information in "Appendix A. Notices" on page 95.

First Edition (June 2002)

This edition applies to Release 2.5 of the IBM 5194 TotalStorage Network Attached Storage 200 (Models 201 and 226) (product numbers 5194-201 and 5194-226) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this book

This book provides information necessary to configure and administer the software for the IBM 5194 TotalStorage Network Attached Storage 200 (Models 201 and 226).

Hereafter, this product is referred to as the NAS 200, unless otherwise noted.

Who should read this book

This book is for administrators of the NAS 200.

Note that although this product is relatively easy to install, configure, and administer, the NAS 200 administrator should have experience in at least the following skills, or have access to personnel with experience in these skills:

- Microsoft® Windows®
- Networking and network management
- Disk management
- General technologies of the product (such as storage, RAID, and so on)
- Critical business issues (such as backup, disaster recovery, security)

Frequently used terms

The following terms, used within this document or within the Safety Information, have these specific meanings:

Term	Definition in this document
Attention	These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
Caution	These notices indicate situations that can be potentially hazardous to you. A caution notice is placed just before descriptions of potentially hazardous procedure steps or situations.
Danger	These notices indicate situations that can be potentially lethal or extremely hazardous to you. A danger notice is placed just before descriptions of potentially lethal or extremely hazardous procedure steps or situations.
Notes	These notices provide important tips, guidance, or advice.

Publications

The latest versions of the following product publications are available in softcopy at:

www.ibm.com/storage/support/nas

NAS 200 product library

The NAS 200 library consists of the following publications:

- *Hardware Installation Guide GA27-4262*

This book describes hardware physical specifications, electrical specifications, cabling, environmental specifications, and networking specifications for installing the NAS 200.

- *User's Reference* GA27-4263
This book describes such operational and administrative activities as:
 - Using the configuration utilities
 - Administering the NAS 200
 - Troubleshooting
 - Using the Recovery and Supplementary CDs
- *Storage Unit Installation and User's Guide* GA27-4259
This book provides instructions for installing and replacing components in your IBM 5194 TotalStorage Network Attached Storage Storage Unit. It also provides information on troubleshooting the unit.

Hardcopy publications shipped with the NAS 200

The following publications are shipped in hardcopy and are also provided in softcopy form at www.ibm.com/storage/support/nas/techdocs:

- *Hardware Installation Guide*, GA27-4262
- *Release Notes*
This document provides any changes that were not available at the time this book was produced.

Related publications

The following publications contain additional information about the NAS 200:

- IBM 5194 TotalStorage Network Attached Storage 200 (Models 201 and 226) Hardware Installation Guide GA27-4262
- IBM 5194 TotalStorage Network Attached Storage 200 (Models 201 and 226) Service Guide GA27-0400
- IBM 5194 TotalStorage Network Attached Storage 200 (Models 201 and 226) Storage Unit Installation and User's Guide GA27-4259
- The following information is provided on the Documentation CD that came with the appliance:
 - ServeRAID Adapter Installation and User's Guide
 - UM Services User's Guide

Web sites

The following Web sites have additional and up-to-date information about the NAS 200:

- www.ibm.com/storage/nas
- www.ibm.com/storage/support/nas

Chapter 1. Introduction

With the IBM TotalStorage Network Attached Storage (NAS) 200 (5194 Models 201, 226, and EXP), your enterprise will gain scalable, network-attached storage devices that deliver excellent value, state-of-the-art systems management capabilities, and task-optimized operating system technology. These NAS devices provide you with increased performance, storage capacity, and functionality.

These models have been developed for workgroup or department environments with file-serving requirements across Windows and NFS clients, e-business, and small applications. In addition, these devices support Ethernet LAN environments with large or shared end-user workspace storage, remote running of executables, remote user data access, and personal data migration.

These new machines replace the IBM 5194 Models 200, 225, and EXU. Enhancements provided by the new models include:

- Greater granularity in configuring storage size
- Double the maximum storage size
- More options in configuring Ethernet connections
- More options for tape backup

To help provide quick and easy installation, both NAS models include preloaded, preconfigured, pretuned, and pretested operating systems, supporting system management, and RAID management software. You can order the models as a workgroup or department appliance depending on the specific use.

The Workgroup Model (Model 201) features:

- Compact tower configuration
- One 1.133-GHz processor; second (dual) processor optional
- 512 MB of ECC 133-MHz memory standard
- ServeRAID-4Lx, an economical, single-channel RAID controller
- One integrated 10/100 Ethernet connection
- A dual-channel, 160 MB/s Ultra 160 SCSI controller
- Three to six 36.4 GB hard-disk drive or 72.8 GB hard-disk drive (109.2 GB up to 436.8 GB)

The Departmental Model (Model 226) features:

- Rack-optimized configuration
- Two 1.133-GHz processors
- 1 GB of ECC 133-MHz memory standard
- ServeRAID-4H, a high function, four-channel RAID controller
- One integrated 10/100 Ethernet connection
- A dual-channel, 160 MB/s Ultra160 SCSI controller
- Configurable with three to six 36.4 hard-disk drive or three to six 72.8 GB hard-disk drive (218.4 GB up to 436.8 GB)
- Expandable up to 3.49 TB using up to three IBM 5194 NAS Storage Unit Model EXP

The preloaded software is based on the Windows Powered OS operating system. Preloaded software includes:

Microsoft® Windows® 2000 for Network Attached Storage

Enables remote administration of the appliance using a Web-based graphical user interface (GUI).

Microsoft Windows Terminal Services

Enables remote administration of the appliance using its Windows desktop.

Microsoft Services for UNIX®

Provides file access to UNIX and UNIX-based clients and servers through Network File System (NFS) protocol.

IBM Director Agent and Universal Manageability Server Extensions

Provides system management support based on industry standards (in conjunction with the IBM Director console application as well as other management software).

IBM Advanced Appliance Configuration Utility agent

Supports management using the IBM Advanced Appliance Configuration Utility console application (supports aggregate Web-based management of all of your IBM appliances).

ServeRAID Manager RAID Configuration and Monitoring

Provides configuration tools and RAID management of the ServeRAID-4x adapter.

Intel PROSet II

Provides diagnostics for the Intel Ethernet adapters.

Alacritech® SLICuser

Provides diagnostics for the Alacritech Quad-port Ethernet adapter.

Columbia Data Products® Persistent Storage Manager (PSM)

Provides 250 persistent images of customer data and enables full online backup of system with Microsoft backup applications.

Tivoli® Storage Manager Client

Provides data backup and archive support (in conjunction with Tivoli Storage Manager Server).

Note: Note that both models are generically referred to as NAS 200 in the rest of this document.

Roadmap for setting up and configuring the NAS 200

The following roadmap presents the requirements and instructions for setting up and configuring the NAS 200.

Configuration and administration tools

The NAS 200 has several different methods of configuration depending on your environment.

First, determine how you will manage the device. You can manage the NAS 200 in “headless” mode or with a keyboard, display, and mouse directly attached to each node. For “headless” management of the NAS 200, you can use one of the following tools:

- Terminal Services, for remote configuration and management from another device on the network

- Universal Manageability Services (UMS) for management through a Web browser
- Windows 2000 for NAS, a Web-based GUI for those not familiar with the Windows desktop
- IBM Advanced Appliance Configuration Utility (IAACU) for setup and configuring multiple devices or other appliances on a single network

After you determine how you will manage the NAS 200, you can begin setup and configuration of the device.

See “Chapter 2. Configuration and administration tools” on page 5 for more information on configuration and administration tools.

Step 1 - Initial network setup

1. Configure the NAS 200 to enable access over the network. First, use DHCP or static addressing to set up one network connection.
 - If you are running with a keyboard, display, and mouse, set up a network connection to access the device.
 - If you are running in a headless environment, use one of the following methods:
 - If DHCP is installed and the IP address requested can be determined, use this method for initial setup, but you should change this address to static later in the configuration.
 - If you have multiple appliances or cannot determine the DHCP address, install the IAACU utility to identify appliances and define IP addresses. The tool will also allow you to set static addresses.
2. Next, complete the steps in “Initial setup and configuration” on page 20.

See “Chapter 3. Getting started” on page 19 for more information on initial network setup.

Step 2 - Define storage

The NAS 200 comes with preconfigured storage spanning the internal hard disk drives:

- A RAID-level 1E array, for the System partition (drive letter C:)
- A RAID-level 1E array, for the Maintenance partition (drive letter D:)
- A RAID-level 5 array, comprised of the remaining storage. This array consists of a single logical unit number (LUN), for the Data drive (drive letter E). The size of this (LUN) depends on the number and size of hard disk drives that came with your NAS 200.

You can use the preconfigured Data drive, or delete it and configure new storage.

See “Chapter 4. Storage configuration” on page 23 for more information on defining storage.

Step 3 - Completing setup

1. Add users (see “Defining Windows users and groups” on page 29 and “Defining UNIX users and groups” on page 30).
2. Add file shares (see “Creating shares” on page 34).

See “Chapter 5. Completing setup” on page 29 for more information on completing setup.

Step 4 - Additional functions

Additional functions are available for such tasks as backup and creating persistent images. It is recommended that after you complete the setup and configuration procedures, you use the Persistent Storage Manager Disaster Recovery option (“Disaster recovery” on page 47) or other method to back up the system configuration in the event of a failure.

See “Chapter 6. Additional administrative functions” on page 37 for more information on additional functions.

Chapter 2. Configuration and administration tools

Attention

Changing the preloaded software configuration of this product, including applying or installing unauthorized service packs or updates to preinstalled software, or installing additional software products that are not included in either the preloaded image or on the Supplementary CD, might not be supported and could cause unpredictable results. For updated compatibility information, refer to the IBM Web site:

<http://www.ibm.com/storage/nas>

To correct problems with a preloaded software component, back up your user and system data. Then, use the Recovery CD to restore the preloaded software image.

The NAS 200 appliance comes with the following configuration programs that you can use to configure and administer the appliance:

- Terminal Services Client (page 7 and page 8)
- IBM Advanced Appliance Configuration Utility (IAACU, page 7 and page 9)
- Universal Manageability Services (page 7 and page 15)
- Windows 2000 for Network Attached Storage (page 7 and page 17)

This chapter describes these tools in general and then in detail.

In addition to these primary tools, the NAS 200 offers several secondary administrative tools:

- Telnet Server support (page 18)
- Simple Network Management Protocol (SNMP) support (page 18)

Using a keyboard, monitor, and mouse for setup and configuration

It is highly recommended that you directly attach a keyboard, monitor, and mouse to the NAS 200 when performing these tasks:

- Initially setting up and configuring the device.
- Changing or adding to RAID arrays (for example, adding a new array with ServeRAID Manager, adding a new RAID controller, or adding a storage expansion unit).
- Troubleshooting the device.

Summary of configuration and administration tools

There are several ways to set up and administer the NAS 200. Table 1 on page 6 suggests which tool to use for specific functions, but does not list all options or combinations. The administrator's training level or preferences might determine an alternate approach from that suggested in the table.

Table 1. Summary of configuration and administration tools for the NAS 200

Administration tool	Main functions
Windows Domain Controller (not NAS appliance)	Users and user groups may be defined and authenticated by a Windows Domain Controller, although this is not required.
IBM Advanced Appliance Configuration Utility	<p>Access a headless NAS 200, particularly for the initial setup of the network connectivity. (Alternatively, you can attach a keyboard, mouse, and display to the NAS 200.) IAACU enables you to perform these tasks:</p> <ul style="list-style-type: none"> • Set time and date • Configure initial network connectivity parameters • Access to Windows 2000 for NAS GUI, Terminal Services (NAS Desktop), and Universal Manageability Services
Windows 2000 for NAS GUI	<p>Provides ease-of-use administration, but not all the capabilities of Terminal Services and IBM NAS Administration. Windows 2000 for NAS GUI enables you to perform these tasks:</p> <ul style="list-style-type: none"> • Configure networking connectivity • Create and format logical drives • Join domains • Set up access permissions and disk quotas for CIFS, NFS, HTTP, FTP, and Novell® NetWare® shares • Use Persistent Storage Manager
IBM NAS desktop and IBM NAS Admin program, using a Terminal Services session or a directly connected keyboard and monitor	<p>Provides in-depth administration of all aspects of NAS 200. Provides all of the Windows 2000 for NAS GUI functions above, plus these capabilities:</p> <ul style="list-style-type: none"> • Use NAS Backup Assistant, or NTBackup and Restore wizard • Learn detailed inventory information about hardware, OS, and so on, using Universal Manageability Services. • RAID configuration using ServeRAID Manager: <ul style="list-style-type: none"> – Create RAID arrays and LUNs. – Add additional RAID or storage enclosure after initial purchase. • Diagnose system problems on storage and adapters
Disaster recovery	Restores a previously saved PSM image of the system partition to a failed machine. This restores all configuration information on the machine. You create the recovery boot diskette from the PSM tools in the Windows 2000 for NAS GUI.
Recovery CD set	Reinstalls the software to the original state as shipped on the machine; however, does not restore configuration information (so configuration changes you applied to the original shipped configuration are lost). You must first boot with the Recovery Enablement Diskette, and then reboot with the Recovery CD. To create the Recovery Enablement Diskette, run enablement_diskette_x.y.exe (where x.y is the version number of the disk), located on the Supplementary CD. You will be prompted to insert a blank disk into drive a: .
Integrated System Management Processor (ISMP) configuration program	Configures the ISMP that is integrated on the engine's planar board.
Remote Supervisor Adapter (RSA) configuration program	Configures the optional RSA.

Terminal Services Client

The Terminal Services Client, when installed on a workstation that is attached to the same network as the NAS 200, enables you to remotely administer the appliance using the NAS 200 desktop. If you are familiar with administrative tasks using a Windows desktop, you can use Terminal Services.

See “Terminal Services and the IBM NAS Administration Console” on page 8 for more information.

IBM Advanced Appliance Configuration Utility (IAACU)

The IBM Advanced Appliance Configuration Utility (IAACU) aids in setting up and reconfiguring the network configuration on your appliances. The IAACU agent works with the IAACU Console to automatically detect the presence of appliances on the network.

After the appliance is detected by the IAACU Console, you can use the IAACU to perform these tasks:

- Set up and manage the appliance’s network configuration, including assigning the IP address, default gateway, network mask, and DNS server to be used by the appliance.
- Start Universal Manageability Services on the appliance, enabling you to perform more advanced systems-management tasks.

See “IBM Advanced Appliance Configuration Utility” on page 9 for more information.

Universal Manageability Services

Universal Manageability Services (UM Services) provides point-to-point remote management of client systems using a Web browser. Use UM Services to:

- Learn detailed inventory information about your computers, including operating system, memory, network cards and hardware.
- Track your computers with features such as power management, event log, and system monitor capabilities.
- Upwardly integrate with Tivoli Enterprise, Tivoli NetView[®], Computer Associates Unicenter, Microsoft SMS, and Intel[®] LANDesk Management Suite.

In addition, you can link to Windows 2000 for Network Attached Storage and Terminal Services from UM Services.

See “Universal Manageability Services” on page 15 for more information.

Windows 2000 for Network Attached Storage

For administrators who are not familiar with Windows operating systems, the NAS 200 provides a Web-based GUI, Microsoft Windows 2000 for Network Attached Storage (Windows 2000 for NAS). Using Windows 2000 for NAS, you navigate through administrative task categories by clicking on the appropriate tabs, and then selecting a task from that category.

See “Windows 2000 for Network Attached Storage” on page 17 for more information.

Detailed information about each of these configuration programs follows.

Terminal Services and the IBM NAS Administration Console

If you are familiar with Windows operating systems, you can use Terminal Services. In some cases, you must use Terminal Services to complete administrative tasks.

You can access Terminal Services in two ways:

1. Through the UM Services browser, as described in Step 3 on page 17.
2. By using the Terminal Services Client software.

Installing Terminal Services

To use Terminal Services Client, complete the following steps to install it on the remote workstation and connect to your NAS 200 appliance:

1. Insert the Supplementary CD into the workstation CD-ROM drive.
2. Select **Start** → **Run**.
3. In the **Open** field, type (with quotation marks)
`"x:\Terminal Services Client\Disk 1\setup.exe"`

where *x* is the drive letter assigned to the CD-ROM drive.

4. Click **OK** to begin the Terminal Services Client Setup program.
5. Accept the defaults at each prompt or refer to the Microsoft Windows documentation for more instructions. When the Terminal Services Client Setup program completes, proceed to the next step.
6. Check the workstation network TCP/IP protocol configuration settings.

Connecting to the desktop through Terminal Services

To connect to Terminal Services from your workstation, do the following:

1. Click **Start** → **Programs** → **Terminal Services** → **Terminal Services Client**.
2. In the Server field, select the computer name of the NAS 200 that you want. If the NAS 200 that you want is not listed, enter the IP address or the computer name of the NAS 200. The computer name is predefined as IBM5194-xxxxxxx, where xxxxxx is the serial number located in the lower right corner of the bezel on the front of the appliance. If you have changed the computer name from the predefined value, use that name instead.

For Size, select a size (other than full screen) in which the NAS 200 desktop will appear.

3. Click **Connect** to start the Terminal Services Client session. A user login window displays.
4. Log in. Type *Administrator* in the Username field, type *password* in the password field, and then click **OK** to log in. After you log in, you can begin using Terminal Services Client to configure and manage your NAS 200, as if your keyboard, mouse, and monitor were directly attached to it. The NAS 200 desktop contains a shortcut, titled **IBM NAS Admin**, to a special console, the IBM NAS Administration console.

IBM NAS Administration console

The IBM NAS Administration console includes all the standard functions provided by the standard Computer Management console available on any Windows 2000 desktop, plus the following functions specific to the NAS 200, as described in “Chapter 6. Additional administrative functions” on page 37:

- NAS Backup Assistant
- Persistent Storage Manager
- ServeRAID Configuration

Determining who is using the network-attached storage

Occasionally, you might want to know who is using the network-attached storage. To determine this information:

1. Start a Windows Terminal Services session from the administrator’s console to the NAS 200.
2. Click the **IBM NAS Admin** icon on the desktop.
3. In the left pane, click **File Systems** → **Shared Folders** → **Sessions**.
4. The users currently using the storage are displayed. If necessary, you can close those sessions with a right-click. Before you close a session, notify the user that you are going to close the session by clicking **Start** → **Programs** → **Accessories** → **Command Prompt**, then issuing the **net send hostname messagetext** command.

IBM Advanced Appliance Configuration Utility

The IBM Advanced Appliance Configuration Utility (IAACU) helps you to set up and reconfigure the network configuration on your NAS 200, as well as other IBM appliances.

The IAACU agent, preinstalled on your NAS 200, works with the IAACU Console, a Java™-based application that is installed on a remote workstation. You can use the agent and console as a systems-management device to automatically detect the presence of NAS 200 appliances on the network. Once the NAS 200 appliance is detected by the IAACU Console, use the IAACU to set up and manage the appliance’s network configuration, including assigning the IP address, default gateway, network mask, and DNS server to be used by the appliance. You can also use the IAACU to start Universal Manageability Services (UM Services) on the appliance, enabling you to perform more advanced systems-management tasks.

For networks that are not currently running DHCP servers, the IAACU is useful for automatically configuring network settings for newly added appliances, such as the NAS 200.

However, networks with DHCP servers will also benefit from using the IAACU because it enables you to reserve and assign the appliance IP address in an orderly, automated fashion. Even when you use DHCP and do not reserve an IP address for the appliance, you can still use the IAACU to discover appliances and to start UM Services Web-based systems management.

Notes:

1. The Advanced Appliance Configuration configures and reports the TCP/IP settings of the first adapter on each appliance only. The first adapter is typically the built-in Ethernet controller. Be sure to connect the built-in Ethernet connector to the same physical network as your systems management console.

2. The Advanced Appliance Configuration Utility must be running to configure newly installed appliances automatically.
3. The system running the Advanced Appliance Configuration Utility console automatically maintains a copy of its database (ServerConfiguration.dat) in the Advanced Appliance Configuration Station installation directory. To remove previous configuration data, close the Advanced Appliance Configuration Utility, delete this file, and then restart the utility. This deletes all previously configured Families. However, the Advanced Appliance Configuration Utility will automatically discover connected appliances and their network settings.

IAACU agent

The IAACU agent is preinstalled on your NAS 200 appliance.

When you connect the NAS 200 to your network, the IAACU agent automatically reports the appliance serial number and type, the MAC address of its onboard Ethernet controller, and whether DHCP is in use by the appliance. Furthermore, it will report the hostname, primary IP address, subnet mask, primary DNS server address, and primary gateway address if these are configured on the system.

Note: The IAACU agent periodically broadcasts the appliance IP settings. To prevent the service from broadcasting this data periodically, stop the `iaaconfig` service.

IAACU Console

The IAACU Console is a Java application that you install on one remote workstation in your network for use as a systems-management console. For information on how to install the IAACU Console, see Table 14 on page 93.

Note: The IAACU creates a private database that is specific to the IP subnetwork to which it is attached. Therefore, do not install it on more than one systems-management console residing on the same IP subnetwork.

The IAACU Console enables you to perform these tasks:

- Automatically discover NAS 200 appliances, as well as other IBM appliances that run the IAACU agent and are attached to the same physical subnet as the IAACU Console.
- Use a GUI-based application to configure the appliance network settings, such as IP addresses, DNS and gateway server addresses, subnet masks, and hostnames.
- Group discovered appliances into function-specific Families. Appliances are added to a Family based on the appliance type. Appliances that perform the same function appear in the same Family. (Note that all NAS 200 appliances are in the same family.)
- Start UM Services Web-based systems-management console.
Launch UM Services on your appliances and perform advanced systems-management tasks on a selected appliance with a single mouse click.

The IAACU Console is divided into two panes:

- **The Tree View Pane**

The Tree View Pane, located on the left side of the IAACU Console window, presents a list of all discovered NAS 200 appliances and includes any Families you have previously defined. The Tree View Pane also includes groups for

appliances that do not fit any of the defined Families, that were not configured using the IAACU, or that have IP addresses that conflict with other devices on your network. When you click on any item in the Tree View, information about that item (and any items that are nested below that item in the tree view) is displayed in the Information Pane.

- **The Information Pane**

The Information Pane, located on the right side of the IAACU Console, displays information about the item that is currently selected in the Tree View Pane. The information that is displayed in the Information Pane varies depending on the item that is selected. For example, if you select the All Appliances item from the Tree View Pane, the Information Pane displays configuration information (IP settings, hostname, serial number, and so on) about each of the NAS 200 appliances that have been discovered by the IAACU Console. However, if you select a Family, the Information Pane displays information about the Family settings for the selected Family.

The IAACU Console also features the following menus:

File Use the File menu to import or export the IAACU Console configuration data, to scan the network, or to exit the program.

Family

Use the Family menu to add or delete Families, or to move Families up or down in the tree view.

Appliance

Use the Appliance menu to remove a previously discovered appliance from a Family or group, and to add an appliance to the first matching Family in the tree view.

Help Use the Help menu to display product information.

Discovering NAS 200 Appliances

Any NAS 200 appliance, or other IBM appliance, that is running and is connected to the same subnet as the system running the IAACU Console is automatically discovered when you start the IAACU Console. Discovered appliances appear in the IAACU Console tree view (in the left pane of the IAACU Console window). Each appliance appears in two locations in the tree view:

- Every discovered appliance is listed in the tree view under All Appliances.
- Each discovered appliance also appears in one of the following sections of the tree view:

- In a *Family*

If the discovered appliance fits the requirements of a Family, it will automatically appear as part of a Family.

Note: If a discovered appliance fits the requirements of more than one Family, it is automatically added to the first appropriate Family that is listed in the tree view, starting from the top of the tree. For information on how to move appliances between families, see “Using Families and Groups in the Tree View” on page 12.

- In the *Unassigned Appliances* group

If the discovered appliance does not fit a previously configured Family, it is placed in the *Unassigned Appliances* group.

- In the *Conflicting IP Addresses* group

Appliances that are running the IAACU agent, but that have a network configuration that was not set by the IAACU agent or console, will appear in

the *Conflicting IP Addresses* group. If an appliance is contained in the Conflicting IP Addresses group, you can use the Adopt By First Matching Family function to add it to a previously defined Family. For more information, see “Using the Adopt by First Matching Family function” on page 14.

Using Families and Groups in the Tree View

Families are important elements of the IAACU. They specify the parameters that the IAACU uses to automatically categorize discovered appliances and to configure them with the appropriate network settings. Family rules are defined solely by appliance type or purpose. Each Family can contain only one type of appliance. The only way to automatically apply predetermined network settings to newly installed and discovered appliances is to create and use Families.

Appliances that match the rules criteria for a Family group can be automatically configured to use predefined network settings. A Family can be configured to allow appliances to use DHCP to configure their IP settings, or can be defined to automatically assign IP settings (such as primary gateway and DNS server addresses, assigning an IP address from a specified IP address range, and specifying a subnet mask). Host names for discovered appliances can also be defined so that they are allocated using either a prefix or appliance serial number.

The IAACU is not the only way to configure network settings. For example, network settings can be configured using Terminal Services for Windows or by attaching a keyboard and mouse to the appliance and using Windows Control Panel. If the appliance network settings have been configured by a method other than using the IAACU, the appliance will be discovered by the IAACU and it will be added to an appropriate Family, if one exists. Appliances that have been configured using a method other than the IAACU for which no appropriate family exists will appear in the Orphaned Externally Configured Appliances group.

The Tree View Pane contains the following items:

- **All Appliances**

Every discovered appliance is listed in the tree view under All Appliances.

- **Families**

The Families group in the Tree View Pane shows all Families that have been defined, with appliances that have already been assigned to each Family nested beneath the Family name in the tree view. Families are defined by appliance purpose, so all appliances that appear in a given family are of the same type. If you select a Family from the Tree View Pane, a description of the Family and the rules that are used to define the selected Family are displayed in the Information Pane. If you select an appliance from a Family in the Tree View Pane, the selected appliance network settings are displayed in the Information Pane.

If you are not using DHCP, the IAACU automatically assigns one IP address per appliance, using available addresses within the range defined in the Family rules. When the IP address range for a Family has been exhausted, the IAACU automatically searches for other Families that have rules matching the appliance being configured. If a matching Family with an available address is found, the appliance will automatically be assigned to the Family that has available IP addresses. This enables you to define multiple Families, each of which uses a set of noncontiguous IP address ranges.

When an appliance is discovered on the network, the IAACU automatically searches all previously defined Families, starting with the first Family listed in the Families tree view and moving downward. Appliances are automatically added to the first defined Family that matches the appliance purpose. Therefore, the order

in which Families appear is important. To adjust this search order, right-click on a Family and then select **Move Up** or **Move Down** to adjust its position within the Families list.

- **Orphaned Appliances**

Any discovered appliances that have been configured using the IAACU but that do not meet the rules for any existing Family are automatically added to the Orphaned Appliances group.

- **Orphaned Externally Configured Appliances**

Any discovered appliance that has been configured without using the IAACU tool and that does not meet the rules for any existing Family is automatically added to the Orphaned Externally Configured Appliances group. Appliances configured without the IAACU that meet the rules for any existing Family are automatically added to the matching Family.

To add an orphaned externally configured appliance to an appropriate Family that was created after the orphaned appliance was discovered, right-click on the appliance and select **Adopt by First Matching Family**. For more information, see “Using the Adopt by First Matching Family function” on page 14.

Note: The IAACU does not change manually configured network settings of discovered appliances. If the manually configured IP and Subnet addresses fit an existing Family, the IAACU will place that appliance into that Family, but does not change any other settings (such as host name, DNS, or gateway addresses).

- **Conflicting Network Addresses**

Any discovered appliance that has the same IP address as a previously discovered appliance will be listed in the Conflicting Network Addresses group.

Creating a Family

To create a Family:

1. Select **Create Family** from the Family menu.

The IAACU Family Setup window opens.

2. Specify a Family name.

In the **Family Name** field type the name that will be used for this Family.

3. Select **Appliance Family Rules**.

The Appliance Family Rules determine what purpose an appliance must serve to be included in the Family. Select one of the following values:

- IBM TotalStorage NAS Appliances
- IBM xSeries 130 and 135

You should select IBM TotalStorage NAS Appliances for a family that is to include your NAS 200.

4. Specify network resources to be used by members of the Family.

You can use the IAACU to assign network resources for members of this Family, or you can use a DHCP server to assign network resources.

- To use the IAACU to assign network resources, clear the **Use DHCP** check box and fill in the following fields:

- **Min IP Address**

- The lowest IP address in a range of IP addresses that can be assigned to an appliance that is a member of this Family.

Max IP Address

The highest IP address in a range of IP addresses that can be assigned to an appliance that is a member of this Family.

Subnet Mask

The subnet mask value that will be used by appliances that are members of this Family.

Default Gateway

The IP address of the default gateway that will be used by appliances that are members of this Family (optional).

DNS The IP address of the DNS server that will be used by appliances that are members of this Family (optional).

- To use a DHCP server to assign network resources, select the **Use DHCP** check box. This will allow a DHCP server on your network to assign an IP address and subnet mask and to specify the default gateway address and address of the DNS server that will be used by appliances that are members of this Family.

5. Select a Host Name Assignment Type.

The Host Name Assignment Type enables you to automatically specify a Host Name that members of this Family will use. You can select one of the following Host Name Assignment Types:

No Allocation

No preconfigured host name format will be assigned to appliances that are members of this Family.

Use Serial Number

The Serial Number of the discovered appliance will be used as a host name for the appliance.

Use Prefix Name

A user-specified prefix, along with an incremental number for each appliance, will be used for the host name of each appliance that is a member of this Family. Type the prefix that you want in the **Host Name Prefix** field.

6. Click **Finish to save this Family.****Removing Appliances from Families**

Use the Remove Appliance function to delete an appliance from the IAACU Console database and view pane. Removing an appliance that is no longer in use allows the IP address that was assigned to the appliance to be allocated to another appliance. You can also remove an appliance from a family and then rescan the network to add it to an appropriate Family that appears higher in the Tree View pane.

To remove an appliance, right-click on the appliance, and then select **Remove Appliance** from the pop-up menu.

- If the IAACU cannot communicate with the selected appliance (because, for example, it has been removed from the network or has failed), the appliance is removed immediately.
- If the IAACU can communicate with the selected appliance, you are prompted to confirm removal of the appliance before the appliance removal task is completed. This helps prevent accidental removal of an active and functional appliance.

Using the Adopt by First Matching Family function

Use this function to perform these tasks:

- Add an *Orphaned Externally Configured Appliance* to an appropriate Family.

Appliances that have been configured without using the IAACU tool and that do not meet the rules for any existing Family are automatically added to the Orphaned Externally Configured Appliances group. If, after the orphaned appliance is discovered, you create a Family that is appropriate for the orphaned appliance, right-click the orphaned appliance and select **Adopt by First Matching Family** to move the appliance from the Orphaned Externally Configured Appliances group to the newly created Family.

- Move an appliance from one Family to another appropriate Family that occurs higher in the list of previously defined Families. If there is more than one appropriate Family for a newly discovered appliance, it automatically appears in the first appropriate Family in the list of Families. To move a discovered appliance from one appropriate Family to another appropriate Family:
 1. Right-click the Family that you want the appliance moved to.
 2. Select **Move Up in List** to move the selected Family up in the list of families. Repeat Steps 1 and 2 until the Family that you want to add the appliance is displayed above the Family that currently contains the appliance.
 3. Right-click the appliance that you want to move to another Family and then select **Adopt by First Matching Family**.

Universal Manageability Services

Universal Manageability Services (UM Services) is a Windows application that acts as both a stand-alone management tool for the system it is installed on, plus a client to IBM Director.

As a Director Client, it receives and sends information to the Director Server as controlled from the IBM Director Console.

As a stand-alone tool, it provides a Web-browser based interface and a Microsoft Management Console (MMC) interface, where you can view the system status, perform certain management tasks and configure alerts.

The Universal Manageability Services (UM Services) GUI enhances the local or remote administration, monitoring, and maintenance of IBM systems. UM Services is a lightweight client that resides on each managed computer system. With UM Services, you can use a Web browser and UM Services Web console support to inventory, monitor, and troubleshoot IBM systems on which UM Services is installed.

This “point-to-point” systems-management approach, in which you use a Web browser to connect directly to a remote-client system, enhances support and enables you to effectively maintain IBM systems without requiring the installation of additional systems-management software on your administrator console.

In addition to point-to-point systems-management support, UM Services also includes support for UM Services Upward Integration Modules. These modules enable systems-management professionals who use any supported systems-management platform (including Tivoli Enterprise, CA Unicenter TNG Framework, and Microsoft Systems Management Server [SMS]) to integrate portions of UM Services into their systems-management console. Because it was designed to use industry-standard information-gathering technologies and messaging protocols, including Common Information Model (CIM), Desktop

Management Interface (DMI), and Simple Network Management Protocol (SNMP), UM Services adds value to any of these supported workgroup or enterprise systems-management platforms.

Complete documentation on how to use UM Services is included on the Documentation CD that came with the appliance.

System requirements

The UM Services client is preinstalled on the NAS 200 appliance. However, you must have a Web browser installed on your systems-management console. It is recommended that you set Microsoft Internet Explorer 5.x (or later) as the default browser.

Notes:

1. You must install the optional Java Virtual Machine (VM) support to access a client system running UM Services.
2. If you reinstall Internet Explorer after installing UM Services, you must reapply the Microsoft VM update. The UM Services client requires Microsoft VM Build 3165 or later. Download the latest Microsoft VM from:
www.microsoft.com/java
3. If you install UM Services before you install Microsoft Management Console (MMC) 1.1 (or a later version), you will not have an icon for Microsoft Management Console in the IBM Universal Manageability Services section of your Start menu.

Starting UM Services

You can use IAACU or Terminal Services Client to configure the network setting remotely, or you can attach a keyboard and mouse to your appliance and configure the Network settings using the Windows Control Panel. After you have configured the network settings for your appliance, you are ready to use UM Services.

To start UM Services:

1. Start your Web browser and then, in the **Address** or **Location** field of the browser, type:

```
http://ip_address:1411
```

where *ip_address* is the IP address of the NAS 200 and then press **Enter**.

Or, type:

```
http://computer_name:1411
```

where *computer_name* is the computer name of the NAS 200. The computer name is predefined as: IBM5194-xxxxxxx, where xxxxxx is the serial number located in the lower right corner of the bezel on the front of the appliance.

If you have changed the computer name from the predefined value, use that name instead. A user login window is displayed.

2. Type *Administrator* in the Username field, and type *password* in the Password field. You can leave the Domain field blank. Make sure the "Save this password in your password list" check box is not selected, and then click **OK**.

Note: To ensure system security, change the Administrator password from "password" to something else. Once you do, or if you create another user

in the Administrator group in the future, use your new username/password combination instead of the default username/password combination.

The first time you connect, you might be prompted to install XML and Swing components. Follow the on-screen instructions to install these components and then close and restart Internet Explorer before you proceed.

You are now connected to the NAS 200 through UM Services. In addition to the standard UM Services functionality, your appliance includes functionality for administering the appliance, available from the Appliances tab in the left pane of the UM Services browser. The default view (in the right pane of the UM Services browser) when you connect to your appliance is Windows 2000 for NAS. The other selectable view in the Appliances tab is Windows 2000 Terminal Services, which displays a Terminal Services Web Connection page.

3. To start Windows 2000 for NAS, click **Administer this server appliance** in the right pane of the UM Services browser. To connect to the NAS 200 and manage it as though you were running Terminal Services Client from your desktop, select **Terminal Services** in the Appliances tab of the UM Services browser, and then follow the instructions for connecting to the NAS 200 using Terminal Services described in “Terminal Services and the IBM NAS Administration Console” on page 8.

Launching UM Services from the configuration utility

You can use the IAACU to launch UM Services on your NAS 200 appliance.

Note: The selected appliance must be running Universal Manageability (UM) Services as a UM Services client. Also, the systems-management console (the system that is running the IAACU Console) must use a Web browser that is supported for use with UM Services. If you have not used UM Services from this system, you must install several plug-ins before proceeding.

To use the IAACU Console to start UM Services on an appliance:

1. Click the appliance in the IAACU Console Tree View Pane.
When you select the appliance from the tree view, information about the selected appliance is displayed in the Information Pane.
2. Click the **Start Web-Based Management** button.
Your default Web browser starts, loading the UM Services browser automatically.
3. Log in to the UM Services browser. Go to Step 2 on page 16 for login instructions.

For more information on using UM Services to manage your appliances, see the *Universal Manageability Services User's Guide*, included on the Documentation CD that came with the appliance.

Windows 2000 for Network Attached Storage

While you can perform most administrative tasks using Windows 2000 for NAS, you must use Terminal Services Client for some advanced tasks. See “Terminal Services and the IBM NAS Administration Console” on page 8 for more information.

To start Windows 2000 for NAS, use one of these methods:

- Through UM Services, as described in Step 3 on page 17.
- From a Web browser, by entering **http://ip_address:8099** or **http://computer_name:8099** and then logging on to the NAS 200.
- From the NAS 200 desktop while using Terminal Services Client and starting a browser.

You can access the online help for Windows 2000 for NAS in two ways:

1. Click the **Help** button at the top of any Web page. This displays a table of contents that you can navigate to find help for any Windows 2000 for NAS task.
2. Click the question mark (?) button at the top of any Web page. This displays context-sensitive help for the task you are currently performing.

Telnet server support

Attention: When you Telnet to another machine, your user name and password are sent over the network in plain, unencrypted, text.

The NAS 200 includes Telnet server capability. The Telnet server provides limited administrative capability for the NAS 200. This might be useful in cases where you need to remotely administer the NAS 200, but do not have access to a Windows-based workstation (from which you could remotely administer the appliance using a supported Web browser or Terminal Services Client).

To access the NAS 200 from any Telnet client, specify the IP address or host name of the NAS 200, then log in using an ID and password (defined on the NAS 200) with administrative authority. From the command line, you can issue DOS-like commands (such as **dir** and **cd**), and some UNIX-like commands (such as **grep** and **vi**). You can launch some applications, but only character-mode applications are supported.

By default, the Telnet server is disabled. To enable the Telnet server, from the Windows 2000 for NAS user interface, go to the Network task group, then select **Telnet**. On the Telnet Administration Configuration page that appears, select the *Enable Telnet access to this appliance* check box. If you do not require Telnet access to the NAS 200, then it is recommended that you leave the Telnet server disabled.

SNMP support

Support for the Simple Network Management Protocol (SNMP) is enabled. In order to manage the NAS 200 from your SNMP-capable management application, you must install the management information base (MIB) files for various components of the NAS 200 on the management application workstation, so that the application can recognize those SNMP elements (values, alerts, etc.) supported by the components.

Chapter 3. Getting started

This chapter presents a recommended minimal procedure to quickly set up, configure, and administer your appliance. These instructions refer specifically to a base configuration as shipped and do not cover the setup of additional storage units, which are purchased separately.

Methods for setting up your NAS 200

The following sections detail how to set up your NAS 200. You must first ensure that the network recognizes the new appliance. The appropriateness of the method you use to do this depends on several conditions:

- In “headless” mode (without a keyboard, monitor, and mouse directly attached to the unit), use one of the following methods:
 - **IBM Advanced Appliance Configuration Utility (IAACU)**

If you have multiple appliances or cannot determine the DHCP address, install the IAACU to identify appliances and define IP addresses. The tool also allows you to set static addresses.

If you are using this method, proceed with “Installing the IBM Advanced Appliance Configuration Utility”.
 - **Windows Terminal Services**

If DHCP is installed and the IP address requested can be determined, use this method for initial setup, but you should change the address to static later in the configuration. This condition is most appropriate when using Windows Terminal Services for operation of the NAS 200.

If you are using this method, proceed with “Initial setup and configuration” on page 20.
- Using a keyboard, display, and mouse is most appropriate when there is a single or few appliances in the network and you use static setup and definition.

If you are operating in this mode, proceed with “Initial setup and configuration” on page 20.

Installing the IBM Advanced Appliance Configuration Utility

These instructions assume that you have installed and powered on the appliance according to the installation guide procedures. You are now ready to install the IBM Advanced Appliance Configuration Console application from the Supplementary CD.

Note: The Advanced Appliance Configuration Utility creates a private database that is specific to the IP subnetwork to which it is attached. Therefore, do not install it on more than one systems management console residing on the same IP subnetwork.

Install the Advanced Appliance Configuration console application from the Supplementary CD onto a Windows NT 4.0 (or more recent version) or Windows 2000 workstation that is attached to the same IP subnetwork to which the appliance is attached. The Advanced Appliance Configuration icon will be placed on the workstation desktop.

For information on how to install the Advanced Appliance Configuration Utility Console, see Table 14 on page 93.

After you install the Advanced Appliance Configuration console application, the following steps will take you to the point where you can administer the appliance.

1. Start the Advanced Appliance Configuration console application by clicking its icon.
2. On the left pane of the Advanced Appliance Configuration console, select the appliance to administer. Initially, the appliance is named **IBM5194-serial number**; the serial number is located in the lower right corner of the bezel on the front of the appliance.
3. Click the **Start Web Management** button to start the Universal Manageability (UM) Services browser. This will open a separate Web browser.

For more information on the Advanced Appliance Configuration Utility, see “IAACU Console” on page 10.

Accessing Universal Management Services

1. You will be prompted to authenticate with administrative user name (“Administrator”) and password (initially “password”, but you will need to change this later).

If this is the first time you have accessed the UM Services browser (on any appliance) from this workstation, you are also prompted to install the Swing and XML Java libraries in your Web browser.

2. The UM Services browser starts. In the left pane, Microsoft Windows 2000 for Network Attached Storage will be automatically selected, on the Appliance tab. In the right pane, Windows 2000 for Network Attached Storage will start.
3. Again, you are prompted to authenticate with the administrative user name (“Administrator”) and password (initially “password”, but you will need to change this later).
4. Click **Administer this server appliance** to bring up the Microsoft Windows 2000 for Network Attached Storage GUI.

You are now ready to begin administering the appliance. Details for this task are described in “Initial setup and configuration”.

Initial setup and configuration

This section provides details on the initial setup and configuration of the NAS 200.

Note that if you are administering the NAS 200 without a keyboard, monitor, and mouse (“headless” mode), you can use one of two methods:

- Terminal Services, which provides full administrative function. (See “Terminal Services and the IBM NAS Administration Console” on page 8.)
- Windows 2000 for Network Attached Storage, which provides a subset of the full administrative function in Terminal Services. (See “Windows 2000 for Network Attached Storage” on page 17.)

In general, you administer the appliance by adjusting information contained in the following task groups:

Note: In this example, you access the task groups through the Windows 2000 for Network Attached Storage Web-based GUI.

- “Setting the date and time” on page 21
- “Setting up the network” on page 21

Although you can modify multiple appliance and network attributes in each task group, the information given here is the minimum you need to know to administer the appliance and network.

You can find more information on administration elsewhere in this book and in the online help.

To access these task groups, use one of these methods:

- Click the **Home** tab and then select the task group link.
- Click the top tab associated with that task group.
- Click the **Back** button on your browser until you arrive Home and then select the task group link.

Setting the date and time

To change the date and time, click **Date and Time**. (Remember that you can also access all of these task groups by clicking the titled tabs at the top of the page.) The Set Date and Time page opens to allow you adjust information as necessary.

Setting up the network

Note: All appliances have an initial default user name of “administrator” and password of “password”.

As part of the Network task group, you are required to change the administrator password and (optionally) the properties of each network interface that resides on the appliance.

To change the administrator password, click **Change Administrator Password**. The Change Administrator Password page is displayed, allowing you to change to password. Note the warning on the page that any information that you enter can be viewed by others on the network. To prevent others from seeing your information, set up a secure administration Web site as described in the online help.

To change IP addresses, click **Interfaces**. The Network Adapters on Server Appliance page opens. Use this page primarily to change IP addresses from dynamic (DHCP, which is the system default) to static.

You can then select the network adapter you want to modify, and then choose one of the following tasks related to that adapter:

- **IP** (to modify IP configuration)
- **DNS** (to modify DNS configuration)
- **WINS** (to modify WINS configurations)
- **Rename**

Enabling National Language Support (NLS)

Through the Windows 2000 for NAS GUI or the Windows desktop, you can set up the NAS 200 interface to display in any of the following languages:

- French
- German
- Japanese
- Spanish
- English

Using Windows 2000 for NAS, open the Maintenance task group, select **Language**, pick one of the languages noted above, and then restart the machine.

Using the desktop, select **Start → Settings → Control Panel → Regional Settings**.

Chapter 4. Storage configuration

This chapter gives details for setting up and configuring the NAS 200 storage.

ServeRAID configuration

This section gives details on configuring the ServeRAID adapter.

RAID technology

RAID technology allows you to group several physical drives into an array that you can define as one or more logical drives. Each logical drive appears to the operating system as a single drive. This grouping technique greatly enhances logical-drive capacity and performance beyond the physical limitations of a single physical drive.

For an overview of RAID technology, see Chapter 3 "Understanding RAID technology" in the ServeRAID-4x Ultra160 SCSI Controller publication, which is included on the Documentation CD that came with your appliance.

Table 2 shows the standard features of the ServeRAID-4Lx and ServeRAID-4H.

Table 2. Standard features of ServeRAID-4Lx and ServeRAID-4H

Feature	ServeRAID-4Lx (Model 201)	ServeRAID-4H (Model 226)
Arrays (maximum)	8	8
Battery-backup cache	No	Yes
Cache memory	16 MB	128 MB
Logical drives (maximum)	8	8
SCSI channels	1	4
SCSI transfer speed (maximum)	160 MB/sec	160 MB/sec
Supported RAID levels	0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (E5), 00, 10, 1E0, 50	0, 1, 5, Enhanced-1 (1E) and Enhanced-5 (E5), 00, 10, 1E0, 50
System PCI data bus	64-bit at 33 MHz	64-bit at 33 MHz

Updating the ServeRAID BIOS, firmware, and device drivers

The NAS 200 preloaded software ships with the required BIOS, firmware and device drivers. You do not need to load or update any of these items. Should replacement software be required, it will be available online as described in the *Storage Unit Installation and User's Guide GA27-4259*.

Attention: Because the NAS 200 hardware and software is preconfigured as a high-performance network-attached storage appliance, you should not update the BIOS, firmware, or device drivers using the procedures described in the ServeRAID-4x Ultra160 SCSI Controller publication.

Functionality not needed and not supported in the NAS 200

Because the ServeRAID hardware and software is used in several IBM products, note that the ServeRAID-4x Ultra160 SCSI Controller publication refers to the following items that are not applicable and not supported on the NAS 200:

- Failover
- Clustering
- Other operating systems

Solving ServeRAID problems

For a complete description of how to diagnose ServeRAID problems see Chapter 18, “Solving ServeRAID problems” in the ServeRAID-4x Ultra160 SCSI Controller publication.

If you need help on your NAS 200, you should follow the support instructions as described in the *Storage Unit Installation and User's Guide GA27-4259* appendix. Because the NAS 200 is a preconfigured system, do not use the information described in Chapter 19 of the ServeRAID-4x Ultra160 SCSI Controller publication.

Initial storage configuration of the NAS 200

The NAS 200 comes with preconfigured storage, formatted as follows:

- A RAID-level 1E array, for the System partition (drive letter C:)
- A RAID-level 1E array, for the Maintenance partition (drive letter D:)
- A RAID-level 5 array, comprised of the remaining storage. This array consists of a single LUN, for the Data drive (drive letter E:). The size of this LUN depends on the number and size of hard disk drives that came with your NAS 200.

Attention: Although you will be using files in the System and Maintenance drives, it is strongly recommended that you do **not** repartition them. Doing so could wipe out important data and seriously impair the functioning of your system. Repartitioning is advised **only** for the Data drive.

You can use the preconfigured Data drive, or delete it and configure new storage. If the preconfigured storage is agreeable with your requirements, you can proceed with “Chapter 5. Completing setup” on page 29. If you delete the Data drive, you will need to complete the steps in this chapter.

Creating arrays and logical drives

You configure RAID disk arrays and logical drives on your NAS 200 using the ServeRAID Manager. With ServeRAID Manager, you can configure and manage the storage mounted in the NAS 200 itself (the internal hard disk drives), in addition to the storage mounted in any IBM 5194 TotalStorage NAS 200 Storage Unit enclosures.

Note: You must be connected or using Terminal Services to create arrays and logical drives. You cannot use UM Services.

To start ServeRAID Manager, click the **IBM NAS Admin** icon, open the Storage folder, then open the Serve RAID Manager folder, and double-click **ServeRAID Manager**.

For details on how to use the ServeRAID Manager, see the following sections in Chapter 4, “Understanding RAID technology” in the ServeRAID-4x Ultra160 SCSI Controller publication:

- *Configuring the ServeRAID controller*
- *Using the ServeRAID manager program*

Considerations for configuring the arrays and logical drives for the NAS 200:

1. It is recommended that all arrays used for data drives are RAID-5, though other RAID levels are supported.
2. All disk drives in a single array must be of the same size (36.4 GB and 72.8 GB disk drives are supported by the NAS 200, but the two sizes cannot be mixed in a single array).
3. The preconfigured arrays for the System (C:) and Maintenance (D:) drives (both RAID-1E) must **not** be deleted.

Continue with “Format the logical drives”.

Format the logical drives

Attention: Disk 0 and Disk 1 that appear in the Disk Management application described in the following procedure represent the System and Maintenance partitions described earlier in this chapter. As a further reminder, do not delete or reformat these partitions.

Follow this procedure to format logical drives:

1. Open IBM NAS Admin and select **Disk Management (Local)**, in the Storage folder.
2. The Write Signature and Upgrade Disk Wizard opens. Click **Cancel**.
3. Right-click the area in the bottom of the right pane, where it says **Disk 2**, and select **Write Signature**.
4. Repeat the previous step for all other data disks (Disk 3, Disk 4, and so on).
5. On each data disk:
 - a. Right-click and select **Create Partition** and click **Next**.
 - b. Select **Primary Partition** and click **Next**.
 - c. Select the entire disk size and click **Next**.
 - d. Specify NTFS as the file system, and specify whatever name you want to assign to the partition.
 - e. Click **Finish**. Do not enable disk compression, and select **Finish**.
6. Assign a drive letter of E for the first drive, G for the second drive, H for the third drive, and so on. Drive letter F will remain assigned to the CD-ROM drive.

At this point, you have set up storage. You can now continue with “Chapter 5. Completing setup” on page 29.

Expanding the LUN

LUN expansion is enabled by the DiskPart command line utility. Using DiskPart, you can dynamically expand an existing logical drive into unallocated space that exists in a LUN.

Note that you cannot use DiskPart to dynamically expand an existing LUN in array. You can do this only with array/LUN management software such as ServeRAID or Storage Manager Application.

To expand a LUN, use the following two DiskPart commands:

select This command focuses on the volume that you want to expand. The format of the command and its options are

```
select volume[=n/l]
```

You can specify the volume by either index, drive letter, or mount point path. On a basic disk, if you select a volume, the corresponding partition is put in focus. If you do not specify a volume, the command displays the current in-focus volume.

extend

This command extends the current in-focus volume into contiguous unallocated space. The unallocated space must begin where the in-focus partition ends. The format of the command and its options are

```
extend [size=n]
```

where *size* is the size of the extension in MB.

Note that if the partition had been formatted with the NTFS file system, the file system is automatically extended to occupy the larger partition, and data loss does not occur. However, if the partition had been formatted with a file system format other than NTFS, the command is unsuccessful and does not change the partition.

DiskPart blocks the extension of only the current system or boot partition.

Several other commands that are useful when you expand the LUN are:

assign

Use this command to assign a letter or mount point to the current selected (in-focus) partition. If you do not specify a drive letter, the next available drive letter is assigned. If the letter or mount point is already in use, an error is generated.

You can use this command to change the drive letter that is associated with a removable drive. The drive letter assignment is blocked on the system, boot, or paging volumes. This command cannot be used to assign a drive letter to an OEM partition or any GPT partition, other than the Msdata partition.

The format of the command and its options are:

```
assign [letter=l] or [mount=path]
```

convert

There are several commands you can use to convert disks. The format and options for each of the commands are:

```
convert mbr  
convert gpt  
convert dynamic  
convert basic
```

convert mbr sets the partitioning style of the current disk to MBR. The disk may be a basic disk or a dynamic disk but the disk must not contain any valid data partitions or volumes.

convert gpt sets the partitioning style of the current disk to GPT. The disk may be a basic or a dynamic disk but it must not contain any valid data partitions or volumes. This command is valid only on Itanium™-based computers; it may be unsuccessful on x-86-based computers.

convert dynamic changes a basic disk into a dynamic disk. The disk may contain valid data partitions.

convert basic changes an empty dynamic disk to basic.

list There are several commands you can use to display summaries of disk configuration. The format for each of the commands is:

```
list disk
list partition
list volume
```

list disk displays summary information about each disk in the computer. The disk with the asterisk (*) has the current focus. Only fixed disks (for example, IDE or SCSI) or removable disks (for example, 1394 or USB) are listed. The removable drives are not displayed.

list partition displays information about each partition on the in-focus disk.

list volume displays information about each volume in the computer.

Additional storage notes

Note: This section applies only to Model 226.

This section contains information on adding and configuring additional storage.

Configuration of Unit ID switch on the 5194-EXP (Model 226 only)

The Unit ID switch comes with a factory default of ID 0. Because each 5194-EXP is on a separate SCSI channel connected to the Model 226's SCSI RAID card, you can leave this Unit ID configuration as ID 0 for any attached 5194-EXP units.

Chapter 5. Completing setup

This chapter gives the details for setting up the NAS 200 so clients and servers on your network can access the storage.

- If Windows clients and servers will access your storage, follow the steps in “Defining Windows users and groups”.
- If UNIX and UNIX-based clients and servers will access your storage, follow the steps in “Defining UNIX users and groups” on page 30.
- If both Windows and UNIX clients and servers will access your storage, follow the steps in “Defining Windows users and groups” and then follow the steps in “Defining UNIX users and groups” on page 30.

Defining Windows users and groups

This section describes how to set up Windows users and groups who will access the NAS 200 storage.

You can define Windows users and groups locally on the NAS 200. Alternatively, you can add the NAS 200 to an existing Windows domain that is controlled by a Primary Domain Controller (PDC), and define new users and groups on the PDC who can access the NAS 200 storage and/or allow existing users and groups to access the NAS 200 storage.

If you are defining local Windows users and groups, follow the steps in “Defining local Windows users and groups”. If you are giving access to the NAS 200 storage to users and groups in an existing Windows domain, follow the steps in “Giving storage access to Windows domain users and groups” on page 30.

Defining local Windows users and groups

If you are defining local Windows users and groups, you can use the Windows 2000 for Network Attached Storage user interface. In the Users task group, you create and manage local users and groups on the NAS 200. Clicking on **Users** takes you to the Users page. From this page you can create, edit, and delete local users and groups on the NAS 200 by clicking either **Local Users** or **Local Groups**.

To create new local users, perform the following tasks:

1. Click **Local Users**.
2. Click **New...**
3. Fill in user name, password, and description (optional).
4. Click **OK**. The new user name should appear in the list of user names.
5. Repeat Steps 1 through 4 for each new local user you want to add.
6. When you are finished adding new users, click **Back** to return to the Users and Groups page.

To create new local groups, do the following:

1. Click **Local Groups**.
2. Click **New...**
3. Fill in group name and description (optional).
4. Click **Members**.
5. For each user you wish to add to the group, select the user name from the list of users, and then click **Add**.

6. Click **OK**. The new group name should appear in the list of group names.
7. Repeat Steps 1 on page 29 through 6 for each new local group you want to add. If your storage is also going to be accessed by UNIX or UNIX-based clients and servers, continue with “Defining UNIX users and groups”. Otherwise, continue with “Creating shares” on page 34.

Giving storage access to Windows domain users and groups

You must first join the NAS 200 to the Windows domain. You can use the Windows 2000 for Network Attached Storage user interface to do this. Start the Windows 2000 for Network Attached Storage user interface, then perform the following tasks:

- Click **Network**.
- Click **Identification**.
- Select the radio button labeled **Domain**, and specify the name of the domain being joined.
- Specify a user name and password that can be used to log on to the domain.
- Click **OK**.
- Shut down and restart the NAS 200.

Users and groups already defined in the domain can now be given access to any file shares that you create on the NAS 200. If you need to add new users and groups to the domain, consult the online documentation on the PDC for information on performing this procedure, or if you are not the administrator of the domain (PDC), contact the domain administrator to have the users and groups defined.

If your storage is also going to be accessed by UNIX or UNIX-based clients and servers, continue with “Defining UNIX users and groups”. Otherwise, continue with “Creating shares” on page 34.

Defining UNIX users and groups

This section describes how to set up UNIX users and groups to access the NAS 200 storage using the Network File System (NFS) protocol.

Support for NFS is provided in the NAS 200 by a preloaded and preconfigured software component, Microsoft Services for UNIX. The levels of NFS supported by Services for UNIX, and in turn the NAS 200, are NFS Versions 2 and 3. Any client or server that is using an NFS software stack supporting NFS Version 2 or NFS Version 3, regardless of the operating system, can connect to the NAS 200 and access its storage through NFS.

You administer NFS file shares and other attributes with standard Windows administration tools, including those provided as part of the IBM NAS desktop and the Microsoft Windows 2000 for NAS user interface. Additional configuration of the User Name Mapping component of Services for UNIX, which maps the UNIX user name space to the Windows user name space, is required to support NFS security.

You can define a local UNIX name space on the NAS 200 by configuring the Server for PCNFS component of Services for UNIX. Alternately, you can point Services for UNIX to an existing Network Information Service (NIS) domain, which defines the UNIX name space. In both cases, you must configure the User Name Mapping component to map the UNIX name space that you select to the Windows name space, because file shares and individual file and directory permissions on the NAS 200 are defined in the context of the Windows name space.

To define a local UNIX name space, continue with “Using a local UNIX name space”. To use a UNIX name space defined on a NIS domain, continue with “Using the UNIX name space on an NIS domain” on page 33.

Using a local UNIX name space

This procedure should have to be performed only once. You might have to add more groups and users in the **Server for PCNFS** page if you add more users and groups to your UNIX environment and NAS 200 or Windows domain at a later time.

1. Open the IBM NAS Administration console by double-clicking the **IBM NAS Admin** icon on the NAS desktop.
2. In the left pane, select **File Systems**, then select **Services for UNIX**.
3. In the left pane, click **Server for NFS**.
4. In the right pane, in the Computer name: field, enter *localhost*.
5. In the left pane, click **Server for PCNFS**.
6. In the right pane, click **Groups**.
7. On the Groups page, you must add the groups from your UNIX host to which all of your UNIX users belong. You need to know both the group name and the group ID (GID) number. This information can be found in the */etc/group* file on most UNIX systems.

As an example, on an AIX system, in the following line from an */etc/group* file, the fields are separated by a colon (:). The first field (“staff”) is the group name; the third column (“1”) is the GID:

```
staff::1:pemodem,ipsec,netinst,protcs
```

To add a group, enter the group name and GID number in the Group name and Group number (GID) fields and then click **New**.

8. When you finish adding groups, click **Apply**.
9. Click **Users**.
10. On the Users page, you will need to add all of the UNIX users who will be accessing and storing files on the NAS 200 through an NFS share. For each user you will need to know the Windows user name, the UNIX user name, the primary group, and the user ID (UID) number. This information can be found in the */etc/passwd* and */etc/group* files on most UNIX systems.

As an example, on an AIX system, in the following line from an */etc/passwd* file, the fields are separated by a colon (:). The first field (“user1”) is the user name; the third field (“3135”) is the UID, and the fourth field (“1”) is the GID of the user’s primary group. This will correspond to a line in the */etc/group* file, where you can find the primary group name corresponding to the GID.

```
user1::!3135:1:User 1:/home/user1:/bin/ksh
```

To add a user, click **New**, enter the required information, and then click **OK**.

11. When you finish adding users, click **Apply**.
12. In the left pane, click **User Name Mapping**.
13. In the right pane, select Personal Computer Network File System (PCNFS).
14. In the **Password file path and name** field, type *c:\winnt\system32\drivers\etc\passwd*.
15. In the **Group file path and name** field, type *c:\winnt\system32\drivers\etc\group*, then click **Apply**.

16. Click **Maps**.

On the Maps page, you can configure simple maps or advanced maps. Configure simple maps if the Windows user name and UNIX user name is the same for each UNIX user to be mapped, and the Windows group name and UNIX group name is the same for each UNIX group to be mapped. Otherwise, you should configure advanced maps.
17. To configure simple maps, select the Simple maps check box and continue with Step 18.

To configure advanced maps, clear the Simple maps check box and continue with Step 19.
18. Under Simple maps, select the Windows domain name from the drop-down list, then continue with Step 20 on page 33. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
19. Under Advanced maps, do the following:
 - a. Define user mappings as follows:
 - 1) Click **Show user maps**.
 - 2) Select the Windows domain name from the drop-down list. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
 - 3) Click **Show Windows Users** to display all of the Windows user names in the Windows domain you selected.
 - 4) Click **Show UNIX Users** to display all of the UNIX user names in the NIS domain you selected.
 - 5) Enter a Windows user name, or select one from the list of Windows user names.
 - 6) Enter a UNIX user name to be mapped to the Windows user name you specified, or select one from the list of UNIX user names.
 - 7) Click **Add** to add the mapping between the UNIX user name and Windows user name to the list of maps.
 - 8) If multiple Windows user names are mapped to one UNIX user name, select one Windows user name to be the primary user name. Select the mapping corresponding to the primary user name from the list of maps, and then click **Set Primary**.
 - b. Define group mappings as follows:
 - 1) Click **Show group maps**.
 - 2) Select the Windows domain name from the drop-down list. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
 - 3) Click **Show Windows Groups** to display all of the Windows group names in the Windows domain you selected.
 - 4) Click **Show UNIX Groups** to display all of the UNIX group names in the NIS domain you selected.
 - 5) Enter a Windows group name, or select one from the list of Windows group names.
 - 6) Enter a UNIX group name to be mapped to the Windows group name you specified, or select one from the list of UNIX group names.
 - 7) Click **Add** to add the mapping between the UNIX group name and Windows group name to the list of maps.

- 8) If multiple Windows group names are mapped to one UNIX group name, you must select one Windows group name to be the primary group name. Select the mapping corresponding to the primary group name from the list of maps, and then click **Set Primary**.
20. Click **Apply**.

You can now continue with “Creating shares” on page 34.

Using the UNIX name space on an NIS domain

The following procedure applies whether your NIS server is UNIX-based or Windows-based (implemented as a Windows domain controller running the Microsoft Server for NIS).

1. Open the IBM NAS Administration console by double-clicking the **IBM NAS Admin** icon on the NAS desktop.
2. In the left pane, expand File Systems, then expand Services for UNIX.
3. In the left pane, click **Server for NFS**.
4. In the right pane, in the Computer name: field, enter *localhost*.
5. In the left pane, click **User Name Mapping**.
6. In the right pane, select Network Information Services (NIS), then click **Maps**.

On the Maps page, you can configure simple maps or advanced maps.

Configure simple maps if the Windows user name and UNIX user name is the same for each UNIX user to be mapped, and the Windows group name and UNIX group name is the same for each UNIX group to be mapped. Otherwise, you should configure advanced maps.

7. To configure simple maps, select the Simple maps check box and continue with Step 8.
To configure advanced maps, clear the Simple maps check box and continue with Step 9.
8. Under Simple maps, perform the following steps:
 - a. Select the Windows domain name from the drop-down list. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
 - b. In the NIS domain box, enter the NIS domain name. You can also enter the name of a specific NIS server in the NIS server box.
 - c. Continue with Step 10 on page 34.
9. Under Advanced maps, perform the following steps:
 - a. Define user mappings as follows:
 - 1) Click **Show user maps**.
 - 2) Select the Windows domain name from the drop-down list. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
 - 3) In the NIS domain field, enter the NIS domain name. You can also enter the name of a specific NIS server in the NIS server field.
 - 4) Click **Show Windows Users** to display all of the Windows user names in the Windows domain you selected.
 - 5) Click **Show UNIX Users** to display all of the UNIX user names in the NIS domain you selected.

- 6) Enter a Windows user name, or select one from the list of Windows user names.
 - 7) Enter a UNIX user name to be mapped to the Windows user name you specified, or select one from the list of UNIX user names.
 - 8) Click **Add** to add the mapping between the UNIX user name and Windows user name to the list of maps.
 - 9) If multiple Windows user names are mapped to one UNIX user name, you must select one Windows user name to be the primary user name. Select the mapping corresponding to the primary user name from the list of maps, and then click **Set Primary**.
- b. Define group mappings as follows:
- 1) Click **Show group maps**.
 - 2) Select the Windows domain name from the drop-down list. (If your Windows users are defined locally on the NAS 200, select the entry containing the computer name of the NAS 200, preceded by two backslash characters (“\”). Otherwise, select the name of the Windows domain where the users are defined from the list.)
 - 3) In the NIS domain field, enter the NIS domain name. You can also enter the name of a specific NIS server in the NIS server field.
 - 4) Click **Show Windows Groups** to display all of the Windows group names in the Windows domain you selected.
 - 5) Click **Show UNIX Groups** to display all of the UNIX group names in the NIS domain you selected.
 - 6) Enter a Windows group name, or select one from the list of Windows group names.
 - 7) Enter a UNIX group name to be mapped to the Windows group name you specified, or select one from the list of UNIX group names.
 - 8) Click **Add** to add the mapping between the UNIX group name and Windows group name to the list of maps.
 - 9) If multiple Windows group names are mapped to one UNIX group name, you must select one Windows group name to be the primary group name. Select the mapping corresponding to the primary group name from the list of maps, and then click **Set Primary**.
10. Click **Apply**.

You can now continue with “Creating shares”.

Creating shares

To create new file shares on the NAS 200, do the following:

1. Start the Windows 2000 for Network Attached Storage user interface.
2. Click the **Shares** tab.
3. Click the **Shares** task.
4. Click **New...**
5. Specify the share name (the name which clients and servers will use to access the share).
6. Specify the share path and select the *Create folder if it does not already exist* check box.
7. By default, the Microsoft Windows (CIFS) and UNIX (NFS) check boxes are selected (enabled). If this share is not to be accessed by Windows clients and servers, clear the Microsoft Windows (CIFS) check box. If this share is not to be accessed by UNIX clients and servers, clear the UNIX (NFS) check box.
8. If this share is to be accessed by:

- Windows clients and servers, then click **CIFS Sharing** and specify access permissions as desired. (Note that by default, every user has full access to all files and directories under the shared folder.)
 - UNIX clients and servers, then click **NFS Sharing** and specify access permissions as desired. (Note that by default, every user has full access to all files and directories under the shared folder.)
9. Click **OK**. The new share should appear in the list of shares.
 10. Repeat Steps 4 on page 34 through 9 for each additional share you want to create.

Before you add software ...

You have now completed setup and initial administration, and the NAS 200 is at a point where you can install software on it. But before you do, it is recommended that you take advantage of the Persistent Storage Manager (PSM) disaster recovery function, detailed in “Disaster recovery” on page 47.

The PSM disaster recovery function enables you to restore the system drive from a single image, without having to go through the entire recovery procedure and then additionally having to restore a system drive backup. So, if any software you install creates unresolvable problems for your system, you can regain the stable system you had before you installed the software.

You can now continue with “Chapter 6. Additional administrative functions” on page 37.

Chapter 6. Additional administrative functions

This chapter describes the additional administrative functions that you can do on the NAS 200.

The following functions are available:

- “IBM Director”, accessed through **Start** → **Programs**
- “NAS Backup Assistant” on page 43, accessed through IBM NAS Admin icon
- “Persistent Images” on page 45, accessed through the Windows 2000 for Network Attached Storage user interface
- “Microsoft Services for UNIX and NFS Support” on page 54
- “Enabling Ethernet adapter teaming” on page 57, accessed through Intel PROSet II or Alacritech SLICuser

IBM Director

Note: This section presents an overview of IBM Director functions. For more detailed information, consult the *Director User's Guide* on the Documentation CD.

IBM Director is a systems-management solution that helps administrators manage single or large groups of IBM and non-IBM devices, NAS appliances, and workstations.

All of the functionality of IBM Director is contained in a simple GUI that enables single-click and drag-and-drop commands. IBM Director can manage up to 5,000 clients depending on configuration density. Powerful remote management functions include:

- Sophisticated discovery of network components
- Scheduled asset (hardware and software) inventories with persistent storage of data
- Proactive problem notification and tools for problem resolution
- Hardware system component monitors and thresholds to trigger alerts of impending problems
- Alert management with automated actions, manual intervention, or both
- Process scheduling to automate wide-scale client software maintenance (clean up temp files, restart tasks, backups, and so on) according to any timetable
- Help desk and routine maintenance functions such as remote control and file transfer
- Extensive security and authentication

IBM Director consists of three main components:

- Management Server
- Agent
- Console

The **Management Server** is a centralized systems manager and is the core of the IBM Director product. Management data, the server engine, and the management application logic reside there. Install the IBM Director Management Server on a dedicated server that has high-availability features. When installed on a Windows

2000 server or Windows NT 4.0 server system in the managed environment, the Management Server provides the management application logic and persistent data storage of management information using an SQL database. The Management Server maintains a database of all Director Agents and their inventory. All alerts from the agents flow to the management server, which also acts as a central point of configuration for Event Action Plans and System Tasks.

The **Agent** resides on the NAS Appliances and other systems that IBM Director manages. IBM Director recognizes two types of managed systems: native agents (IBM Director Agent installed) and nonnative agents (SNMP agent installed). The Agent comes preinstalled on all IBM NAS appliances. It runs as a service that is automatically started at boot time. IBM Director Agent provides valuable information to IBM Director management server and other supported management applications. In addition to its native interface with the Director Management Console, it provides point-to-point remote management of client systems through a Web browser window.

You perform administrative tasks at the **Console**. It is a Java application that serves as the user-interface to the Director-managed environment. The console provides comprehensive hardware management using a single click or drag-and-drop operation. You can install the Console on a machine at a remote location from the server. Consoles are not licensed, so you can distribute them freely among unlimited number of machines. In addition, there is no limit to the number of IBM Director Consoles that can connect into the Management Server.

Dependencies

The IBM Director 3.1 Agent (the version included in this release) must be managed by an IBM Director 3.1 Management Server. If your Management Server is running an earlier version of IBM Director (V2.2 or earlier), then you must upgrade it to ensure proper operation. This includes Director Consoles as well. The IBM Director 3.1 Management Server contains an Agent software distribution package that you can use to upgrade pre-version 3.1 Agents. This allows easy and automated upgrading of the entire system to version 3.1. You can check the version of IBM Director Agent running on a NAS appliance by issuing: `http://<system_name>:411/` on a local Web browser.

Hardware requirements

It is highly recommended that you install the IBM Director Server on a server separate from the IBM NAS appliance. The IBM Director Server running on an IBM NAS appliance will significantly reduce its performance. The server must meet these minimum requirements:

Hardware vendor	Must be IBM. The management tools of IBM Director and Director Extensions require IBM equipment.
CPU	A 733 MHz PIII processor is recommended. Standard PII processors can be functional, but these processors might not be sufficient during heavy usage.
Memory	512 MB RAM is recommended. During idle times, while using the standard JET database, the Management Console can consume 300+ MB RAM. The number of managed agents, active

consoles, and amount of alerts being processed increases the amount of memory needed.

Disk

Because the Management Server software requires only 250 MB, and the JET database has a maximum size of 1 GB, 9 GB of disk space is sufficient. Use a 4 GB partition for the operating system (including the swap file).

All IBM NAS products exceed the minimum hardware requirements for operating an IBM Director Agent.

Director extensions

A portfolio of advanced management tools for IBM-specific hardware is provided by IBM Director as a set of optional enhancements. These tools integrate into IBM Director and provide management capabilities from a single console with a consistent look and feel. These extensions are provided as part of the preinstalled IBM Director Agent on the IBM NAS appliances:

- Management Processor
- Assistant Capacity Manager
- Cluster Systems Management
- Rack Manager
- ServeRAID Manager
- Software Rejuvenation
- Systems Availability

To use these extensions, you must load them on the IBM Director Management Server during installation.

Naming conventions

All IBM Director Agents have a Director system name that it is known by the Management Server and Consoles. This Director System Name is defaulted to the computer name during the NAS appliance preinstallation process. The Director system name does not have to be the same as the computer name. The Director system name is displayed on the IBM Director Console to identify the NAS Appliance under the Group Contents column. You can optionally change the Director System Name on an agent using the following procedure:

1. Open a command prompt window and enter the following IBM Director Agent command to open the GUI interface:

```
twgipccf.exe
```

2. Type the new Director System Name and click **OK**.

The change takes place immediately.

Note: You might need to delete the NAS appliance from the Group Contents and have it rediscover the appliance by its new name.

Web-based access

IBM Director Agent uses an Apache Web Server for Web-based access. All traffic, even logon, is certificate-based encrypted. The Web server requires two ports. One port (411) accepts non-SSL HTTP requests and automatically redirects to the second port (423), which handles SSL requests.

Disaster recovery

It is important to provide adequate backup for key IBM Director Management Server files for restoration purposes. It is recommended that you regularly back up the IBM Director Management Server so that you can recover in the event of a server disaster. You need to save customizations that you make to the IBM Director, including event action-plans, schedules, thresholds, and so on. Several commands are provided with IBM Director to accomplish this task:

twgsave

This command saves the complete settings to a directory named *Director.save.#*, where # shows the number of backups (for example, the third backup of the server will be saved in directory *Director.save.3*). You must stop the IBM Director Management Server service to execute this command. The command supports the following options:

```
twgsave -s
```

where the optional parameter *-s* specifies that software distribution packages not be saved. This helps reduce the size of the backup files.

twgrestore

This command restores the saved data from an IBM Director Management Server. Do not attempt to use this restore feature to replicate an IBM Director Server. The command supports the following options:

```
twgrestore -t directory
```

where the optional parameter *-t* specifies that the data is restored, but server ID and system name is not restored. The IBM Director Management Server cannot be running on this directory when this command is issued.

twgreset

This command resets the Director Server system to the status after installing. You can use it if you want to clear all tables in the database and to erase the system ID files. This command can be helpful to make sure that after a restore only the data from the saved directory will be in the Director System. The command supports the following options:

```
twgreset -d -i
```

Where *-d* means to clear the tables in the database, and *-i* means to erase the unique identification files for the system. You can save and restore data only when the Director Support Program and service are stopped. Agents running on IBM NAS appliances do not need to be explicitly backed up because the NAS recovery CD provides this feature. Applying the Recovery CD will reinstall the IBM Director Agent.

Software distribution

The Software Distribution task enables you to import and silently distribute predefined software distribution packages to an IBM Director Client system. These packages are prepared by IBM for IBM NAS products and include software fixes and release updates only. This includes upgrading the IBM Director client itself.

The basic delivery is a single file package that is signed with a unique IBM NAS key. Only IBM can create the signed packages that can be used by the IBM Director Software Distribution tool.

Software distribution using IBM Director can be deployed to a single IBM Director client, all IBM Director clients, or some combination in between. The administrator

has complete control over which IBM Director clients receive any given package. By default, software distribution packages automatically install themselves immediately following delivery to the IBM client. Delivery of the package can be done manually or scheduled for a later, more convenient time.

Real-time diagnostics

Real Time Diagnostics provides nondisruptive testing of the agent. This is an add-in provided automatically on all IBM NAS appliances, but you must also install it on the IBM Director Management Server and Console. When installed, this function appears in the Tasks column with the name Diagnostics.

To use Real Time Diagnostics:

1. From the IBM Director Console, in the Tasks column, select **Diagnostics**. Then, drag and drop **Diagnostics** onto the system that you want to diagnose.
2. In the Component field, select the component to test.
3. In the Action field, select the action for the component.
4. Click **Start Action**.
5. The action results are displayed in the Results window.
6. You can then highlight the text, right-click the mouse, and copy and paste the results into a text editor.

Some results might require that you take specific action. For details on correcting a failed device, consult the documentation that comes with the NAS appliance.

You can also run all tests by selecting **All Components** for the Component, and **All Non-Destructive Actions** for the Action. Depending on the number and size of hard disks present, this full test suite can take considerable time to complete. Even though this is a nondisruptive diagnosis, testing might impact performance.

Rack Manager and inventory enhancements

The Rack Manager task has been updated to include all of the IBM NAS components. A new component category, **NAS**, includes all of the IBM NAS appliance engines. All IBM NAS Appliances will be automatically discovered by the Rack Manager task for drag-and-drop rack construction. The following component categories have been updated to include the new IBM NAS appliance components:

Racks Includes the new component, NAS Rack Model 36U

Storage

Includes these new components:

- NAS Storage Expansion Unit Model 0RU
- NAS Storage Expansion Unit Model 1RU

Fibre Channel

Includes these new components:

- NAS 8-port Fibre Channel Hub Model 1RU
- NAS Raid Storage Controller Model EXP
- NAS Raid Storage Controller Model 0RU
- NAS Raid Storage Controller Model 2RU
- NAS Raid Storage Controller Model EXU

NAS Is a new component category that includes these components:

- NAS 100 Engine Model R12
- NAS 100 Engine Model R18
- NAS 200 Engine Model 200

- NAS 200 Engine Model 201
- NAS 200 Engine Model 225
- NAS 200 Engine Model 226
- NAS 200i Engine Model 100
- NAS 200i Engine Model 110
- NAS 300 Engine Model 5RZ
- NAS 300 Engine Model 6RZ
- NAS 300G Engine Model 5RY
- NAS 300G Engine Model 6RY

Dynamic NAS groups

Dynamic NAS groups are an IBM Director Management Server enhancement made specifically for IBM NAS appliances. You must install this enhancement on the IBM Director Management Server as well as all IBM Director Consoles. You can add dynamic NAS groups to the IBM Director Server and Consoles by downloading the InstallShield extension from the IBM Web site and invoking the executable file. This will create a new Group on all consoles that represent IBM NAS appliances in the managed network.

Dynamic groups are automatically populated and maintained based on queries to the database. These dynamic NAS groups must be added after the IBM Director Management Server has been installed on a dedicated server. IBM NAS appliances appear under the Groups column in the IBM Director Management Server. The Group Contents column will then contain all the IBM NAS devices that have been discovered on the network.

NAS Web UI task

NAS Web UI is an IBM Director Management Server enhancement made specifically for managed networks containing IBM NAS appliances. Install NAS Web UI on the IBM Director management Server and all IBM Director Consoles to create a new task called **IBM NAS Appliances** with a subtask named **Launch UI Web**. You can apply this new Console task to a NAS machine, causing a web browser to be automatically launched with a URL pointing to the Web UI on the target NAS machine. The port specified in the URL is port 8099, which invokes Windows 2000 for NAS.

Electronic Service Agent (eSA)

Electronic Service Agent optionally resides on the customer's system and works in tandem with IBM Director to monitor events and securely transmit data to IBM on a periodic, customer-definable timetable.

This monitor watches system inventory, hardware error logs and performance information, and, if the server is under a service agreement or within warranty period, automatically reports hardware problems to IBM. IBM will either contact the customer or send out a replacement part before it fails, based on a PFA alert received for a component under warranty. Information collected through this Service Agent is available to IBM service support representatives while they are answering or diagnosing problems. With early knowledge about potential problems, IBM can provide proactive service, assisting in maintaining higher availability and performance.

The eSA agent must be installed on all IBM NAS appliances that you want to participate in this service. You can download the software from the following URL:

www.pc.ibm.com/qttechinfo/MIGR-4L4QVC.html

Predictive Failure Analysis

Predictive Failure Analysis (PFA) provides advanced notification of a pending failure so that corrective action can be taken to avoid unplanned downtime. The PFA alerts are sent to IBM Director, where a wide variety of Event Action Plans can be established, such as automatically notifying the administrator through e-mail or page, or executing tasks in response to the alert. When used in conjunction with the IBM electronic service agent, the PFA alerts are routed to IBM support personnel, who responds to the customer or even sends out a replacement part in advance of the actual failure. The alerts can also be forwarded to other management packages.

For more information

For more information on IBM Director, consult the user's manual contained on the Documentation CD.

NAS Backup Assistant

The NAS Backup Assistant is a preloaded utility that helps you create and schedule backup batch files, and maintain log files. It can be used for backing up either the NAS 200 operating system or user data.

Because NAS Backup Assistant only creates and launches scripts, and is not a comprehensive backup application, it does not support interactive error messages. To check status of jobs, you must either view the Backup Logs or view the Windows Event Viewer.

To invoke the NAS Backup Assistant, click on the **IBM NAS Admin** desktop icon to open the IBM NAS Administration console. Select **Backup and Restore** to expand that tree, then select **IBM NAS Backup Assistant**. Once you select this option, a logon prompt appears. Log on as a user who has backup operator privilege (an administrator or backup administrator). If a logon prompt does not appear, right-click on the **IBM NAS Backup Assistant** link, and select refresh. Once you log on, the main panel appears.

There are four tabs on the main panel:

Backup Operations

The main window where you create and schedule backup batch jobs.

Scheduled Jobs

Displays a list of backup batch jobs that you scheduled.

Backup Logs

Displays a list of log files for each backup that has run.

Displayed Logs

Displays the text contained in the log files that you can select from the **Backup Logs** tab.

All of the options on each tab are described in detail in the online help. To access the online help:

1. Click on the **IBM NAS Admin** icon.
2. Expand the Backup and Restore directory.
3. Select **IBM NAS Backup Assistant Help**.
4. Log in.

Restoring using the NT Backup panel

To restore backups, use the following procedure:

1. If you are restoring a backup that you created using the standard backup method, go to Step 3.
2. If you are restoring a backup that you created using Persistent Images in the NAS Backup Assistant, the NT Backup file (*.BKF) was created for the persistent image virtual drive letter instead of the original drive letter. For example, if you selected drive C for backup, a persistent image was created on the next available drive letter in the system, and that drive was backed up instead of drive C. If you do not remember the original drive letter, you can view the backup log files in NAS Backup Assistant. The top section of the log file gives you the original drive letter, and the bottom section gives you the persistent image drive letter. Now that you have the original drive letter, go to Step 3.
3. Click on the **Restore using NT Backup** link in the Backup and Restore section of the IBM NAS Admin console to open the backup GUI.
4. Click **Restore Wizard**, then click **Next**. You are asked what you want to restore.
5. Select the appropriate media that you are restoring from.
6. If you are restoring from tape, expand the backup media pool name, and then double-click on the media (this will normally be named *media created on {date - time}*). This action will read the set list from the tape.

If you are restoring from file, click the **Import File...** button, then click **Browse** and find the .BKF file created for this backup.

Note: If you do not know the .BKF file name, refer to the backup log in NAS Backup Assistant.

7. Click **OK**. You will now have a *Media created on {date - time}* listed under file.
8. Click on the plus sign (+) to the left of this media to see the set list. You might be prompted to enter the path to the file you want to catalog; if so, select the same file that you just imported. This will build a set list.
9. Select the files and directories to restore.
10. Select **Alternate Location** from the **Restore files to:** pull-down.
11. In the alternate location window, select the root directory of the original backup drive letter you determined in Step 2 on page 44.
12. If you want to change restore options, select **Tools** from the menu bar at the top of the window, and then select **Options**. Refer to NTBackup online help (see **Restore files from a file or a tape**) for use of these options.
13. After you select the files or directories for restore, the alternate location, and options, click the **Start Restore** button.
14. At the prompt, begin the restore. Click the **Advanced** button to select advanced options (see the NTBackup online help for details), then click **OK** to begin the restore.

Persistent Images

A persistent image is a copy you make of one or more file system volumes at a specific time. The Persistent Images function allows the recovery of a file or volume to the state it was in at the time you created the persistent image. Persistent images are maintained in a way that minimizes the storage required to keep multiple copies of the volume. This is done by using a copy-on-write technique that uses, for each volume, an area of pre-allocated storage (the PSM cache file) that keeps only those data blocks which have been written since the time you made a persistent image of the volume.

Persistent Storage Manager (PSM) allows you to create and preserve images of the NAS 200 drives. You can take a persistent image immediately or schedule persistent images as one-time events or regularly repeated events.

You can access the PSM tasks in the Disks/Persistent Storage Manager task group within the Windows 2000 for Network Attached Storage user interface in one of two ways:

- Open the IBM NAS Admin console on the appliance desktop and select **Persistent Storage Manager**. This automatically launches the Windows 2000 for Network Attached Storage user interface and brings up the Disks/Persistent Storage Manager page containing the PSM tasks.
- Start the Windows 2000 for Network Attached Storage user interface directly.

Once you create a persistent image, it appears as a directory on the original drive. Access rights and permissions from the original drive are inherited by the persistent image. Persistent images are used in the same way as conventional drives. However, unlike conventional drives, persistent images are records of the content of the original drive at the time you created the persistent image. Persistent images are retained following shutdown and reboot.

There are six PSM tasks in the Disks/Persistent Storage Manager group:

- Global Settings
- Volume Settings
- Persistent Images
- Schedules
- Restore Persistent Images
- Disaster Recovery

Each of these tasks are described in the following sections. More detailed descriptions and instructions for each of the control panels and topics are contained in the online help.

Global Settings

On this panel, you can configure the following attributes of the persistent image function:

Attribute	Default value
Maximum number of persistent images	250
Inactive period	5 seconds
Inactive period wait timeout	15 minutes

Volume Settings

This panel displays statistics for each volume, such as total volume capacity, free space, and cache file size and usage. You can also select any volume and configure volume-specific PSM attributes for that volume:

Attribute	Default value
Cache-full warning threshold	80 percent full
Cache-full persistent image deletion threshold	90 percent full
Cache size	15 percent (of the total volume capacity)

Note: You cannot change the cache size for a volume while there are persistent images on that volume (the Cache size combo box will be disabled). You must delete all persistent images on the volume before changing the cache size for that volume.

Persistent Images

This panel lists all of the persistent images that exist on all volumes. On this panel, you can:

- Create a new persistent image immediately (without scheduling it via the Schedules panel).

When you create the persistent image, you can specify properties for the persistent image, including:

Volume(s)

The persistent image can contain a single volume or multiple volumes. To select multiple volumes, hold down the **Ctrl** key while clicking on the volumes to select. For multi-volume persistent images, a virtual directory containing data for a volume appears under the persistent image directory in the top level of each volume in the persistent image (the name of the persistent image directory is configured in the Global Settings panel).

Name

You can name the persistent image. This becomes the name of the virtual directory containing the persistent image, underneath the persistent image directory in the top level of the volume (the name of the persistent image directory is configured in the Global Settings panel).

Read-only or read-write

A persistent image is read-only by default, so no modifications can be made to it. However, you can set the persistent image to read-write, which permits you to modify it. When a persistent image is written, the modifications made are also persistent (they survive a reboot of the system). Changing a persistent image from read-write to read-only resets the persistent image to its state at the time you took the persistent image, as

does selecting **Undo Writes** for a read-write persistent image from the Persistent Images panel.

Retention value

A persistent image can be given a relative retention value or weight. This is important when PSM needs to delete some persistent images for a volume because the capacity of the cache file for the volume has reached a certain threshold, as described later in this section. If the volume cache file completely fills, all persistent images for that volume are deleted regardless of the retention values. By default, a new persistent image is assigned a “Normal” retention value (there are other higher and lower values which can be selected).

- Delete an existing persistent image.
- Modify properties of an existing persistent image, including read-only or read-write, and retention value.

Schedules

Use this panel to schedule persistent images to be taken at specific times (this is independent of the scheduled backup function via NAS Backup Assistant described earlier). Each PSM schedule entry defines a set of persistent images to be taken starting at a specified time and at a specified interval, with each image having the set of properties defined in the entry. This allows you to customize scheduled persistent images on a per-volume basis. For instance, you could set a persistent image for one volume to occur every hour, and for another volume to occur only once a day.

The set of properties you define are the same properties described in the Persistent Images panel description above; when you define these properties, all persistent images created according to this schedule entry will be assigned those properties. Once a scheduled persistent image is created, certain properties of that persistent image can be modified via the Persistent Images panel, independently of other persistent images created according to the schedule.

Once a schedule entry is created, it appears in the list of scheduled persistent images. Subsequently, you can modify the properties of an existing entry, such as start time, repetition rate, the volume(s), and so on. For a schedule, you can name the persistent images based on a pattern you configure. Format specifiers (defined on the New Persistent Image Schedule panel under the Persistent image name(s) entry field) allow you to customize variable portions of the name.

Restore Persistent Images

On this panel, you can select an existing persistent image and quickly restore the volume contained in the image back to the state it was in at the time the selected persistent image was taken. This is useful if you need to recover an entire volume, as opposed to just a few files. This volume restore function is available for the data volumes, but not the system volume.

Disaster recovery

PSM provides a disaster recovery solution for the system drive. This extends the volume restore function of PSM to provide disaster recovery in the event that the

system drive is corrupted to the point where the file system is corrupt, or the operating system is unbootable. Note that while disaster recovery is also supported via the Recovery CD-ROM and backup and restore capability, that is a two-step process. In contrast, the method supported by PSM allows you to restore the system drive from a single image, without having to go through the entire recovery procedure and then additionally having to restore a system drive backup.

Use the Disaster Recovery panel to schedule and create backup images of the system drive, and to create a bootable diskette which will allow you to restore the system drive from a backup image (located on the maintenance partition, or network drive). The remainder of this section provides additional information on how to perform backup and recovery operations for the NAS 200.

Note: Restoration of a PSM backup image over the network is not supported for the Gigabit Ethernet Adapter. If you have only Gigabit Ethernet adapters installed, it is recommended that you perform PSM backup of each NAS 200 to its maintenance partition (D: drive), which would allow you to recover if the system volume is corrupt and/or unbootable. Should the hard disk drive fail completely, you would need to use the Recovery CD as described in “Using the Recovery Enablement Diskette and Recovery CD Set” on page 91 to restore the NAS 200 to its original (factory) configuration.

Backing up the system drive

The Disaster Recovery panel lists status information for backup operations, both scheduled and immediate, as well as buttons for starting and stopping a backup operation, for configuring backup, and for creating a recovery diskette.

Click the **Modify Settings** button to open the Disaster Recovery Settings page. Modify the settings for backup as you desire. Do not include spaces in the *Backup name* field. When you have modified the settings, click the **OK** button to save the changes.

On the Disaster Recovery page, click the **Start Backup** button to begin the backup. The backup process will first create a persistent image of the system drive (C:), named *System Backup*. Then it will create the backup images from that persistent image, and then delete that persistent image once the backup operation is complete.

Creating a PSM recovery diskette

You will now create a bootable recovery diskette which, when used to boot up the NAS 200, will use the backup location settings you configured on the Disaster Recovery Settings page to locate the backup image and restore it to the system drive of the NAS 200.

1. Insert a blank, formatted diskette in the diskette drive of the NAS 200.
2. On the Disaster Recovery page, click **Create Disk**.
3. Click **OK** on the Create Recovery Disk page. The diskette drive LED will turn off when the creation is complete. The diskette creation should take no more than two minutes.
4. One of the files that is copied onto the diskette is a utility to make it DOS bootable called *fixboot.exe*. From a command prompt, either via the desktop of the NAS 200 itself (with the diskette still in the diskette drive of the NAS 200), or on another system with the diskette in its diskette drive, type **a:fixboot.exe** and answer the prompts.

Note: Once you run `fixboot.exe` on the diskette, the diskette remains bootable unless you reformat it (without specifying an option to make it bootable). If you later erase files on the diskette, you do not need to run `fixboot.exe` again.

5. Remove the diskette from the appropriate diskette drive.
6. Label the diskette appropriately and keep it in a safe place.

You can create additional copies of the diskette using the above procedure for each new copy.

Note: If you change the backup location or logon settings using the Disaster Recovery Settings page, you must rebuild the recovery diskette(s) for that NAS 200 to reflect the new settings for that NAS 200.

Static IP addressing

If you do not have a DHCP server on your network, and you must access a backup image that is only accessible via the network (for example, no backup image is located on the maintenance partition [D: drive] of the NAS 200 to be recovered), then you must configure the recovery diskette so that it will use a static IP address and subnet mask when accessing the network.

On the recovery diskette, edit the file `a:\net_sets.bat`. Set the `IPAddress` and `SubnetMask` environment variables as follows:

1. Uncomment the two lines that begin with `rem` (comment lines) by removing the `rem` from the beginning of both lines.
2. For each line, what follows the equals sign (=) is an IP address expressed as a set of four space-separated numbers (an IP address without the dots [.]). Change the `SubnetMask` value to match the subnet mask your network uses. Change the `IPAddress` value to match the IP address you want to assign to the NAS 200, during the recovery operation. Do not insert dots between the numbers (octets) in either value.

As an example, here is how the lines would look for a NAS 200 using IP address 192.168.1.200, and subnet mask 255.255.255.0:

```
set SubnetMask=255 255 255 0
set IPAddress=192 168 1 200
```

If you later want to reconfigure the recovery diskette to use DHCP to obtain an IP address instead of static IP addressing, you must reinsert `rem` in front of the `SubnetMask` and `IPAddress` lines to disable static IP addressing, as follows (based on the previous example):

```
REM set SubnetMask=255 255 255 0
REM set IPAddress=192 168 1 200
```

Specifying multiple 10/100 Ethernet adapters

If your NAS 200 has more than one 10/100 Ethernet adapter, then you must configure the recovery diskette to select the 10/100 Ethernet adapter to be used for disaster recovery over the network. On the recovery diskette, edit the file `a:\net_sets.bat`, and add the following line:

```
set SLOT=slotvalue
```

where *slotvalue* is one of the following, depending on the PCI slot (on the rear of the NAS 200) in which the desired 10/100 Ethernet adapter is installed:

0x0027	For the integrated Ethernet adapter
0x0001	For PCI slot 1
0x0022	For PCI slot 2
0x0023	For PCI slot 3
0x0044	For PCI slot 4
0x0045	For PCI slot 5

Restoring the system drive using the PSM recovery diskette

If you need to restore the system drive from a backup image created via the PSM Disaster Recovery panel as described above, you must use a recovery diskette created via the Disaster Recovery panel. If you did not create a PSM recovery diskette then you must use the Recovery CD as described in “Using the Recovery Enablement Diskette and Recovery CD Set” on page 91 to restore the system drive to its original (factory) configuration.

To restore the system drive:

1. Set the write-protection tab of the PSM recovery diskette to the write-protect position. This prevents accidental initiation of the recovery process (by booting the NAS 200 with the PSM recovery diskette in the diskette drive).
2. Insert the recovery diskette in the diskette drive of the NAS 200, and restart the NAS 200.
3. The recovery process begins. The recovery diskette software locates the first backup image it can find, based on the backup locations specified when the diskette was created. Once it locates a backup image, it begins restoring the system drive from the image. During the restore operation, the hard disk drive LEDs (on the front right of each hard disk drive) will flash green or stay nearly solid green; this indicates write activity to the system volume.

Note: If the hard disk drive LEDs remain off for at least 10 minutes since you restarted the NAS 200, then there is a problem with the recovery procedure and it will not be able to restore the system volume from a backup image. Should this occur, you will need to restore the system drive as described in “Using the Recovery Enablement Diskette and Recovery CD Set” on page 91.

4. When the restore operation completes, the hard disk drive LEDs turn off, and a short song will play periodically (every 15 seconds). Remove the diskette, set the write-protection tab back to the write-enabled position, and reinsert the diskette. The log file `results.htm` will be written to the diskette; this log file can be viewed with any Web browser to examine the results of the restore operation.
5. When the log file is written, another song will play (continuously). Remove the diskette and restart the NAS 200. If the restore was successful, the NAS 200 will come back up in the state it was in at the time you created the backup image used for the recovery operation.

Note: The persistent image that was created on the system drive (named System Backup) by the backup process is restored by the restore process as it is preserved in the backup image. It is recommended that you now delete that persistent image as it is no longer needed. On the Persistent Images panel, select the persistent image named **System Backup** on drive C: from the list of persistent images, then click **Delete**, then click **OK** on the Delete Persistent Image panel that appears.

If the restore was unsuccessful, then you must use the Recovery CD as described in “Using the Recovery Enablement Diskette and Recovery CD Set” on page 91.

Granting user access to persistent image files

You can give end-users access to files in the persistent images. For example, this would be helpful to a user who has accidentally corrupted a file and needs to get an uncorrupted copy of that file.

To enable end-user access to persistent image files:

1. Go into Terminal Services.
2. Click the **My Computer** icon.
3. Click the volume on which you want to enable persistent image access.
4. Go into the persistent images directory and right-click the mouse on your desired persistent image mount point, select **Sharing**, then specify sharing as desired. If you want to enable the same access to all persistent images on the volume, right-click on the persistent images directory (from the top level of the volume), select **Sharing**, and then specify sharing as desired.

Note: The share settings are maintained in a persistent image. Therefore, granting access to all end-users only permits those users to access files and directories within the persistent image that they had permission to access originally on the actual drive.

PSM notes

- You can take and keep a maximum of 250 persistent images at one time. These can be taken on local drives, or drives on the external storage that are logically local.

On various panels, such as the New Persistent Image Schedule panel, the *Keep the last:* field indicates the number of persistent images. The total number of persistent images that you enter in these fields does not override the maximum number of persistent images that you set in the Global Settings panel. For example, if your maximum number of persistent images is 10, and you enter numbers in other fields that add up to greater than 10, only 10 persistent images will be taken.

- You cannot take a persistent image of the maintenance drive (D:). Hence, you will not see it as a choice in either the New Persistent Image Schedule panel or the Create Persistent Image panel.
- PSM stores the cache file for each drive on the drive itself. The first persistent image created on a particular drive will take a significant amount of time because the PSM cache file must be created (pre-allocated) for that drive.

The time required for creation depends on the configured size of the cache file (15 percent of the total drive size by default). Creation takes roughly three to four minutes per gigabyte. For example, a 10 GB cache file would require 30 to 40 minutes to create. You should create a persistent image for a drive before

scheduling any persistent images for that drive, to build the cache file. You may then delete the persistent image that you just created if you do not need to keep it.

After the creation of the first persistent image on a volume, future persistent images on that volume will complete faster.

- The default size of the cache file per drive is 15 percent of the total drive capacity. In most cases, that should be sufficient.

However, it is possible that it will not be enough to maintain the number of persistent images you want to keep concurrently on the drive, given the amount of file-write activity to the drive. PSM automatically takes action to prevent the cache file from overflowing, because if that occurred, PSM would be forced to automatically delete all persistent images on the drive (once it cannot keep track of changes made to the drive, it cannot maintain a valid persistent image).

PSM takes the following actions as the cache file usage approaches a full condition:

- When the cache file usage exceeds the warning threshold (configured in the PSM Volumes panel for the drive; the default value is 80 percent), PSM generates a warning message to the system event log (viewable via the Windows 2000 Event Viewer in the IBM NAS Admin console), and to the alert log in the Microsoft Windows 2000 for Network Attached Storage user interface. The name of the source for the message is *psman5*. Additionally, while the cache file usage is above the warning threshold, PSM prohibits any attempt to create a new persistent image, and logs error messages (to the system log and alert log). The text of the error message that is logged in the system event log (from *psman5*) is “A persistent image could not be created due to error 0xe000102b”.
- When the cache file usage exceeds the automatic deletion threshold (also configured in the PSM Volumes panel for the drive; the default value is 90 percent), PSM automatically selects a persistent image on the volume and deletes it to reduce the cache file usage. It selects the persistent image with the lowest retention value (as described in “Persistent Images” on page 46). If more than one persistent image has the same (lowest) retention value, then the oldest image is selected for deletion. If this deletion does not reduce the cache file usage below the automatic deletion threshold, then it will continue to select and delete persistent images until the cache file usage is reduced below the automatic deletion threshold. For each deletion, PSM generates an error message to the system event log and to the Windows 2000 for Network Attached Storage alert log indicating that a persistent image was deleted.

You should periodically check the system event log or Windows 2000 for Network Attached Storage alert log to ensure that the cache file usage is not consistently high, forcing existing persistent images to be deleted and preventing new persistent images from being created. If the cache file usage is high, you can increase the size of the cache file using the PSM Volumes page. However, because dynamic cache file resizing is not supported in this release, you will need to delete all persistent images currently on that volume first.

- Volume restore of the system volume (C: drive) is not supported. If you attempt to restore a persistent image containing the system volume, the restore operation will not take place.
- Volume restore of a data volume might require a reboot of the node. You will be notified by the Restore Persistent Images panel whether a reboot is required after a restore operation is initiated.

- When you restart the NAS 200, Persistent Storage Manager (PSM) takes two actions:
 1. Loading
 2. Mapping

During loading, PSM loads existing persistent images from the cache files on each of the volumes. The loading time depends on the amount of cache data there is to read. Cached data is used by PSM to maintain the persistent images, and the more cache data there is, the longer it takes to load the persistent images, and thus the longer it might take your NAS 200 to become fully operational after a restart.

During mapping, PSM makes the loaded persistent images accessible through the file system by mounting them as virtual volumes underneath the persistent images directory on the volume for which the persistent image was created. The mapping time varies with the number of persistent images, as well as the size of the volume.

As an example, suppose that on your NAS 200, you defined a 1 TB volume with 50 percent of the volume allocated to the cache (500 GB cache), and that you had 20 persistent images on the volume, using 100 GB (20 percent) of the cache (based on the write activity to the volume since the first persistent image was created). You would observe an increase in the NAS 200 startup time of roughly 3 minutes, 20 seconds over what it would be without any persistent images on the volume. Then, when the NAS 200 has become fully operational, all 20 persistent images would become accessible within another 13 minutes.

- PSM imposes a limit of 1 terabyte (TB) of cached data, across all volumes on the NAS 200. Ensure that the total configured size of all cache files on the NAS 200 is not greater than 1 TB.
 1. Access Persistent Storage Manager through the **Persistent Storage Manager** link on the IBM NAS Admin console on the NAS 200 desktop, or by starting the Windows 2000 for Network Attached Storage user interface and then selecting **Disks** → **Persistent Storage Manager**.
 2. Go to the Volume Settings page and make sure that the total of all values in the Cache Size column is 1 TB or less.
 3. If the total configured size of all cache files is greater than 1 TB, reduce the size of the cache on one or more of the volumes by selecting the volume from the list, then clicking **Configure**, then selecting a smaller value from the “Cache size” drop-down list and clicking **OK**.

Note: You cannot change the size of the cache on a volume that has persistent images. You must delete all persistent images on the volume before changing the cache size. Before deleting any persistent images, try to reduce the cache size on a volume that has no persistent images, if possible.

If more than 1 TB of cache is configured on the NAS 200, the following can occur:

- When you restart the NAS 200, PSM prevents a volume from being mounted on the file system (prevents it from being accessible) if that volume’s PSM cache would increase the total size of all cache files (on all volumes mounted to that point) above 1 TB, and an error message is written to the system event log. The event source is psman5, and the text of the error message is:
There is insufficient memory available.

- If you increase the size of any cache such that the total cache size of all volumes on the NAS 200 becomes greater than 1 TB, and if you do not restart the NAS 200 after you change the cache size, then no persistent images can be created on the volume for which the cache size increase was made. An attempt to create a persistent image on that volume will cause an error message to be written to the system event log. The event source is psman5, and the text of the error message is:

There is insufficient memory available.

- If you delete the last persistent image on a volume, and then immediately attempt to create a new persistent image on that volume, the creation of the new persistent image might fail, and an error message will be written to the system event log.

The event source is psman5, and the text of the error message is:

A persistent image could not be created due to error 0xc0000043.

This message is generated because when PSM is reinitializing the PSM cache file on a particular volume (after you delete the last persistent image on that volume), a new persistent image cannot be created. If this error occurs, wait for a few minutes, and then try to create the persistent image again.

- If you use the Windows Powered Disk Defragmenter to attempt to defragment a volume containing persistent images, the volume will not be defragmented. If you select the volume and click **Defragment**, the Disk Defragmenter will run on the volume and then indicate that the volume was successfully defragmented. However, the Analysis display will appear the same as it did before you clicked **Defragment**, which indicates that defragmentation did not take place. You can defragment volumes without persistent images.

Attention: The recovery process invalidates persistent images and leaves them in an inconsistent state. So, if you plan to use the Recovery CD, it is recommended that you first delete all persistent images to ensure a clean reload of the system software. For more information on using the Recovery CD, see “Using the Recovery Enablement Diskette and Recovery CD Set” on page 91.

Microsoft Services for UNIX and NFS Support

Support for the Network File System (NFS) is provided in the NAS 200 by a preloaded and preconfigured software component, Microsoft Services for UNIX. The levels of NFS supported by Services for UNIX, and in turn the NAS 200, are NFS Versions 2 and 3. Any client workstation that is using an NFS software stack supporting NFS Version 2 or NFS Version 3, regardless of the client workstation’s operating system, should be able to connect to the NAS 200 and access its storage as defined by the NAS 200 administrator.

You administer NFS file shares and other attributes with standard Windows administration tools, including those provided as part of the IBM NAS desktop, and the Microsoft Windows 2000 for NAS user interface. Additional configuration of the User Name Mapping component of Services for UNIX, which maps the UNIX user name space to the Windows user name space, is required to support NFS security. Consult the online documentation for Services for UNIX for more information on configuring User Name Mapping. To view the online documentation for Services for UNIX on the NAS 200:

1. From the NAS 200 desktop, click the IBM NAS Admin icon.
2. On the left pane of the IBM NAS Admin console, expand File Systems.
3. Expand Services for UNIX.

4. Select any of the items that appear under Services for UNIX.
5. Click anywhere on the right pane of the IBM NAS Admin console, then press the **F1** key to bring up the online documentation for Services for UNIX in a separate window.

Configuring Server for NFS

This section describes how to configure Server for NFS.

Services for UNIX is installed on every IBM NAS machine. Additional installation is required only when the NAS is installed into a Windows domain. If the NAS is installed as part of a Windows 2000 domain, you must install the Server for NFS Authentication module on the domain controllers. This module is on the Supplementary CD.

User and group identification

You can enumerate UNIX users and groups using one of two methods: get the data from an NIS server, or from local copies of the UNIX *passwd* and *group* files. If you use an NIS server, no special preparation is necessary. If local files are used, you must copy them to the NAS machine and possibly modify their format for use by the User Name Mapping function, as described in “Preparing local copies of *passwd* and *group*”.

Preparing local copies of *passwd* and *group*: If you will be using an NIS server, go to “Creating Windows users and groups”. If you are using local files instead of NIS, you must import these files to the NAS and prepare them as follows.

Obtain copies of the UNIX *passwd* and *group* files. Copy them into directories on the NAS machine as:

```
c:\winnt\system32\drivers\etc\passwd
```

and

```
c:\winnt\system32\drivers\etc\group
```

Next, delete all special users and groups, leaving just the actual users and groups that will be used in accessing files. An example of a special user is *root*, usually, and UID numbers from 0 to 99 are generally reserved for system accounts and should not be mapped.

Services for UNIX supports a limited syntax in the *passwd* file. In particular, it seems to work best when the second field of each line—the password field—is filled in with a random 13-character string. This need not have anything to do with the user’s password, so a string such as *0123456789012* is acceptable. Some UNIX systems use shadow passwords and fill in this field with a meaningless token value such as *!* or *x*, and you will need to change this.

Finally, if this is a clustered NAS, copy these finished files to the same location on the other node. Both nodes must have the same files for the system to failover properly.

Creating Windows users and groups

Using the IBM NAS Admin, under the **Users and Groups** folder, create Windows accounts corresponding to the UNIX accounts.

Note: A potential problem at this point is the practice in some UNIX systems of defining a UNIX group for each UNIX user using the same name as the user's name. Windows does not allow the creation of groups with the same name as users.

To map these groups, it is necessary to adopt a naming convention to apply to all Windows group names. So for a user named *alpha*, you might have a group named *g_alpha* on the NAS that corresponds to the group *alpha* in UNIX. The naming convention must be selected so as not to conflict with any existing user or group names. Introducing any such convention creates the need for an advanced map in User Name Mapping, as described in "User Name Mapping".

For best results, replicate the UNIX group membership among the mapped users and groups on the NAS by adding the mapped users to the mapped groups. You can add Windows users to Windows groups using the IBM NAS Admin **Users and Groups** folder.

User Name Mapping

Note: This section supplements other information on User Name Mapping in this book.

Decide where the User Name Mapping server will run. If the NAS is a single-node product, the server runs on the NAS. For a clustered NAS, User Name Mapping clustering is recommended, so User Name Mapping can run on both nodes and failover as needed.

When you have decided where the User Name Mapping server will run, complete the following steps.

Note that you will need to click the **Apply** button to effect changes to the settings.

1. Specify the enumeration source.

In the IBM NAS Admin, follow this path, **Services for UNIX → User Name Mapping → Configuration**. Then click on **Network Information Service (NIS)** if you will use an NIS server, or specify where the local files reside.

User Name Mapping rereads its enumeration source on a schedule. By default, this occurs once a day. You can reset the refresh period. To force User Name Mapping to reread the enumeration source, you can click **Synchronize Now** on the Configuration panel.

Note: If maps do not seem to synchronize, you might need to stop and restart User Name Mapping. You can do this through the GUI, or by the commands:

```
net stop mapsvc
```

```
net start mapsvc
```

2. Define maps.

Simple maps provide automated mapping between UNIX and Windows users (and groups) with the same names. This is recommended. You can enable simple maps by following this path **User Name Mapping → Maps** and clicking **Simple Maps**.

To create advanced maps for users and groups, on the Maps panel, click **Show User Maps** or **Show Group Maps** and then fill in the appropriate fields.

3. Click **Apply**.

Enabling Server for NFS

To enable Server for NFS, you need to specify where User Name Mapping is running.

To specify where User Name Mapping is running, follow this path, **Services for UNIX → User Name Mapping**, and then enter the server name that is running User Name Mapping in the Computer Name field. For a cluster, this entry must be the clustered name or IP address, not that of an individual node.

When planning an NFS installation, consider which machines you want to have what level of access to NFS shares. Each class of access should be captured by defining a separate client group.

- To define a client group, follow this path: **Services for UNIX → Client Groups**, and enter the group name in the Group Name field; then click **New**.
- To add members to a client group, select a group name from the current groups list, then click **Advanced** and enter the name of a client (a valid computer name).
- **A note on anonymous access:** It is strongly recommended that you not disable anonymous access. If a client presents a UID that is not recognized, Server for NFS can still grant that client a very limited form of access as a special *nobody* user. This is known as anonymous access, and you can enable or disable on a per-share basis. This anonymous user will have very limited access to resources on the NAS: it has only the permissions that are granted to the *Everybody* group in Windows, which corresponds to the *other* (or *world*) bits in a POSIX permissions mode.

Allowing anonymous access is not a security risk, so disabling it might provide a false sense of security. (The real security risk is to grant everyone access to resources that should be protected.) And disabling anonymous access has one severe consequence: it is so unexpected by NFS clients that they may not be able to connect as NFS V3 clients at all, and may instead downgrade the connection to use the NFS V2 protocol.

Enabling Ethernet adapter teaming

This section describes how to enable adapter teaming on the Ethernet adapters.

Intel adapters

The Intel Ethernet adapters (Gb Ethernet SX and 10/100 Ethernet) that you install in the PCI slots of the nodes support *adapter teaming*. With adapter teaming, two or more PCI Ethernet adapters can be physically connected to the same IP subnetwork and then logically combined into an adapter team. Such a team can support one of the following functional modes:

Adapter Fault Tolerance (AFT)

Only one adapter in the team is fully active on the Ethernet network (for example, sending and receiving data) at any point in time, while the other adapters are in standby mode (receiving data only). If that adapter detects a link failure or fails completely, another adapter in the team automatically and rapidly takes over as the active adapter, and all Ethernet traffic being handled by the failing adapter is seamlessly switched to the new active adapter, with no interruption to network sessions (for example, file transfers) in progress at the time of the failover.

Adapter Load Balancing (ALB)

All adapters in the team are active, increasing the total transmission throughput over the common IP subnetwork. If any adapter in the team fails

(link failure or complete failure), the other adapters in the team continue to share the network transmission load, although total throughput is decreased. Load balancing is only supported for adapter teams consisting of only one type of adapter; different types of adapters cannot be combined in a load-balancing team.

Fast Etherchannel (FEC)

FEC is a proprietary technology developed by Cisco. With FEC, you can create a team of two to four ports on an adapter to increase transmission and reception throughput. The FEC might also be referred to as load balancing, port aggregation, or trunking. When you configure this feature, the adapter ports comprising the FEC team or group create a single high-speed, fault-tolerant link between the engine and the Ethernet switch sharing one IP address. With FEC, fault tolerance and load balancing is provided for both outbound and inbound traffic, unlike other load-balancing schemes that only balance outbound traffic.

Note: FEC requires an Ethernet switch with FEC capability. The FEC implementation on the 4-port 10/100 Ethernet adapter does not support the optional Port Aggregation Protocol (PAgP) feature of FEC-capable Ethernet switches.

802.3ad

802.3ad is an IEEE industry-standard similar to Cisco's FEC/Gigabit Etherchannel (GEC). 802.3ad requires an Ethernet switch with 802.3ad capability.

To configure adapter teaming, use Intel PROSet II, which is preloaded on the , as follows:

1. Physically connect the adapters that you want to team to the same IP subnetwork.
2. Access the desktop by directly attaching a keyboard, mouse, and monitor, or over the network by starting Terminal Services on another workstation (see "Terminal Services and the IBM NAS Administration Console" on page 8).
3. From the desktop, go to the Start menu, then select **Settings**, then select **Control Panel**.
4. Double-click the Intel PROSet II icon in the Control Panel to start Intel PROSet II. You will see a list of all adapters for each slot and type supported under Network Components.
5. Under Network Components, you will see a list of resident and non-resident adapters for each slot and type supported. Drivers are preset for all supported adapter configurations but will be loaded only for resident adapters.
6. Identify which adapters you are going to team. Left-click the adapter under Network Components, and select one of the adapters that will be part of the teaming.
7. Right click the adapter, select **Add to Team**, then select **Create New Team...**
8. Select the type of team to create.
9. Select the adapters to add to the team from the list, and then select **Next**.
10. Verify that these settings are correct, and then select **Finish**.
11. Perform Steps 1 through 10 for the other node.

This procedure creates a device named Intel Advanced Network Services Virtual Adapter. It also binds all network protocols that were bound to the physical adapters

that were added to the team to this virtual adapter, and unbinds those protocols from the physical adapters. If you delete the team, the settings will return to the state prior to creating the team.

For complete help on adapter teaming, from Intel PROSet II, click **Network Components**, and then select **Help** from the Help menu.

Note: The integrated Ethernet controller on each node is dedicated to the clustering interconnection between it and another node and cannot be used for teaming.

Alacritech 10/100 Quad-Port Ethernet adapter

The Quad-Port 10/100 Ethernet adapter supports FEC and 802.3ad across the four ports on the adapter.

To configure it:

1. Click on **Control Panel**.
2. Select **Network and Dial-Up**.
3. Select **Adapter**.
4. Select **Properties**.
5. Select **Alacritech SLIC Team Configurator**.
6. Select **New Team**.

PRO/1000 XT Server adapter

This adapter supports several teaming functions that you can configure using the PROSet configuration utility. This adapter can also team with the integrated onboard 10/100 Intel Ethernet controller on the engine. Specific teaming modes supported across multiple instances of this adapter are AFT, ALB, FEC/GEC, and 802.3ad.

Antivirus protection

You can perform antivirus scanning of the NAS 200 storage from clients having the appropriate access permissions. Also, you can install Norton AntiVirus Version 7.5 or later on the NAS 200 engine using standard Windows 2000 software installation procedures.

Depending on configuration options, antivirus scanning might use substantial CPU or disk resources. Therefore, you should carefully select the scanning options and schedule.

Memory notes

The following sections contain information on adding memory.

Adding more engine memory to increase performance

You can enhance the performance of the NAS 200 in an NFS environment by adding more RAM to its processor. To do this:

1. From your IBM representative, purchase any of the 5194 memory field-upgrade feature codes applicable to your model:

Model 201 (feature code and title):

3411 256 MB to 512 MB Memory Upgrade

3412 256 MB to 1 GB Memory Upgrade

3413 256 MB to 2 GB Memory Upgrade
3421 512 MB to 1 GB Memory Upgrade
3422 512 MB to 2 GB Memory Upgrade
3431 1 GB to 2 GB Memory Upgrade

Model 226 (feature code and title):

3531 1 GB to 2 GB Memory Upgrade

2. Follow the instructions in Chapter 3, section “Replacing memory modules,” of the *Installation Guide*.
3. Before rebooting the appliance, attach a keyboard and display directly to the rear connectors of the product. During the first IPL, you will have to read and answer questions about the additional memory you have installed.

Using the Recovery CD-ROM if you have added more processor memory

If you have installed more processor memory, and later use the Recovery CD-ROM (see “Chapter 8. Using the Recovery and Supplementary CDs” on page 91), you will have to attach a keyboard and display and answer questions about the additional memory that you have installed.

Chapter 7. Troubleshooting

This chapter provides basic troubleshooting information to help you resolve some common problems that might occur with your NAS 200. The chapter is divided into the following sections:

- “Engine troubleshooting and diagnostics”
- “Adapter troubleshooting and diagnostics” on page 74

If you cannot locate and correct the problem using the information in this section, see “Appendix B. Getting help, service, and information” on page 97 for more information.

Engine troubleshooting and diagnostics

This section gives troubleshooting information for the IBM 5187 Network Attached Storage Model 6RZ (engine).

Engine diagnostic tools overview

The following tools are available to help you identify and resolve hardware-related problems:

- **POST beep codes, error messages, and error logs**

The power-on self-test (POST) generates beep codes and messages to indicate successful test completion or the detection of a problem. See “Power-on self-test (POST)” on page 101 for more information.

POST error messages and descriptions are given in “Appendix C. Engine POST messages” on page 101.

- **Diagnostic programs and error messages**

The diagnostic programs are stored in upgradable read-only memory (ROM) on the system board. These programs are the primary method of testing the major components of your appliance. See “POST diagnostic programs” on page 111 for more information.

- **Light-path diagnostics**

Your appliance has light-emitting diodes (LEDs) to help you identify problems with appliance components. These LEDs are part of the light-path diagnostics that are built into your appliance. By following the *path of lights*, you can quickly identify the type of system error that occurred. See “Light-path diagnostics” on page 63 for more information.

- **Intel® PROSet II**

See “Testing the Ethernet adapters with Intel PROSet II” on page 78.

- **Troubleshooting charts**

These charts list problem symptoms, along with suggested steps to correct the problems. See “Engine troubleshooting charts” on page 65 for more information.

- **Support**

You can register with the following support site to subscribe to e-mail notification of new technical tips and frequently asked questions, obtain downloads, and join forum discussions:

www.ibm.com/storage/support/nas

Identifying problems using LEDs

The LEDs are part of the light-path diagnostics built into the NAS 200 engine. The LEDs help you identify the type of system error that occurred. See the following sections for more information.

Power supply LEDs

The AC and DC power LEDs on the power supply provide status information about the power supply.

Table 3 describes the AC and DC power LEDs.

Note: The minimum configuration required for the DC good light to come on is:

- Power supply
- Power backplane
- System board (with pins 2 and 3 on J23 extension cable connected together to bypass the power switch)

Table 3. Power supply LEDs

AC Good LED	DC Good LED	Description	FRU/action
Off	Off	No power to system or AC problem.	<ol style="list-style-type: none"> 1. Check AC power to system. 2. Power supply
On	Off	Standby mode or DC problem.	<ol style="list-style-type: none"> 1. Check system board cable connectors J32, J33, and J35. Move jumper on J32's extension cable to pins 2-3 to bypass power control. If the DC Good LED comes on, press Ctrl+Alt+Delete. Watch the screen for any POST errors. Check the System Event/Error Log for any listed problems. If the system powers up with no errors: <ol style="list-style-type: none"> a. Power switch assembly b. System board 2. Remove the adapters and disconnect the cables and power connectors to all internal and external devices. Power-on the system. If the DC Good LED comes on, replace the adapters and devices one at a time until you isolate the problem. 3. Power supply 4. Power backplane 5. System board
On	On	Power is OK.	N/A

Light-path diagnostics

You can use the light-path diagnostics built into the NAS 200 engine to identify the type of system error that occurred. Any LEDs that are illuminated remain illuminated during a shutdown as long as the AC power source is good and the power supplies can supply +5V DC current to the NAS 200 engine. This feature helps you isolate the problem, if an error causes the NAS 200 to shut down. See “Light-path diagnostics”.

Diagnostics panel

You can use the light path diagnostics to quickly identify the type of system error that occurred. The diagnostics panel is under the “wind tunnel.” Any LEDs that are On remain On when the NAS 200 shuts down as long as the AC power source is stable and the power supplies can provide +5V DC current. This feature helps isolate the problem if an error causes the NAS 200 to shut down.

Figure 1 shows the LEDs on the diagnostics panel on the system board. You must remove the top cover to view the LEDs.

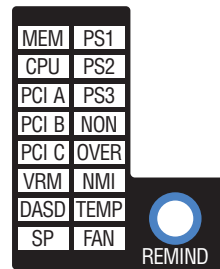


Figure 1. Diagnostics panel LEDs

Table 4 on page 64 describes the light-path diagnostics LEDs. The system error LED is turned on when an error is detected. If the system error LED (an amber “!” on the lower right corner) is on, remove the cover and check the diagnostic panel LEDs. Table 4 on page 64 is valid only when the system error LED is on.

Notes:

1. If a diagnostic panel LED is on and the information LED panel system error LED is off, there is probably an LED problem. Run LED diagnostics.
2. Check the System Error Log for additional information before replacing a FRU.
3. The DIMM error LEDs, processor error LEDs, and VRM error LEDs turn off when the system is powered off.

Table 4. Descriptions of light-path diagnostics LEDs

LED	Meaning
PS1	Power supply 1 failure
PS2	Power supply 2 failure
PS3	Power supply 3 failure
NON	Non-redundant power
OVER	The system has exceeded the power capabilities of the installed power supplies
NMI	Non-maskable-interrupt occurred
TEMP	System temperature exceeded maximum rating
FAN	A fan failed or is operating slowly
MEM	Memory failure. One or more memory DIMMs have failed
CPU	Microprocessor failure. One or both microprocessors have failed
PCI A	Error on PCI channel A or system board. Note: PCI bus A is often referred to as PCI bus 0
PCI B	Error on PCI channel B or system board. Note: PCI bus B is often referred to as PCI bus 1
PCI C	Error on PCI channel C or system board. Note: PCI bus C is often referred to as PCI bus 2
VRM	VRM Error on voltage regulator module or on integrated voltage regulator
DASD	A hot-swap disk drive, backplane, or other part of SCSI channel A has failed
SP	Integrated System Management Processor detected an error

Remind button: You can use the remind button to place the front panel system-error light into a remind mode. By pressing the button, you acknowledge the failure but indicate that you will not take immediate action. If a new error occurs, the LED will illuminate again.

In the remind mode, the system-error LED flashes every 2 seconds. The system-error LED remains in remind mode until one of the following situations occurs:

- All known problems are resolved.
- The system is restarted.
- A new problem occurs.

You can use the remind button to delay maintenance. Also, resetting the system-error LED enables the LED to react to another error. If the LED is still blinking from the first error, it will mask additional errors.

Engine troubleshooting charts

You can use Table 5 to find solutions to problems with the described symptoms.

If you cannot find the problem in the table, go to “Starting the diagnostic programs” on page 112 to test the appliance. If you have already run the diagnostic test programs or if running the tests does not reveal the problem, call for service.

The symptom appears in the left column of the table. Instructions and probable solutions to the problem are in the right column. If you have just added new software or a new option and your appliance is not working, do the following before using the troubleshooting charts:

1. Remove the software or device that you just added.
2. Run the diagnostic tests to determine if your appliance is running correctly.
3. Reinstall the new software or new device.

Table 5. Engine troubleshooting symptoms and suggested actions

Device/Problem	Symptom	Suggested action
CD-ROM drive	CD-ROM drive is not recognized.	Verify that: <ol style="list-style-type: none"> 1. The primary IDE channel is enabled in the Configuration/Setup Utility program. 2. All cables and jumpers are installed correctly. 3. The correct device driver is installed for the CD-ROM drive. If the problem remains, call for service.
Diskette drive	Diskette drive in-use light stays on, or the system bypasses the diskette drive.	If there is a diskette in the drive, verify that: <ol style="list-style-type: none"> 1. The diskette drive is enabled in the Configuration/Setup Utility program. 2. The diskette is good and not damaged. (Try another diskette if you have one.) 3. The diskette contains the necessary files to start the appliance. 4. Your software program is OK. If the diskette drive in-use light stays on, or the system continues to bypass the diskette drive, call for service.
Expansion enclosure problems	SCSI expansion enclosure used to work, but does not work now.	Verify that: <ol style="list-style-type: none"> 1. The cables for all external SCSI options are connected correctly. 2. The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly. 3. Any external SCSI option is turned on. You must turn on an external SCSI option before turning on the appliance. For more information, see your SCSI and expansion enclosure documentation.
General problems	Problems such as broken cover locks or indicator lights not working.	Call for service.

Table 5. Engine troubleshooting symptoms and suggested actions (continued)

Device/Problem	Symptom	Suggested action
Intermittent problems	A problem occurs only occasionally and is difficult to detect.	Verify that: <ol style="list-style-type: none"> 1. All cables and cords are connected securely to the rear of the appliance and attached options. 2. When the appliance is turned on, air is flowing from the rear of the appliance at the fan grill. If there is no air flow, the fan is not working. This causes the appliance to overheat and shut down. 3. Ensure that the SCSI bus and devices are configured correctly and that the last external device in each SCSI chain is terminated correctly. If the items above are correct, call for service.
Keyboard, mouse, or pointing-device problems (if attached).	All or some keys on the keyboard do not work.	<ol style="list-style-type: none"> 1. Make sure that the keyboard cable is properly connected to the appliance. 2. Make sure that the appliance and the monitor are turned on. 3. Try using another keyboard. If the items above are correct, call for service.
	The mouse or pointing device does not work.	<ol style="list-style-type: none"> 1. Verify that the mouse or pointing-device cable is securely connected and the device drivers are installed correctly. 2. Try using another mouse or pointing device. If the problem remains, call for service.
Memory problems	The amount of memory displayed is less than the amount of memory installed.	Verify that: <ol style="list-style-type: none"> 1. The memory modules are seated properly. 2. You have installed the correct type of memory. 3. If you changed the memory, you updated the memory configuration with the Configuration/Setup Utility program. 4. All banks of memory on the DIMMs are enabled. The appliance might have automatically disabled a DIMM bank when it detected a problem or a DIMM bank could have been manually disabled. If the above items are correct, run the memory diagnostic program. The system might have detected a bad memory module and automatically reallocated memory to enable you to continue to operate. If the memory tests fail, call for service or replace the failing DIMM.
Microprocessor problems	The appliance emits a continuous tone during POST.	The startup (boot) microprocessor is not working properly. Verify that the startup microprocessor is seated properly. If it is, replace the startup microprocessor. If the problem remains, call for service.

Table 5. Engine troubleshooting symptoms and suggested actions (continued)

Device/Problem	Symptom	Suggested action
Monitor	Testing the monitor.	Some IBM monitors have their own self-tests. If you suspect a problem with your monitor, refer to the information that comes with the monitor for adjusting and testing instructions. If you still cannot find the problem, call for service.
	The screen is blank.	Verify that: 1. The appliance power cord is plugged into the appliance and a working electrical outlet. 2. The monitor cables are connected properly. 3. The monitor is turned on and the Brightness and Contrast controls are adjusted correctly. If the items above are correct and the screen remains blank, call for service.
	Only the cursor appears.	Call for service.
	The monitor works when you turn on the appliance, but goes blank when you start some application programs.	Verify that: 1. The primary monitor cable is connected to the video port. 2. You installed the necessary device drivers for the applications. If the items above are correct and the screen remains blank, call for service.
	Wavy, unreadable, rolling, distorted screen, or screen jitter.	If the monitor self-tests show the monitor is OK, consider the location of the monitor. Magnetic fields around other devices (such as transformers, appliances, fluorescent lights, and other monitors) can cause screen jitter or wavy, unreadable, rolling, or distorted screen images. If this happens, turn off the monitor. (Moving a color monitor while it is turned on might cause screen discoloration.) Then move the device and the monitor at least 305 mm (12 in.) apart. Turn on the monitor. Notes: 1. To prevent diskette drive read/write errors, be sure the distance between monitors and diskette drives is at least 76 mm (3 in.). 2. Non-IBM monitor cables might cause unpredictable problems. 3. An enhanced monitor cable with additional shielding is available for the 9521 and 9527 monitors. For information about the enhanced monitor cable, see your IBM reseller or IBM marketing representative. If the problem remains, call for service.
	Wrong characters appear on the screen.	If the wrong language is displayed, update the BIOS with the correct language. If the problem remains, call for service.

Table 5. Engine troubleshooting symptoms and suggested actions (continued)

Device/Problem	Symptom	Suggested action
Option problems	An IBM option that was just installed does not work.	Verify that: <ol style="list-style-type: none"> 1. The option is designed for the appliance. Refer to the hardware installation guide that came with this appliance for a list of supported options. 2. You followed the installation instructions that came with the option. 3. The option is installed correctly. 4. You have not loosened any other installed options or cables. 5. You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or an option is changed, you must update the configuration. If the problem remains, call for service.
	An IBM option that used to work does not work now.	Verify that all of the option hardware and cable connections are secure. <p>If the option comes with its own test instructions, use those instructions to test the option.</p> <p>If the failing option is a SCSI option, verify that:</p> <ol style="list-style-type: none"> 1. The cables for all external SCSI options are connected correctly. 2. The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly. 3. Any external SCSI option is turned on. You must turn on an external SCSI option before turning on the appliance. If the problem remains, call for service.
Power problems	The appliance does not power on.	Verify that: <ol style="list-style-type: none"> 1. The power cables are properly connected to the appliance. 2. The electrical outlet functions properly. 3. The type of memory installed is correct. 4. If you just installed an option, remove it, and restart the appliance. If the appliance now powers on, you might have installed more options than the power supply supports. 5. The LEDs on the power supply are on. If the problem remains, call for service.
Serial port problems	The number of serial ports identified by the operating system is less than the number of serial ports installed.	Verify that: <ol style="list-style-type: none"> 1. Each port is assigned a unique address by the Configuration/Setup Utility program and none of the serial ports are disabled. <p>Note: The management C connector is the same as a serial port connector, but it is used only by the ISMP, and is not available for use by the operating system. This port does not appear in the Configuration/Setup Utility program menus; it can be configured using Netfinity Manager.</p> 2. The serial-port adapter, if you installed one, is seated properly. If the problem still exists, call for service.

Table 5. Engine troubleshooting symptoms and suggested actions (continued)

Device/Problem	Symptom	Suggested action
	A serial device does not work.	<p>Verify that:</p> <ol style="list-style-type: none"> 1. The device is compatible with the appliance. 2. The serial port is enabled and is assigned a unique address. 3. Make sure that the device is not connected to the management port C. <p>Note: The management C connector is the same as a serial port connector, but it is used only by the ISMP, and is not available for use by the operating system. This port does not appear in the Configuration/Setup Utility program menus; it can be configured using Netfinity Manager.</p> <p>If the problem still exists, call for service.</p>
Service processor problems	Netfinity Service Processor Manager reports a general monitor failure	<p>Disconnect the appliance from all electrical sources, wait for 30 seconds, reconnect the appliance to the electrical sources, and restart the appliance.</p> <p>If a problem remains, call for service.</p>
Software problem	Suspected software problem.	<p>To determine if problems are caused by the software, verify that:</p> <ol style="list-style-type: none"> 1. Four appliance has the minimum memory requirements needed to use the software. For memory requirements, refer to the information that comes with the software. Note: If you have just installed an adapter or memory, you might have a memory address conflict. 2. The software is designed to operate on your appliance. 3. Other software works on your appliance. 4. The software that you are using works on another system. <p>If you received any error messages when using the software program, refer to the information that comes with the software for a description of the messages and solutions to the problem.</p> <p>If the items above are correct and the problem remains, contact your place of purchase.</p>
Universal Serial Bus (USB) port problems	A USB device does not work.	<p>Verify that:</p> <ol style="list-style-type: none"> 1. You are not trying to use a USB device during POST if you have a standard (non-USB) keyboard attached to the keyboard port. Note: If a standard (non-USB) keyboard is attached to the keyboard port, then the USB is disabled and no USB device will work during POST. 2. The correct USB device driver is installed. 3. Your operating system supports USB devices. <p>If the problem still exists, call for service.</p>

Power problems

Power problems can be difficult to troubleshoot. For example, a short circuit can exist anywhere on any of the power distribution busses. Usually a short circuit causes the power subsystem to shut down because of an overcurrent condition.

Table 6 lists the power error messages that you might encounter.

A general procedure for troubleshooting power problems is as follows:

1. Power off the system and disconnect the AC cord(s).
2. Check for loose cables in the power subsystem. Also check for short circuits, for example, if there is a loose screw causing a short circuit on a circuit board.
3. Remove adapters and disconnect the cables and power connectors to all internal and external devices until the NAS 200 engine is at minimum configuration required for power on.
4. Reconnect the AC cord and power on the NAS 200 engine. If the engine powers up successfully, replace adapters and devices one at a time until the problem is isolated. If the engine does not power up from minimal configuration, replace FRUs of minimal configuration one at a time until the problem is isolated.

Table 6. Power error messages

Message	Action
Power supply “X” current share fault (level-critical; excessive current demand on power supply “X”)	See “Power problems”.
Power supply “X” DC good fault (level-critical; power good signal not detected for power supply “X”)	Replace power supply “X”.
Power supply “X” temperature fault	Replace fan “X”.
Power supply “X” removed	No action required - information only.
Power supply “X” fan fault (level-critical; fan fault in power supply “X”)	Replace power supply “X”.
Power supply “X” 12V fault (level-critical; overcurrent condition detected)	See “Power problems”
Power supply “X” 3.3V fault (level-critical; 3.3V power supply “X” had an error)	1. See “Power problems”.
Power supply “X” 5V fault (level-critical; 5V power supply “X” had an error)	See “Power problems”.
System over recommended “X” current (level-non-critical; system running too much current on that voltage)	See “Power problems”.
System running non-redundant power (level-non-critical; system does not have redundant power)	<ol style="list-style-type: none"> 1. Add another power supply. 2. Remove options from system. 3. System can continue to operate without redundancy protection if 1 and 2 above are not followed.
System under recommended voltage for “X” v (level-warning; indicated voltage supply under nominal value; value for “X” can be +12, -12, or +5)	<ol style="list-style-type: none"> 1. Check connections to power subsystem. 2. Replace power supply. 3. Replace power backplane.

Table 6. Power error messages (continued)

Message	Action
System under recommended voltage on 3.3 v (level-warning; 3.3 volt supply under nominal value)	<ol style="list-style-type: none"> 1. Check connections to power subsystem. 2. Replace power supply. 3. Replace power backplane.
System under recommended "X" current (level-non-critical; system drawing less current than recommended on voltage "X")	See "Power problems" on page 70.
"X" V bus fault (level-critical; overcurrent condition on "X" voltage bus)	<ol style="list-style-type: none"> 1. Check for short circuit on "X" voltage bus. 2. See "Power problems" on page 70.
12V "X" bus fault (level-critical; overcurrent condition on 12 volt "X" voltage bus)	<ol style="list-style-type: none"> 1. Check for short circuit on 12 volt "X" voltage bus. 2. See "Power problems" on page 70.
5V fault (level-critical; overcurrent condition on 5 V subsystem)	<ol style="list-style-type: none"> 1. Check for short circuit on 5 v bus. 2. See "Power problems" on page 70.
240 VA fault (level-critical; overcurrent or overvoltage condition in power subsystem)	See "Power problems" on page 70.

Recovering BIOS

If your BIOS has become corrupted, such as from a power failure during a flash update, you can recover your BIOS using the recovery boot block and a BIOS flash diskette.

Note: You can obtain a BIOS flash diskette from one of the following sources:

- Download a BIOS flash diskette image from the Web site at: www.ibm.com/storage/support/nas
- Contact your IBM service representative.

The flash memory contains a protected area that cannot be overwritten. The recovery boot block is a section of code in this protected area that enables the NAS 200 to start up and to read a flash diskette. The flash utility recovers the system BIOS from the BIOS recovery files on the diskette.

To recover the BIOS:

1. Power off the NAS 200 and peripheral devices. Disconnect all external cables and power cords. Remove the cover.
2. Locate the boot-block jumper block (J16) on the system board. See Figure 2 on page 72.
3. Place a jumper on pins 2 and 3 to enable the BIOS backup page.
4. Insert the BIOS flash diskette into the diskette drive.
5. Restart the NAS 200.
6. When the NAS 200 completes POST, select **1 -- Update POST/BIOS** from the menu that contains various flash (update) options.
7. At the prompt to move the current POST/BIOS image to the backup ROM location, type **N**. **Attention:** Typing **Y** will copy the corrupted BIOS into the secondary page.
8. At the prompt to save the current code on a diskette, select **N**.
9. At the prompt, select your language (**0-7**) and press **Enter** to accept your choice. Remove the diskette and press **Enter** to restart the system.

10. Power off the NAS 200.
11. Remove the jumper on the boot-block jumper block, or move it to pins 1 and 2 to return to normal startup mode.
12. Restart the NAS 200. It should start up normally.

Figure 2 shows the location of the boot block jumper on the system board.

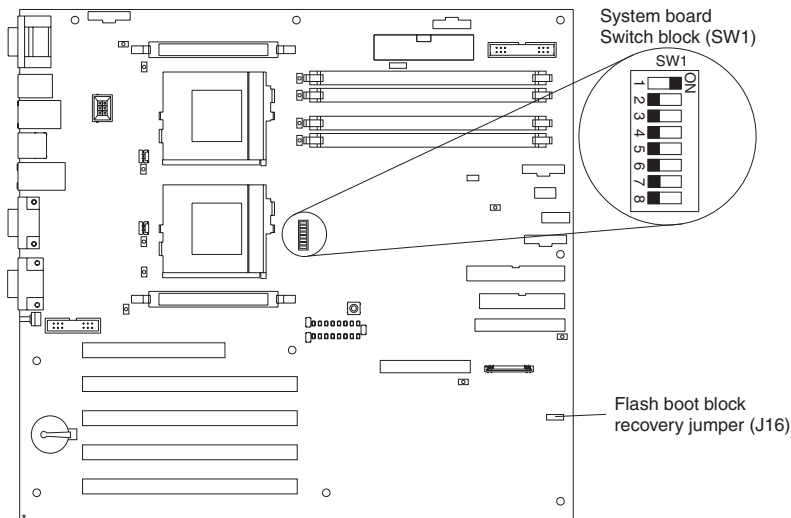


Figure 2. Boot block jumper location

Replacing the battery

IBM has designed this product with your safety in mind. The lithium battery must be handled correctly to avoid possible danger. If you replace the battery, you must adhere to the following instructions.

Note: In the U.S., call 1-800-IBM-4333 for information about battery disposal.

If you replace the original lithium battery with a heavy-metal battery or a battery with heavy-metal components, be aware of the following environmental consideration. Batteries and accumulators that contain heavy metals must not be disposed of with normal domestic waste. They will be taken back free of charge by the manufacturer, distributor, or representative, to be recycled or disposed of in a proper manner.

To order replacement batteries, call 1-800-772-2227 within the United States, and 1-800-465-7999 or 1-800-465-6666 within Canada. Outside the U.S. and Canada, call your IBM reseller or IBM marketing representative.

Note: After you replace the battery, you must reconfigure your appliance and reset the system date and time.

CAUTION:



When replacing the lithium battery, use only IBM Part Number 10L6432 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water.
- Heat to more than 100 C (212 F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations or in the U.S., call 1-800-IBM-4333 for information about battery disposal.

Note: For translations of the safety notice, refer to the multilingual Safety Information on the Documentation CD that came with the appliance.

To replace the battery:

1. Review the information in the section “Before you begin” in the hardware installation guide that came with this appliance, and any special handling and installation instructions supplied with the replacement battery.
2. Turn off the appliance and peripheral devices and disconnect all external cables and power cords; then, remove the appliance cover.
3. Remove the battery:
 - a. Use one finger to lift the battery clip over the battery.
 - b. Use one finger to slightly slide the battery from its socket. The spring mechanism behind the battery will push the battery out toward you as you slide it from the socket.
 - c. Use your thumb and index finger to pull the battery from under the battery clip.
 - d. Ensure that the battery clip is touching the base of the battery socket by pressing gently on the clip.

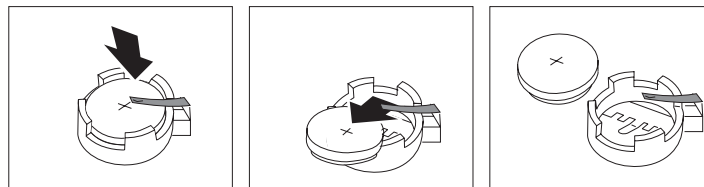


Figure 3. Battery removal

4. Insert the new battery:
 - a. Tilt the battery so that you can insert it into the socket, under the battery clip.
 - b. As you slide it under the battery clip, press the battery down into the socket.

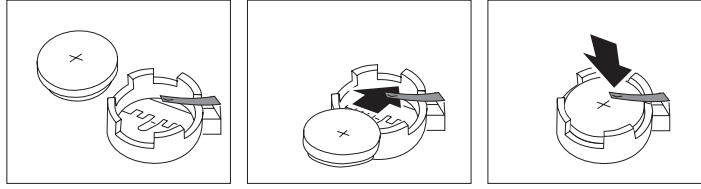


Figure 4. Battery replacement

5. Reinstall the appliance cover and connect the cables.

Note: Wait approximately 20 seconds after you plug the power cord of your appliance into an electrical outlet for the Power Control button to become active.

6. Turn on the appliance.
7. Start the Configuration/Setup Utility program and set configuration parameters.
 - Set the system date and time.
 - Set the power-on password.
 - Load setup defaults and save the settings
 - Exit the utility
 - Restart

Adapter troubleshooting and diagnostics

This section presents information on troubleshooting and diagnosing the following engine adapters:

- 10/100 integrated Ethernet adapter (“Integrated Ethernet adapter” on page 75)
- IBM 10/100 PCI Ethernet adapter (“Troubleshooting the 10/100 PCI Ethernet adapter” on page 77)
- IBM Gigabit Ethernet SX adapter (“Gigabit Ethernet SX adapter” on page 79)
- Intel PRO 1000 XT Server Adapter (“PRO/1000 XT Server adapter troubleshooting chart” on page 80)
- Alacritech Quad-Port Ethernet Adapter (“Troubleshooting the Alacritech Quad-Port 10/100 Ethernet adapter” on page 82)
- IBM ServeRAID-4Lx and 4H SCSI Controller (“Troubleshooting the ServeRAID-4Lx and 4H” on page 83)
- SCSI HVD 3570 adapter (“Troubleshooting the SCSI HVD 3570 adapter” on page 87)
- Integrated System Management Processor (ISMP) (“Troubleshooting the Integrated System Management Processor” on page 87)
- Remote Supervisor Adapter (RSA) (“Troubleshooting the Remote Supervisor Adapter” on page 88)
- IBM Fast/Wide Ultra SCSI Adapter (“Testing SCSI adapters” on page 89)
- IBM PCI Ultra 160 SCSI Adapter (“Testing SCSI adapters” on page 89)

001801xx Resource Allocation Error warning message

If you install a ServeRAID adapter or a 10/100 Ethernet adapter in an engine as a field upgrade or as a field replaceable unit (FRU), resulting in a combination of PCI adapters that includes three or more 10/100 Ethernet adapters and a ServeRAID

adapter, the system BIOS might write a POST *001801xx Resource Allocation Error* message to the error log. If a monitor is attached to the engine, the message will also be displayed on the monitor.

This message will not cause actual operational problems with the appliance. The engine will continue to boot to completion and will otherwise function normally. However, each time you reboot the engine, the same message again will be written to the error log and displayed on the monitor (if attached).

To eliminate these warning messages during POST, you can obtain a utility to disable the 10/100 Ethernet adapter's expansion ROM from the NAS support Web site at:

www.ibm.com/storage/support/nas

Integrated Ethernet adapter

This section provides troubleshooting information for problems that might occur with the 10/100 Mbps integrated Ethernet adapter.

Network connection problems

If the Ethernet adapter cannot connect to the network, check the following:

1. Make sure that the cable is installed correctly.

The network cable must be securely attached at all connections. If the cable is attached but the problem persists, try a different cable.

If you set the Ethernet adapter to operate at 100 Mbps, you must use Category 5 cabling.

If you directly connect two workstations (without a hub), or if you are not using a hub with X ports, use a crossover cable.

Note: To determine whether a hub has an X port, check the port label. If the label contains an X, the hub has an X port.

2. Determine if the hub supports auto-negotiation. If not, try configuring the integrated Ethernet adapter manually to match the speed and duplex mode of the hub.
3. Check the Ethernet adapter lights on the operator information panel.

These lights indicate whether a problem exists with the connector, cable, or hub.

- The Ethernet Link Status light is On when the Ethernet adapter receives a LINK pulse from the hub. If the light is Off, there might be a bad connector or cable, or a problem with the hub.
 - The Ethernet Transmit/Receive Activity light is On when the Ethernet adapter sends or receives data over the Ethernet Network. If the Ethernet Transmit/Receive Activity light is Off, make sure that the hub and network are operating and that the correct device drivers are loaded.
4. Make sure that you are using the correct device drivers, supplied with the NAS 200 engine.
 5. Check for operating system-specific causes for the problem.
 6. Make sure that the device drivers on the client and the NAS 200 engine are using the same protocol.
 7. Test the Ethernet adapter by running the diagnostic program.

Integrated Ethernet adapter troubleshooting chart

Use Table 7 on page 76 to find solutions to 10/100 Mbps integrated Ethernet adapter problems that have definite symptoms.

Table 7. Integrated Ethernet adapter troubleshooting chart

Ethernet adapter symptom	Suggested Action
Ethernet Link Status light is not On.	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that the hub is powered on. 2. Check all connections at the Ethernet adapter and the hub. 3. Check the cable. A crossover cable is required unless the hub has an X designation. 4. Use another port on the hub. 5. If the hub does not support auto-negotiation, manually configure the Ethernet adapter to match the hub. 6. If you manually configured the duplex mode, ensure that you also manually configure the speed. 7. Run diagnostics on the LEDs. <p>If the problem remains, go to “Starting the diagnostic programs” on page 112 to run the diagnostic programs.</p>
The Ethernet Transmit/Receive Activity light is not On.	<p>Check the following:</p> <p>Note: The Ethernet Transmit/Receive Activity LED is On only when data is sent to or by this Ethernet adapter.</p> <ol style="list-style-type: none"> 1. Ensure that you have loaded the network device drivers. 2. The network might be idle. Try sending data from this workstation. 3. Run diagnostics on the LEDs. 4. The function of this LED can be changed by device driver load parameters. If necessary, remove any LED parameter settings when you load the device drivers.
Data errors	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that you are using Category 5 cabling when operating the NAS 200 engine at 100 Mbps. 2. Make sure that the cables do not run close to noise-inducing sources like fluorescent lights.
The Ethernet adapter stopped working when another adapter was added to the NAS 200 engine.	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that the cable is connected to the Ethernet adapter. 2. Ensure that the PCI system BIOS is current. 3. Reseat the adapter. 4. Ensure that the adapter you are testing is supported by the NAS 200 engine. <p>Go to “Starting the diagnostic programs” on page 112 to run the diagnostic programs.</p>
The Ethernet adapter stopped working without apparent cause.	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Run diagnostics for the Ethernet adapter. 2. Try a different connector on the hub. 3. Reinstall the device drivers. Refer to your operating-system documentation and to the <i>User’s Reference</i> information. <p>If the problem remains, go to “Starting the diagnostic programs” on page 112 to run the diagnostic programs.</p>

Troubleshooting the 10/100 PCI Ethernet adapter

You can use Table 8 to find solutions to 10/100 Mbps Ethernet adapter problems that have definite symptoms.

See “Testing the Ethernet adapters with Intel PROSet II” on page 78 for more information.

Table 8. 10/100 PCI Ethernet adapter troubleshooting chart

Ethernet adapter symptom	Suggested Action
<p>The adapter cannot connect to the network.</p>	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that the network cable is installed correctly. The cable must be securely attached at both RJ-45 connections (adapter and hub). The maximum allowable distance from adapter to the hub is 100 m (328 ft.). If the cable is attached and the distance is within acceptable limits but the problem persists, try a different cable. If you are directly connecting two computers without a hub or switch, make sure you are using a crossover cable. 2. Check the LED lights on the adapter. The adapter has two diagnostic LEDs, one on each side of the cable connector. These lights help you to determine whether there is a problem with the connector, cable, switch, or hub. <ul style="list-style-type: none"> ACT/LNK — On Adapter and switch is receiving power and cable connection between them is good. ACT/LNK — Off Check the following: <ul style="list-style-type: none"> • Adapter not sending or receiving data • Adapter or switch not receiving power • Cable connection between adapter and switch is faulty • Drivers not configured properly ACT/LNK — Flashing Normal operation. LED flashes when the adapter sends or receives data. The frequency of the flashes varies with the amount of network traffic 100 — On Adapter is operating at 100 Mbps 100 — Off Adapter is operating at 10 Mbps 3. Ensure that you are using the correct drivers. Ensure that you are using the drivers that come with this adapter. Drivers that support previous versions of this adapter do not support this version of the adapter. 4. Ensure that the switch port and the adapter have the same duplex setting. If you configured the adapter for full-duplex, ensure that the switch port is also configured for full-duplex. Setting the wrong duplex mode can degrade performance, cause data loss, or result in lost connections.
<p>Diagnostics pass, but the connection fails or errors occur.</p>	<p>Check the following:</p> <ol style="list-style-type: none"> 1. For 100 Mbps: <ul style="list-style-type: none"> • Use Category 5 cabling and ensure that the network cable is securely attached. • Verify the adapter is seated firmly in the slot and connected to a 100BASE-TX hub/switch (not 100BASE-T4). 2. Ensure the duplex mode setting on the adapter matches the setting on the switch

Table 8. 10/100 PCI Ethernet adapter troubleshooting chart (continued)

Ethernet adapter symptom	Suggested Action
The LNK LED is not On.	Check the following: <ol style="list-style-type: none"> 1. Ensure that you loaded the correct network drivers. 2. Check all connections at the adapter and the switch. 3. Try another port on the switch. 4. Ensure that the duplex mode setting on the adapter matches the setting on the switch. 5. Ensure that you have the correct type of cable between the adapter and the hub. 100BASE-TX requires two pairs. Some hubs require a crossover cable while others require a straight-through cable.
The ACT LED is not On.	Check the following: <ol style="list-style-type: none"> 1. Ensure that you loaded the correct network drivers. 2. The network might be idle. Try accessing a server. 3. The adapter is not transmitting or receiving data. Try another adapter. 4. Ensure that you are using two-pair cable for TX wiring.
Adapter stops working without apparent cause.	Check the following: <ol style="list-style-type: none"> 1. Run the diagnostics. 2. Try reseating the adapter in its slot, or try a different slot if necessary. 3. The network driver files might be corrupt or missing. Remove and then reinstall the drivers.
The LNK LED is not On when you connect the power.	Ensure that the network cable is securely attached at both ends.

Testing the Ethernet adapters with Intel PROSet II

Each NAS 200 engine comes with Intel PROSet II. Use PROSet to view the following:

- Adapter parameters such as MAC and IP addresses
- Network link status such as speed, duplex mode, and activity
- Device-driver level used for the adapter

You can also use PROSet II to test the 10/100 Ethernet and Gigabit Ethernet PCI adapters for any problems with the adapter hardware, cabling, or network connections. PROSet performs a loopback test on the 10/100 Ethernet and Gigabit Ethernet PCI cards.

To access the PROSet II utility, go into Terminal Services. For instructions on how to invoke Terminal Services, see “Terminal Services and the IBM NAS Administration Console” on page 8. From Terminal Services do the following steps:

1. From the Start menu, select **Settings**, then **Control Panel**.
2. Double-click the INTEL PROSet II icon in the Control Panel.
3. In the INTEL PROSet II utility, select the Ethernet adapter to test (Gigabit Ethernet PCI adapter or 10/100 Ethernet Adapter).
4. Select the **Diagnostics** tab. A list of available tests is displayed.
5. Select **Run Tests**. You can also select or deselect individual tests with the check boxes. If an error is detected, information about the error is displayed.
6. Repeat Steps 3 through 5 for each Ethernet adapter installed.

For additional information about Intel PROSet, refer to the online help that accompanies the utility.

Gigabit Ethernet SX adapter

Use Table 9 to find solutions to Gigabit Ethernet adapter problems that have definite symptoms.

See “Testing the Ethernet adapters with Intel PROSet II” on page 78 for more information.

Table 9. Gigabit Ethernet SX adapter troubleshooting chart

Gigabit adapter symptom	Suggested Action
No Link or TX/RX Activity	<p>If you cannot link to your switch, check the following:</p> <ol style="list-style-type: none"> Check the following LED lights on the adapter: <ul style="list-style-type: none"> TX — On The adapter is sending data. RX — On The adapter is receiving data. Link — On The adapter is connected to a valid link partner and is receiving link pulses. Link — Off Link is inoperative. <ol style="list-style-type: none"> Check all connections at the adapter and link partner. Make sure the link partner is set to 1000 Mbps and full-duplex. Ensure the required drivers are loaded. PRO — Programmable LED Identifies the adapter by blinking. Use the Identify Adapter push-button in INTEL PROSet II to control blinking. Ensure that the cable is installed correctly. The network cable must be securely attached at all connections. If the cable is attached but the problem persists, try a different cable.
Your computer cannot find the Gigabit Ethernet SX adapter	<p>Check the following:</p> <ol style="list-style-type: none"> Verify that the adapter is seated firmly in the slot. Try a different Gigabit Ethernet SX adapter.
Diagnostics pass but the connection fails	<p>Ensure the network cable is securely attached.</p>
Another adapter stopped working after you installed the Gigabit Ethernet SX Adapter	<p>Check the following:</p> <ol style="list-style-type: none"> Verify that the cable is connected to the Gigabit Ethernet SX Adapter and not to another adapter. Check for a resource conflict. Ensure both adapters are seated firmly in the slot. Check all cables.
The adapter stopped working without apparent cause	<p>Check the following:</p> <ol style="list-style-type: none"> Reseat the adapter. Reinstall the drivers. The network driver files might be damaged or deleted. Try a different Gigabit Ethernet SX Adapter.

Table 9. Gigabit Ethernet SX adapter troubleshooting chart (continued)

Gigabit adapter symptom	Suggested Action
LINK LED is not On	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that you have loaded the adapter driver. 2. Check all connections at the adapter and the buffered repeater or switch. 3. Try another port on the buffered repeater or switch. 4. Ensure that the buffered repeater or switch port is configured for 1000 Mbps and full-duplex. 5. Try changing the auto-negotiation setting on the link partner, if possible.
RX or TX LED is no On	<p>Check the following:</p> <ol style="list-style-type: none"> 1. Ensure that you have loaded the adapter driver. 2. Network might be idle; try logging in from a workstation. 3. The adapter is not transmitting or receiving data; try another adapter.

PRO/1000 XT Server adapter troubleshooting chart

Use the troubleshooting chart in Table 10 to find solutions to the PRO/1000 XT Server adapter problems that have definite symptoms.

Table 10. PRO/1000 XT Server adapter troubleshooting chart

PRO/1000 XT Server adapter problem	Suggested action
The PRO/1000 XT Server adapter can not be found.	<ol style="list-style-type: none"> 1. Verify that the adapter is seated firmly in the slot. 2. Reboot the machine. 3. Try a different PRO/1000 XT Server adapter.
Diagnostics pass but the connection fails.	<ol style="list-style-type: none"> 1. Verify that the responding link is operating correctly. 2. Ensure that the network cable is securely attached. 3. Try a different cable.
Another adapter stopped operating correctly after you installed the PRO/1000 XT Server adapter.	<ol style="list-style-type: none"> 1. Verify that the cable is securely connected to the PRO/1000 XT Server adapter and not to another adapter. 2. Check for a resource conflict. 3. Reload all PCI device drivers. 4. Ensure that both adapters are seated firmly in the slot. 5. Check all cables.
PRO/1000 XT Server adapter is unable to connect at 1000 Mbps, instead it connects at 100 Mbps. (Copper-based connections only)	<ol style="list-style-type: none"> 1. Ensure that the cable is the correct type. 2. Try another cable.
The adapter stopped working without apparent cause.	<ol style="list-style-type: none"> 1. Reseat the adapter. 2. The network driver files might be damaged or deleted. Reinstall the drivers. 3. Reboot the machine. 4. Try a different cable. 5. Use a different PRO/1000 XT Server adapter.

Table 10. PRO/1000 XT Server adapter troubleshooting chart (continued)

PRO/1000 XT Server adapter problem	Suggested action
LINK LED is off.	<ol style="list-style-type: none"> 1. Ensure that you have loaded the adapter driver. 2. Check all connections at the adapter and the buffered repeater or switch. 3. Use another port on the buffered repeater or switch. 4. Ensure that the cable is securely attached. 5. Change the auto-negotiation setting on the link partner, if possible.
The link light is on, but communications are not correctly established.	<ol style="list-style-type: none"> 1. Ensure that the latest drivers are loaded. 2. Ensure that the adapter and its link partner are set to either auto-negotiate or set to the same speed and duplex settings.
The ACT light is off.	<ol style="list-style-type: none"> 1. Ensure that the drivers are loaded. 2. Try accessing a server. 3. Try another PRO/1000 XT Server adapter. 4. Ensure that the cable is securely attached.
Windows 2000 and XP message: Unable to remove PROSet in SAFE mode.	<p>If the machine hangs after configuring the adapters with the PROSet utility, perform the following steps:</p> <ol style="list-style-type: none"> 1. Start Windows in Safe mode. 2. Access the Device Manager and disable the network adapters and teams. 3. Restart the machine. 4. Windows should operate normally if the disabled adapters were causing the problem. <p>To uninstall PROSet, perform the following steps:</p> <ol style="list-style-type: none"> 1. Start Windows in Safe mode. 2. Access the Device Manager and disable all teaming instances. 3. Restart in Normal mode. 4. Using PROSet, remove all teams and VLANs. 5. From the Windows Control Panel, select Add/Remove Programs. 6. Uninstall PROSet.

Table 10. PRO/1000 XT Server adapter troubleshooting chart (continued)

PRO/1000 XT Server adapter problem	Suggested action
LED indicators	<ul style="list-style-type: none"> • ACT/LNK <ul style="list-style-type: none"> Green on The adapter is connected to a valid link partner. Green flashing Data activity is detected. Off No link is detected. Yellow flashing There is an identity problem. Use the Identify Adapter button in Intel PROSet II to control the blinking. See the PROSet online help for more information. • <ul style="list-style-type: none"> 10=OFF 100=GREEN 1000=YLW <ul style="list-style-type: none"> Off The adapter is operating at a 10-Mbps data rate. Green on The adapter is operating at a 100-Mbps data rate. Yellow on The adapter is operating at a 1000-Mbps data rate.

Troubleshooting the Alacritech Quad-Port 10/100 Ethernet adapter

Table 11 displays the LED definitions for the Alacritech Quad-Port 10/100 Ethernet adapter LED definitions

Table 11. Alacritech Quad-Port 10/100 Ethernet adapter LED definitions

LED	Indication	Meaning
LNK	Off	Either the adapter or the switch (or both) are not receiving power, or the cable connection between them is faulty.
	Green	The adapter and switch are receiving power. The cable connection between them is good. A 100 Mbps link has been established.
	Amber	The adapter and switch are receiving power. The cable connection between them is good. A 10 Mbps link has been established.
ACT	Off	The adapter is not sending or receiving network data.
	Flashing amber	The adapter is sending or receiving network data.

Testing the Quad-Port 10/100 Ethernet adapter

The event log tells you when you should run diagnostics. You can view the event log from the Event Viewer located in the Administrative Tools folder on the Start Menu, located under Programs. When the event log reports that “SLICx has

determined that the adapter is not functioning properly,” you can run diagnostics on the Quad-Port 10/100 Ethernet adapter using the following procedure:

1. Run the SLICuser application from the Start Menu, located under the Program Files folder in the Alacritech Folder.
2. Select the **Diagnostics** tab.

Note: Running diagnostics disrupts all ports of the adapter.

3. Click **Run**. The adapter will then run through a self-test of the IPP and the selected port of the adapter. A properly functioning board will display a window in which all of its tests have *Passed*.
4. Click **OK** to close the SLICuser utility.

Troubleshooting the ServeRAID-4Lx and 4H

Error codes and messages display on the screen in a line of text immediately after the adapter BIOS version.

If POST detects changes in the controller configuration or detects a controller hardware problem, messages appear on the screen. See “POST (ISPR) error procedures” on page 84 and correct the problem.

If there is no POST Error or Configuration Error message, the BIOS screen messages resemble the sample shown below.

Note: Your version might be different from the one shown.

```
IBM ServeRAID BIOS
Copyright IBM Corp. 1994, 2001. All rights reserved.
BIOS Ver: 4.70.17

Controller 1 Slot 3, Logical drive=3, Other=0, Firmware=4.70.17, Status=OK
<< Press Ctrl+I to access the Mini-Configuration Program >>

Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Passed.
Drive configuration can take up to 6 Minute(s) 0 Second(s) -- test Passed.
```

If there is a POST Error message, the BIOS screen resembles the sample shown below. See “POST (ISPR) error procedures” on page 84 and correct the problem.

Note: Your version might be different from the one shown.

The characters XXXX indicate the POST (ISPR) error.

```
IBM ServeRAID BIOS
Copyright IBM Corp. 1994, 2001. All rights reserved.
BIOS Ver: 4.70.17

Controller 1 Slot 3, Logical drive=3, Other=0, Firmware=4.70.17, Status=Failed
<< Press Ctrl+I to access the Mini-Configuration Program >>

Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Failed.
Controller is not responding properly - Run Diagnostics.
Error Code: XXXX-YY
```

The sample BIOS screen below shows configuration status and error information.

```
IBM ServeRAID BIOS
Copyright IBM Corp. 1994, 2001. All rights reserved.
BIOS Ver: 4.70.17

Controller 1 Slot 3, Logical drive=3, Other=0, Firmware=4.70.17, Status=OK
<< Press Ctrl+I to access the Mini-Configuration Program >>

Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Passed.
Drive configuration-can take up to 6 Minute(s) 0 Second(s) -- test Failed.
Controller POST and Config Error Codes: ISPR = EF10 BCS = 09 ECS = 20.
Following drives not responding (old state: new state: ch SID)

(RDY:EMP: 2:0)

The system has a configuration error due to above condition(s). Press: F4 - Retry
the command F5 - Update Controller configuration to exclude
NON-RESPONDING drives Warning: NON-RESPONDING drives will be set to
DDD, DHS, or EMP state F10 - Exit without change
```

Note: Do *not* replace a ServeRAID-4 controller or a system board containing an embedded ServeRAID-4 controller for ServeRAID problems unless replacing the controller is listed in Table 12 on page 85.

POST (ISPR) error procedures

The Interrupt Status Port Register (ISPR) Error Procedures list errors, symptoms, and the possible causes. The most probable cause is listed first. Use these procedures to help you solve ServeRAID problems when servicing the computer. A complete list of error codes is in Table 12 on page 85.

EF 10 Default ISPR. No ISPR error present.

9ZXX through BZXX

SCSI bus error caused either by cables, termination, defective drives, and so on.

1. Isolate the error between SCSI subsystem and controller by disconnecting all SCSI cables from suspect card, and reboot.

CAUTION:

Do not press F5. Doing so changes the configuration.

If an ISPR error is still present, take the following actions until the error is no longer present:

- a. Reseat the controller.
- b. Replace the controller.

Note: If the controller detects a configuration change, do *not* choose **Save Changes**. Instead, press **F10** to bypass any options to this effect.

2. If the ISPR error is EF10 after disconnecting cables:
 - a. Confirm that the identified channel(s) is the cause of the error by verifying that the error presents itself only when the offending channel is reconnected.
 - b. Check termination of identified channel.
 - c. Check for proper backplane jumper configuration.
 - d. Check for proper cabling configuration in systems that use DASD status cables. Reconnect all cables that you disconnected at the beginning of this procedure.
 - e. Replace SCSI cable.

- f. Replace SCSI backplane.

FFFF (or other code not listed)

1. Isolate between SCSI Subsystem and controller by disconnecting all SCSI cables attached to the suspect card, and reboot.

CAUTION:

Do not press F5. Doing so changes the configuration.

If ISPR code is EF10 after disconnecting cables, follow the steps below until the error is eliminated:

- a. Identify which channel is causing the error by reconnecting cables one at a time and rebooting until the error returns.
 - b. Disconnect one drive at a time attached to identified channel and reboot each time to determine which drive is causing the problem.
 - c. Replace SCSI cable attached to the identified channel.
 - d. Replace backplane attached to the identified channel.
2. If the original ISPR code is still present after disconnecting all SCSI cables and rebooting, take the following actions until the error is no longer present:
 - a. Reseat the controller.
 - b. Replace the controller.

ServeRAID-4x problems and actions

Table 12 lists problems and corrective actions associated with the adapter. The table helps you determine which adapters might need to be replaced at the conclusion of troubleshooting procedures.

Note: Do *not* replace any controllers until you have followed the POST (ISPR) error procedures (see “POST (ISPR) error procedures” on page 84). Replace a ServeRAID controller only when indicated to do so in the POST (ISPR) error procedures.

XXX in Table 12 is used as a placeholder and can be any letter or number in an actual error message.

Table 12. ServeRAID-4x problems and actions

Problem	Action
1XXX (Microcode Checksum Error)	Check the ServeRAID-4 controller
2XXX through 5XXX (Code DRAM Error)	<ol style="list-style-type: none"> 1. Install download jumpers, flash latest level BIOS and firmware for controller. Remove jumpers. 2. Check the ServeRAID-4 controller.
6XXX (Cache DRAM Error) (ServeRAID-4H only)	<ol style="list-style-type: none"> 1. Reseat daughter card 2. Install download jumpers, flash latest level BIOS and firmware for controller. Remove jumpers. 3. Check the ServeRAID-4 controller.
7XXX through 8XXX (Host/Local PCI Bus Interface Error)	<ol style="list-style-type: none"> 1. Install download jumpers, flash latest level BIOS and firmware for controller. Remove jumpers. 2. Check the ServeRAID-4 controller.

Table 12. ServeRAID-4x problems and actions (continued)

Problem	Action
9ZXX through BZXX SCSI Bus error caused by cables, termination, defective drives, and so on). The Z refers to the specific channel or channels that cause the error.	<ol style="list-style-type: none"> 1. Follow indications in the POST error procedures (see "POST (ISPR) error procedures" on page 84). Follow those instructions before continuing with the next steps listed in this table. 2. SCSI cable. 3. SCSI backplane. 4. Hard drive. 5. Check the ServeRAID-4 controller.
EFFE (Firmware code corrupt or download jumpers are in place)	<ol style="list-style-type: none"> 1. Flash latest level BIOS and firmware for controller. Remove jumpers. 2. Check the ServeRAID-4 controller.
FFFF or other code not listed	<ol style="list-style-type: none"> 1. Follow indications in the POST (ISPR) error procedures ("POST (ISPR) error procedures" on page 84). 2. SCSI cable. 3. SCSI backplane. 4. Hard drive. 5. Check the ServeRAID-4 controller.

Testing the ServeRAID 4x adapter

You can run all diagnostic operations for the ServeRAID adapters through the IBM ServeRAID Configuration software in the **Advanced Functions** option. You can run subsystem diagnostics through the system diagnostics.

Note: Before running any test, back up the current disk array configuration using the ServeRAID diagnostics test program. Always keep a current backup of the ServeRAID configuration information. Dynamic changes might occur in the configuration due to hot-spare replacement.

The IBM PC ServeRAID Adapter diagnostics test program runs independently of the operating system and runs from diskette. You can obtain a copy from the ServerGuide Diskette Factory or download the image from the IBM Web site.

To back up the ServeRAID configuration:

1. From the Main Menu, select **Advanced Functions**
2. Select **Backup IPS ServeRaid Config**

You can use the ServeRAID Subsystem Diagnostic program to test the PC ServeRAID Adapter and the devices connected to it. To test the ServeRAID subsystem:

1. Start the ServeRAID Configuration Utility program.
2. Select **Advanced Functions** from the Main Menu and press **Enter**.
3. Select **IBM ServeRAID Subsystem Diagnostic** from the next menu and press **Enter**.
4. Select the diagnostic test that to run and press **Enter**. Descriptions of the diagnostic tests available include:

Run Adapter Self-tests

Tests the PC ServeRAID Adapter. Restart the server after the self-test completes.

SCSI Device Self-test

Runs diagnostic tests on the SCSI devices attached to the PC ServeRAID Adapter.

Troubleshooting the SCSI HVD 3570 adapter

You can use the troubleshooting chart in Table 13 to find solutions to the HVD adapter problems that have definite symptoms.

Table 13. SCSI HVD 3570 adapter troubleshooting chart

SCSI HVD 3570 adapter problem	Suggested action
The adapter is not operating correctly.	<ol style="list-style-type: none">1. Ensure the the adapter is seated correctly.2. Ensure that all of the SCSI devices are on.3. Ensure that all bus and power cables are connected correctly.4. Ensure that the host adapter and all SCSI devices have unique SCSI IDs.5. Ensure that the pin-1 orientation is maintained throughout the bus.6. Replace the adapter.
Adapter stops operating correctly without apparent cause.	<ol style="list-style-type: none">1. Run the diagnostics.2. Reseat the adapter in its slot, or use a different slot, if necessary.3. The network driver files might be corrupt or missing. Remove and then reinstall the drivers.
BIOS startup messages	<p>Device connected, but not ready Set the Send Start Unit Command to Yes for the host adapter.</p> <p>Start unit request failed Set the Send Start Unit Command to No for the device.</p> <p>Time-out failure during... Ensure the SCSI bus is terminated correctly by following these steps:</p> <ol style="list-style-type: none">1. Disconnect the peripheral cables from the host adapter.2. Restart the engine.3. If the engine restarts successfully, check the bus terminations and cable connections. Also, one of the devices on the bus may be defective.

Troubleshooting the Integrated System Management Processor

1. Insert the ISMP Utility CD-ROM into the CD-ROM drive and restart the NAS 200 engine. If the engine does not boot from the CD-ROM, use POST/BIOS setup to configure the CD-ROM drive as a boot device.
2. After the engine boots, the main menu appears, containing the following selections:
 - Hardware Status and Information
 - Configuration Settings
 - Update System Management firmware
3. Use the up and down arrow keys to select **Hardware Status and Information** and press **Enter**. The Hardware Status and Information menu contains the list of ISMP devices with the following diagnostic test results:

```
Processor Communication : Passed
-> Built in Self Test Status ..... : Passed
Boot Sector Code Revision ... :6, Build ID: RIET62A
Main Application Code Revision :4, Build ID: ILET15A
```

```

Processor Communication : Passed
-> Built in Self Test Status ..... : Passed
Boot Sector Code Revision ... :6, Build ID: WMICT60A
Main Application Code Revision :4, Build ID: WMXT57A

```

4. Use the up and down arrow keys to select the device to view in more detail. Press **Enter**. You see a list of tests and results on the device:

Current System Management Processor Status

```

Current BIST Results:
SRAM Memory Test: Passed
Serial Port 1 Test : Passed
Serial Port 2 Test: Passed
NVRAM Memory Test Passed
Realtime Clock Test Passed
Programmable Gate Array Test: Passed
I2C Interface Test: Passed
Main Application Checksum: Passed
Boot Sector Checksum: Passed

```

Current System Management Adapter Status

```

Current BIST Results:
SRAM Memory Test: Passed
Serial Port 1 Test : Passed
Serial Port 2 Test: Passed
NVRAM Memory Test Passed
Realtime Clock Test Passed
Programmable Gate Array Test: Passed
I2C Interface Test: Passed
Main Application Checksum: Passed
Boot Sector Checksum: Passed
Onboard Ethernet Hardware Test: Passed
PCI EEPROM Initialization Test: Passed

```

5. When you finish viewing this information, press **Esc** to return to the main menu. Remove the CD, then restart the NAS 200 engine.

Troubleshooting the Remote Supervisor Adapter

1. Insert the Remote Supervisor Adapter Support CD into the CD-ROM drive and restart the engine. If the engine does not boot from the CD-ROM, use POST/BIOS setup to configure the CD-ROM drive as a boot device.
2. After the engine boots, the main menu appears, containing the following selections:
 - Hardware Status and Information
 - Configuration Settings
 - Update System Management firmware
3. Use the up and down arrow keys to select **Hardware Status and Information** and press **Enter**. The Hardware Status and Information menu contains the list of devices with the following diagnostic test results:

```

System Management Processor Communication : Passed
-> Built in Self Test Status ..... : Passed
Boot Sector Code Revision ... :16, Build ID: CNET15A
Main Application Code Revision :16, Build ID: TUET15A

```

4. Use the up and down arrow keys to select the device to view in more detail. Press **Enter**. You see a list of tests and results on the device:

Current System Management Processor Status

```

Current BIST Results:
SRAM Memory Test: Passed
Serial Port 1 Test : Passed

```

Serial Port 2 Test:	Passed
NVRAM Memory Test	Passed
Realtime Clock Test	Passed
Programmable Gate Array Test:	Passed
I2C Interface Test:	Passed
Main Application Checksum:	Passed
Boot Sector Checksum:	Passed

Current System Management Adapter Status

Current BIST Results:	
SRAM Memory Test:	Passed
Serial Port 1 Test :	Passed
Serial Port 2 Test:	Passed
NVRAM Memory Test	Passed
Realtime Clock Test	Passed
Programmable Gate Array Test:	Passed
I2C Interface Test:	Passed
Main Application Checksum:	Passed
Boot Sector Checksum:	Passed
Onboard Ethernet Hardware Test:	Passed
PCI EEPROM Initialization Test:	Passed

5. When you finish viewing this information, press **Esc** to return to the main menu. Remove the CD, then restart the engine.

Testing SCSI adapters

The SCSI adapters are used for tape backup operations. You can configure them during engine boot time by entering **Ctrl-A** when prompted. This invokes the BIOS SCSI Select utility. Follow the on-screen directions when this utility appears. The adapters are tested during the boot process.

Chapter 8. Using the Recovery and Supplementary CDs

This chapter describes the applications included on the Supplementary and Recovery CDs, and how and when you should use them.

Attention: Changing the preloaded software configuration of this product, including applying or installing unauthorized service packs or updates to preinstalled software, or installing additional software products that are not included in the preloaded image, on the Supplementary CD, or on the IBM Web site, might not be supported and could cause unpredictable results. For updated compatibility information, go to:

www.ibm.com/storage/support/nas

To correct problems with a preloaded software component, back up your user and system data. Then use the Recovery CD Set to restore the preloaded software image.

As an alternative to using the Recovery CD Set, you can use the restore portion of the disaster recovery solution provided by Persistent Storage Manager (PSM) to recover the appliance, if you meet the requirements. The restore function allows you to restore the appliance to the state it was in at the time of the PSM backup, in one step, without having to revert back to the original (factory) configuration which would require you to subsequently reconfigure networking and other components. See “Restoring the system drive using the PSM recovery diskette” on page 50 to determine whether you have met the requirements. If so, you can use the PSM recovery method. If you have not met the requirements for using the PSM recovery method, or if the PSM recovery fails, then you must use the Recovery CD Set as described in this chapter.

Using the Recovery Enablement Diskette and Recovery CD Set

The Recovery CD Set (four CDs, labeled as “Recovery CD 1,” “Recovery CD 2,” “Recovery CD 3,” and “Recovery CD 4”) contains the preload image for your NAS 200 and is used to recover the preloaded image on your appliance. You must start the appliance using the Recovery Enablement Diskette before you can use Recovery CD 1.

Attention: The NAS 200 does not have a monitor, keyboard, or mouse attached to it under normal operating conditions. Because of this, you cannot interact with the preload-image restore process using a monitor. Starting Recovery CD 1 will, without visually prompting the user, automatically destroy all data on the system drive. Use the Recovery Enablement Diskette and Recovery CD Set only when it is absolutely necessary to restore the preloaded system image.

To recover the preloaded image on an appliance, perform the following steps.

1. Delete all persistent images to ensure a clean reload of the system software.

Note: The recovery process invalidates persistent images and leaves them in a state that is inconsistent with their pre-recovery state.

2. Attach a keyboard and display to the appliance.
3. Insert the Recovery Enablement Diskette into the diskette drive and place Recovery CD 1 into the CD-ROM drive of the appliance.

Important

The Recovery Enablement Diskette restores the NAS 200 from the CD-ROM drive. You will not be able to restore the preload image from the Recovery CD Set without first restarting the appliance using the Recovery Enablement Diskette.

4. Restart the appliance.
5. If you installed additional processor memory on the appliance, the BIOS configuration program will appear. Click **Continue** on the first screen, click **Continue** again, click **Exit Setup**, and finally, click **Yes, save and exit Setup**.
6. When the diskette loads, you will be prompted with a message which asks if you wish to proceed. Enter *Y* to proceed. If you enter *N*, you will be returned to a command prompt.
7. The recovery process begins automatically. Follow the instructions provided by the image restoration software, and the original manufacturing preload will be restored. During the restoration of the preload image, you are prompted to insert the other recovery CDs into the CD-ROM drive. When the preload image is restored, the appliance restarts automatically.
8. If you installed additional processor memory, the BIOS configuration program will now appear a second time. Click **Continue** on the first screen, click **Continue** again, click **Exit Setup**, and finally, click **Yes, save and exit Setup**. You can now detach the keyboard and display from the appliance and allow the recovery process to complete automatically. You may now remove Recovery CD 3 from the CD-ROM drive.

Important

Do not connect to or configure the appliance for at least 15 minutes after system restart. After the appliance restarts, a series of configuration and system preparation programs that finish configuring the appliance run automatically. These programs must finish running before you use any included applications (such as the IBM Advanced Appliance Configuration Utility or the Terminal Services Client) to connect to or configure your NAS 200. This notice applies only to the first time the NAS 200 is started after using the Recovery CD Set.

Logical Disk 0 will be configured to have a 6-GB NTFS boot partition. Any other previously configured logical disk drives, as well as the remainder of Logical Disk 0 (which, on the original hard disk drive of the appliance, contains the Maintenance partition, but for a replacement hard disk drive would not contain any other partitions), will be left unchanged.

9. Reinstall any software updates that are newer than those on the Recovery CD Set.

Using the Supplementary CD

The Supplementary CD contains documentation and copies of key software applications that are preinstalled on your NAS 200. Table 14 on page 93 includes the names of the directories found on the Supplementary CD and a description of the contents of the directory.

Table 14. Supplementary CD directories

Directory name	Contents
IBM Advanced Appliance Configuration	<p>IBM Advanced Appliance Configuration console and agent installation files. The IBM Advanced Appliance Configuration agent is preinstalled as a Windows Powered service on the NAS 200. To install the Advanced Appliance Configuration console (on another network-attached workstation running Windows 98, Windows NT, or Windows 2000), run <code>lpv2setup.exe</code> (if you have Supplementary CD Version 1.6) or <code>setup.bat</code> (if you have Supplementary CD Version 1.0) from the <code>x:\IBM Advanced Appliance Configuration</code> directory, where <code>x</code> is the drive letter assigned to your workstation CD-ROM drive.</p> <p>Note: When the installation is complete, it leaves behind a temporary directory named <code>iaacu</code> on the workstation, under the directory specified by the <code>TEMP</code> environment variable (usually <code>c:\temp</code>; you can determine the value of the <code>TEMP</code> variable by typing <code>set temp</code> from a DOS command prompt). Remove this directory (using Windows Explorer) after the installation has completed.</p>
DiskImages	<p>Diskette images for the Recovery Enablement Diskette and the ServeRAID Configuration Reset diskette.</p> <p>To create the Recovery Enablement Diskette, run <code>RecovDsk.bat</code> and insert an HD 1.44 floppy diskette into drive A: when prompted.</p> <p>Note: Note that in conjunction with NAS 200 software Version 1.6, the NAS 200 Model 200 Tower Model now supports three to six internal hard disk drives. There are different versions of the ServeRAID Configuration Reset diskette for each of the four hard disk drive configurations. Read the file <code>readme.txt</code> in the root directory and <code>readme!.txt</code> in this directory for more information about the diskette images and how to create diskettes from the images.</p> <p>Attention: Starting the NAS 200 with the ServeRAID Configuration Reset diskette removes all RAID configuration changes from your ServeRAID adapter, including any changes you applied to the configuration for any additional storage (internal hard disk drives and/or external storage units) you added to the NAS 200 since you received it, and restore the RAID configuration to its factory default configuration. All data stored in your ServeRAID arrays will be lost. Use this diskette only if you want to reset the NAS 200 to factory default settings. After using the diskette, you must use the Recovery CD (described earlier in this chapter) to restore the preloaded software image on the system drive.</p>
I386	<p>Windows Powered installation files. If you add device drivers, OS features, and so on, you might be prompted to insert your Windows Powered CD-ROM. If so, insert the Supplementary CD, and specify path <code>x:\i386</code>, where <code>x</code> is the drive letter assigned to your CD-ROM drive.</p>
W2KSP2	<p>Windows Powered Service Pack 2, which is preloaded on your NAS 200 (if you are at Version 1.00, Build 54 or later). If you add any device drivers, OS features, and so on, you should reapply Service Pack 2. Run the executable, <code>w2ksp2.exe</code>, and follow the instructions provided.</p>
Services for UNIX	<p>SFU 2.2 installation files, zipped into <code>sfu22.exe</code>. If you add features that are not preloaded, you will be prompted for these installation files. You will need to extract the installation files onto the hard disk drive of your NAS 200. It is recommended that you use the maintenance drive (D: drive) as the destination, but you can use the system drive (C: drive). Ensure that you have at least 250 MB of free space, create a temporary directory on the drive, and then issue the following command from the Services for UNIX directory on the Supplementary CD: <code>sfu22 path</code>, where <code>path</code> is the drive letter and path of the temporary directory. At the prompt, specify the same path you specified in extracting the files from the CD.</p>
Terminal Services Client	<p>The standalone Win32 Terminal Services Client application. The NAS 200 appliance supports Web-based terminal services, so this is an optional installation. To install the Terminal Services Client, run <code>setup.exe</code> from the <code>Disk1</code> subdirectory.</p>
readme.txt	<p>This is a text file that describes the contents of the Supplementary CD.</p>

Appendix A. Notices

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Appendix B. Getting help, service, and information

If you need help, service, technical assistance, or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you.

IBM maintains pages on the World Wide Web where you can get information about IBM products and services and find the latest technical information.

Table 15 lists some of these pages.

Table 15. IBM Web sites for help, services, and information

www.ibm.com	Main IBM home page
www.ibm.com/storage	IBM Storage home page
www.ibm.com/storage/support/nas	IBM NAS Support home page

You might also want to visit the Web pages of other companies for information about other operating systems, software, and accessories. The following are some other Web sites you might find helpful:

www.tivoli.com
www.cdpi.com

Services available and telephone numbers listed are subject to change without notice.

Service support

With the original purchase of an IBM hardware product, you have access to extensive support coverage. During the IBM hardware product warranty period, you may call the IBM Support Center (1-800-426-7378 in the U.S.) for hardware product assistance covered under the terms of the IBM hardware warranty. See “Getting help by telephone” on page 99 for Support Center telephone numbers in other countries.

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 Engineering Changes (ECs) available that apply to your hardware.

Be sure to retain your proof of purchase to obtain warranty service.

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

If possible, be at your computer when you call.

A compatible monitor, keyboard, and mouse may be required for some service activities.

The following items are not covered:

- Replacement or use of non-IBM parts or nonwarranted IBM parts

Note: 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's warranty terms.

Before you call for service

Many computer problems can be solved without outside assistance, by using the online help or by looking in the online or printed documentation that comes with your Model 200. Also, be sure to read the information in any README files that come with your software.

Your Model 200 comes with documentation that contains troubleshooting procedures and explanations of error messages. The documentation that comes with your appliance also contains information about the diagnostic tests you can perform.

If you receive a POST error code or beep code when you turn on your Network Attached Server appliance, refer to the POST error-message charts in your hardware documentation. If you do not receive a POST error code or beep code, but suspect a hardware problem, refer to the troubleshooting information in your hardware documentation or run the diagnostic tests.

If you suspect a software problem, consult the documentation (including any README files) for the operating system or application program.

Getting customer support and service

Purchasing an IBM Network Attached Storage appliance entitles you to standard help and support during the warranty period. If you need additional support and services, a wide variety of extended services are available for purchase that address almost any need.

Getting help online: www.ibm.com/storage/support/nas

Here you can visit a support page that is specific to your hardware, complete with FAQs, parts information, technical hints and tips, technical publications, and downloadable files, if applicable.

Getting help by telephone

During the warranty period, you can get help and information by telephone through the IBM Support Center. Expert technical-support representatives are available to assist you with questions you might have on the following:

- Setting up your Network Attached Storage appliance
- Arranging for service
- Arranging for overnight shipment of customer-replaceable parts

In addition, if you purchased a Network Attached Storage appliance, you are eligible for IBM up-and-running support for 90 days after installation. This service provides assistance for:

- Setting up your appliance
- Limited configuration assistance

Please have the following information ready when you call:

- Machine Type and Model
- Serial numbers of your appliance and other components, or your proof of purchase
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information for your system

If possible, be at your computer when you call.

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.¹

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

Appendix C. Engine POST messages

This appendix identifies and describes POST messages that you might encounter, and gives corrective actions where applicable.

Note: The information in this appendix applies to each engine in the appliance. For example, when the text reads, “When a monitor and keyboard is attached to the appliance,” that means that a monitor and keyboard has been attached to either of the two engines.

Power-on self-test (POST)

When you turn on your NAS 200, its engine performs a power-on self-test (POST) to check the operation of appliance components and some of the options installed in the appliance.

If POST finishes without detecting any problems when a monitor and keyboard are not attached to the appliance, you hear one long and three short beeps. When a monitor and keyboard are attached, you will hear one short beep. Any other series of beeps indicates a problem, and an error message appears on your screen. See “POST beep code descriptions” for more information.

Notes:

1. If you have set a power-on password or administrator password, you must type the password and press **Enter**, when prompted, before POST continues.
2. A single problem might cause several error messages. When this occurs, work to correct the cause of the first error message. After you correct the cause of the first error message, the other error messages usually will not occur the next time you run the test.

POST beep code descriptions

Beep codes are sounded in a series of beeps. For example, a 1-2-4 beep code sounds like one beep, a pause, two consecutive beeps, another pause, and four more consecutive beeps.

The possible types of beep codes that your appliance might emit include the following:

No beeps

If no beep occurs after your appliance completes POST, call for service.

Continuous beep

The recovery enablement disk has booted, your startup (boot) microprocessor has failed, or your system board or speaker subsystem might contain a failing component. If the system continues through POST with no errors, call for service. If no video appears, the startup processor has failed; replace the startup processor.

One short beep

When a monitor and keyboard is attached to the appliance, one beep indicates that your appliance successfully completed POST. POST detected no configuration or functional errors. One beep also occurs after your appliance completes POST if you enter an incorrect power-on password.

Two short beeps

POST encountered an error. The Configuration/Setup Utility program displays additional information; follow the instructions that appear on the screen. See “POST error messages” on page 106 for descriptions of the text messages that might appear.

Three short beeps

A system memory error has occurred. This combination occurs only if the video Basic Input/Output System (BIOS) cannot display the error message. Replace the failing memory module.

Repeating short beeps

The system board might contain a failing component, your keyboard might be defective, or a key on the keyboard might be stuck. Ensure that:

1. Nothing is resting on the keyboard and pressing a key.
2. No key is stuck.
3. The keyboard cable is connected correctly to the keyboard and to the correct connector on the appliance.

Running the diagnostic tests can isolate the appliance component that failed, but you must have your system serviced. If the error message remains, call for service.

Note: If you just connected a new mouse or other pointing device, turn off the appliance and disconnect that device. Wait at least 5 seconds; then, turn on the appliance. If the error message goes away, replace the device.

One long and one short beep

POST encountered an error on a video adapter. If you are using the integrated video controller, call for service. If you are using an optional video adapter, replace the failing video adapter.

One long and two short beeps

A video I/O adapter ROM is not readable, or the video subsystem is defective. If you hear this beep combination twice, both the system board and an optional video adapter have failed the test. This beep combination might also indicate that the system board contains a failing component.

One long and three short beeps

This series of beeps has two meanings. The first means that the POST has completed without detecting errors, when a monitor and keyboard is not attached. However, when a monitor is attached, and you hear this series, it means the system-board video subsystem has not detected a monitor connection to the appliance. Ensure that the monitor is connected properly to the appliance. If the problem persists, replace the monitor.

Two long and two short beeps

POST does not support the optional video adapter. This beep combination occurs when you install a video adapter that is incompatible with your appliance. Replace the optional video adapter with one that the appliance supports or use the integrated video controller.

Table 16 on page 103 describes the codes and specifies the action to take.

POST beep codes

Table 16. POST beep codes

Symptom	FRU/action
1-1-2 (Processor register test failed)	Processor
1-1-3 (CMOS write/read test failed)	1. Battery 2. System board
1-1-4 (BIOS EEPROM checksum failed)	System board
1-2-1 (Programmable Interval Timer failed)	System board
1-2-2 (DMA initialization failed)	System board
1-2-3 (DMA page register write/read failed)	System board
1-2-4 (RAM refresh verification failed)	1. DIMM 2. System board
1-3-1 (1st 64K RAM test failed)	DIMM
1-3-2 (1st 64K RAM parity test failed)	1. DIMM 2. System board
2-1-1 (Secondary DMA register failed)	System board
2-1-2 (Primary DMA register failed)	System board
2-1-3 (Primary interrupt mask register failed)	System board
2-1-4 (Secondary interrupt mask register failed)	System board
2-2-2 (Keyboard controller failed)	1. System board 2. Keyboard
2-2-3 (CMOS power failure and checksum checks failed)	1. Battery 2. System board
2-2-4 (CMOS configuration information validation failed)	1. Battery 2. System board
2-3-1 (Screen initialization failed)	1. Jumper on J14 2. System board
2-3-2 (Screen memory failed)	System board
2-3-3 (Screen retrace failed)	System board
2-3-4 (Search for video ROM failed)	System board
2-4-1 (Video failed; screen believed operable)	System board

Table 16. POST beep codes (continued)

Symptom	FRU/action
3-1-1 (Timer tick interrupt failed)	System board
3-1-2 (Interval timer channel 2 failed)	System board
3-1-3 (RAM test failed above address OFFFFH)	1. DIMM 2. System board
3-1-4 (Time-Of-Day clock failed)	1. Battery 2. System board
3-2-1 (Serial port failed)	System board
3-2-2 (Parallel port failed)	System board
3-2-3 (Math coprocessor failed)	Processor
3-2-4 (Failure comparing CMOS memory size against actual)	1. DIMM 2. Battery
3-3-1 (Memory size mismatch occurred; see the Hardware Installation Guide.)	1. DIMM 2. Battery
3-3-2 (Critical SMBUS error occurred)	1. Disconnect the server power cord from outlet, wait 30 seconds and retry. 2. System board 3. DIMMs 4. DASD backplane 5. Power supply 6. Power supply backplane 7. I2C cable
3-3-3 (No operational memory in system)	1. Install or reseal the memory modules, then do a 3 boot reset. (See the <i>Hardware Installation Guide</i> .) 2. DIMMs 3. Memory board 4. System board
Two Short Beeps (Information only, the configuration has changed)	1. Run diagnostics 2. Run Configuration/Setup
Three Short Beeps	1. DIMM 2. System board
One Continuous Beep	1. Processor 2. System board
Repeating Short Beeps	1. Keyboard 2. System board
One Long and One Short Beep	1. Video adapter (if present) 2. System board

Table 16. POST beep codes (continued)

Symptom	FRU/action
One Long and Two Short Beeps	<ol style="list-style-type: none"> 1. Video adapter (if present) 2. System board
Two Long and Two Short Beeps	Video adapter

Table 17. POST no-beep codes

No Beep Symptom	FRU/action
No beep and the system operates correctly.	<ol style="list-style-type: none"> 1. Check speaker cables 2. Speaker 3. System board
No Beeps occur after successfully completing POST (The Power-On Status is disabled.)	<ol style="list-style-type: none"> 1. Run Configuration/Setup, set the Start Options Power-On Status to enable. 2. Check speaker connections 3. System board
No AC power (Power supply AC LED is off)	<ol style="list-style-type: none"> 1. Check the power cord. 2. Power supply (If two are installed, swap them to determine if one is defective.) 3. Power backplane 4. Hot-swap power AC inlet box
No beep and no video	See the <i>Hardware Installation Guide</i>.
System will not power-up (Power supply AC LED is on)	See the <i>Hardware Installation Guide</i>

POST error messages

Table 18 provides information about the POST error messages that can appear during startup.

Note that these diagnostic error messages require the attachment of a monitor, keyboard, and mouse (before you power on the system) to enable you to see them.

In the following error messages, X can be any number or letter.

Table 18. POST error messages

Error code/Symptom	Meaning	FRU/action
062	Three consecutive boot failures using the default configuration	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Battery 3. System board 4. Processor
101, 102	System and processor error	System board
106	System and processor error	System board
111	Channel check error	<ol style="list-style-type: none"> 1. Failing ISA Adapter 2. DIMM 3. System board
114	Adapter read-only memory error	<ol style="list-style-type: none"> 1. Failing Adapter 2. Run Diagnostics
129	Internal cache error	<ol style="list-style-type: none"> 1. Processor 2. Optional processor (if installed)
151	Real-time clock error	<ol style="list-style-type: none"> 1. Run Diagnostics 2. Battery 3. System board
161	Real-time clock battery error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Battery 3. System board
162	Device Configuration error	<ol style="list-style-type: none"> 1. Run Configuration/Setup Note: Be sure to load the default settings and any additional desired settings; then, <i>save the configuration</i>. 2. Battery 3. Failing Device 4. System board
163	Real-time clock error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Battery 3. System board
164	Memory configuration changed	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. DIMM
175	Hardware error	System board

Table 18. POST error messages (continued)

Error code/Symptom	Meaning	FRU/action
176	Computer cover or cable cover was removed without a key being used	<ol style="list-style-type: none"> Run Configuration/Setup System board C2 Security Switch
177, 178	Security hardware error	<ol style="list-style-type: none"> Run Configuration/Setup System board
184	Power-on password corrupted	<ol style="list-style-type: none"> Run Configuration/Setup System board
185	Drive startup-sequence information corrupted	<ol style="list-style-type: none"> Run Configuration/Setup System board
186	Security hardware-control logic failed	<ol style="list-style-type: none"> Run Configuration/Setup System board
187	VPD serial number not set	<ol style="list-style-type: none"> Set serial number in Setup System board
188	Bad EEPROM CRC #2	<ol style="list-style-type: none"> Run Configuration/Setup System board
189	An attempt was made to access the appliance with invalid passwords	Run Configuration/Setup, enter the administrator password
201	Memory test error	<p>If the appliance does not have the latest level of BIOS installed, update the BIOS to the latest level and run the diagnostic program again.</p> <ol style="list-style-type: none"> DIMM System board
229	Cache error	<ol style="list-style-type: none"> Run Configuration/Setup Processor Second Processor
262	DRAM parity configuration error	<ol style="list-style-type: none"> Battery System board
289	DIMM has been disabled by the user or system	<ol style="list-style-type: none"> Run Configuration/Setup, if disabled by user Disable DIMM, if not disabled by user
301	Keyboard or keyboard-controller error	<ol style="list-style-type: none"> Keyboard System board
303	Keyboard controller error	<ol style="list-style-type: none"> System board Keyboard
602	Invalid diskette boot record	<ol style="list-style-type: none"> Diskette Diskette drive Cable System board

Table 18. POST error messages (continued)

Error code/Symptom	Meaning	FRU/action
604	Diskette-drive error	<ol style="list-style-type: none"> 1. Run Configuration/Setup and diagnostics 2. Diskette Drive 3. Drive cable 4. System board
605	Unlock failure	<ol style="list-style-type: none"> 1. Diskette drive 2. Drive cable 3. System board
662	Diskette-drive configuration error	<ol style="list-style-type: none"> 1. Run Configuration/Setup and Diagnostics 2. Diskette Drive 3. Drive Cable 4. System board
762	Coprocessor configuration error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Battery 3. Processor
962	Parallel-port error	<ol style="list-style-type: none"> 1. Disconnect external cable on parallel port. 2. Run Configuration/Setup 3. System board
11XX	System-board serial port 1 or 2 error	<ol style="list-style-type: none"> 1. Disconnect external cable on serial port. 2. Run Configuration/Setup 3. System board
0001200	Machine-check architecture error	<ol style="list-style-type: none"> 1. Processor 2. Optional Processor
0001295	ECC circuit check	<ol style="list-style-type: none"> 1. System board 2. Processor
1301	I ² C cable to front panel not found	<ol style="list-style-type: none"> 1. Cable 2. Front panel 3. Power switch assembly 4. System board
1302	I ² C cable from system board to power on and reset switches not found	<ol style="list-style-type: none"> 1. Cable 2. Power Switch Assembly 3. System board
1303	I ² C cable from system board to power backplane not found	<ol style="list-style-type: none"> 1. Cable 2. Power backplane 3. System board
1304	I ² C cable to diagnostic LED board not found	<ol style="list-style-type: none"> 1. Cable 2. Diagnostic LED Board 3. Power Switch Assembly 4. System board

Table 18. POST error messages (continued)

Error code/Symptom	Meaning	FRU/action
1600	The Service Processor is not functioning	<ol style="list-style-type: none"> 1. Ensure that a jumper is not installed on J-51 2. Remove the AC power to the system, wait 20 seconds and then reconnect the AC power. Wait 30 seconds; then, power-on the appliance. 3. System board 4. Processor/PCI board
1601	The system is able to communicate to the Service Processor, but the Service Processor failed to respond at the start of POST	<p>Suspected part:</p> <ol style="list-style-type: none"> 1. Remove the AC power to the system, wait 20 seconds, and reconnect the AC power. Wait 30 seconds and power on the system. 2. Flash update the service processor. 3. System board 4. Processor/PCI board
1762	Hard-disk-drive configuration error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Hard disk cables 3. Hard disk adapter 4. Hard disk drive 5. SCSI backplane 6. System board
178X	Hard-disk-drive error	<ol style="list-style-type: none"> 1. Run diagnostics 2. Hard disk cables 3. Hard disk adapter 4. Hard disk drive 5. System board
1800	No more hardware interrupts available for PCI adapter	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Failing adapter 3. System board
1962	Drive does not contain a valid boot sector	<ol style="list-style-type: none"> 1. Verify that a bootable operating system is installed. 2. Run diagnostics 3. Hard disk drive 4. SCSI backplane 5. Cable 6. System board
5962	IDE CD-ROM configuration error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. CD-ROM drive 3. CD-ROM power cable 4. IDE Cable 5. System board 6. Battery
8603	Pointing-device error	<ol style="list-style-type: none"> 1. Pointing device 2. System board

Table 18. POST error messages (continued)

Error code/Symptom	Meaning	FRU/action
00019501	Processor 1 is not functioning	<ol style="list-style-type: none"> 1. Check VRM and processor LEDs 2. VRM 1, VRM 2 3. Processor 1 4. Processor board 5. System board
00019502	Processor 2 is not functioning	<ol style="list-style-type: none"> 1. Check VRM and processor LEDs 2. VRM 2 3. Processor 2 4. System board
00019701	Processor 1 failed BIST	<ol style="list-style-type: none"> 1. Processor 1 2. System board
00019702	Processor 2 failed BIST	<ol style="list-style-type: none"> 1. Processor 2 2. System board
00180100	No room for PCI option ROM	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Failing adapter 3. System board
00180200	No more I/O space available for PCI adapter	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Failing adapter 3. System board
00180300	No more memory (above 1 MB for PCI adapter)	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Failing adapter 3. System board
00180400	No more memory (below 1 MB for PCI adapter)	<ol style="list-style-type: none"> 1. Move the failing adapter to slot 1 or 2 2. Run Configuration/Setup 3. Failing adapter 4. System board
00180500	PCI-option ROM checksum error	<ol style="list-style-type: none"> 1. Remove failing PCI card 2. System board
00180600	PCI built-in self-test failure; PCI-to PCI-bridge error	<ol style="list-style-type: none"> 1. Run Configuration/Setup 2. Move the failing adapter to slot 1 or 2 3. Failing adapter 4. System board
00180700, 00180800	General PCI error	<ol style="list-style-type: none"> 1. System board 2. PCI card
01295085	ECC checking hardware test error	Processor
01298001	No update data for processor 1	<ol style="list-style-type: none"> 1. Ensure that all processors are the same stepping level and cache size. 2. Processor 1

Table 18. POST error messages (continued)

Error code/Symptom	Meaning	FRU/action
01298002	No update data for processor 2	<ol style="list-style-type: none"> 1. Ensure that all processors are the same stepping level and cache size. 2. Processor 2
01298101	Bad update data for processor 1	<ol style="list-style-type: none"> 1. Ensure that all processors are the same stepping level and cache size. 2. Processor 1
01298102	Bad update data for processor 2	<ol style="list-style-type: none"> 1. Ensure that all processors are the same stepping level and cache size. 2. Processor 2
I9990301	Fixed boot sector error	<ol style="list-style-type: none"> 1. Hard disk drive 2. SCSI backplane 3. Cable 4. System board
I9990305	Fixed boot sector error, no operating system installed	Install the operating system to the hard disk drive
I9990650	AC power has been restored	<ol style="list-style-type: none"> 1. Check power cable 2. Check for interruption of power supply

Event/error logs

The POST error log contains the three most recent error codes and messages that the system generated during POST. The System Event/Error Log contains all error messages issued during POST and all system status messages from the Advanced System Management Processor. In event of a POST error, check the System Event/Error Log as it may indicate the most recent errors commonly associated with typical hardware failures. It may not detect all hardware failures but many times will provide an indicator as to the nature of key failures.

To view the contents of the error logs, start the Configuration/Setup Utility program, then select **Event/Error Logs** from the main menu.

POST diagnostic programs

The appliance diagnostic programs are stored in upgradable read-only memory (ROM) on the system board. These programs are the primary method of testing the major components of your appliance.

Diagnostic program error messages indicate that a problem exists; they are not intended to be used to identify a failing part. Troubleshooting and servicing of complex problems that are indicated by error messages should be performed by trained service personnel. For a list of error messages and associated actions that you can take, see Table 18 on page 106.

Sometimes the first error to occur causes additional errors. In this case, the appliance displays more than one error message. Always follow the suggested action instructions for the *first* error message that appears.

The following sections contain the error codes that might appear in the detailed test log and summary log when running the diagnostic programs.

The error code format is as follows:

fff-ttt-iii-date-cc-text message

fff The three-digit function code that indicates the function being tested when the error occurred. For example, function code 089 is for the microprocessor.

ttt The three-digit failure code that indicates the exact test failure encountered.

iii The three-digit device ID.

date The date that the diagnostic test was run and the error recorded.

cc The check digit used to verify the validity of the information.

text message

The diagnostic message that indicates the reason for the problem.

Text messages

The diagnostic text message format is as follows:

Function Name: Result (Test Specific String)

Function Name

The name of the function being tested when the error occurred. This corresponds to the function code (fff) given in the previous list.

Result Can be one of the following:

Passed

The diagnostic test has completed without any errors.

Failed The diagnostic test has discovered an error.

User Aborted

You stopped the diagnostic test before it is complete.

Not Applicable

You specified a diagnostic test for a device that is not present.

Aborted

The test could not proceed because of the system configuration.

Warning

A possible problem was reported during the diagnostic test, such as when a device that is to be tested is not installed.

Test Specific String

This is additional information that you can use to analyze the problem.

Starting the diagnostic programs

To start the diagnostic programs:

1. Connect a monitor, keyboard, and mouse to your NAS 200.
2. Power on the NAS 200 and watch the screen.

Notes:

- a. When you do **not** have a monitor, keyboard, and mouse attached and the NAS 200 engine passes POST, one long and three short beeps sound.

- b. When you **have** a monitor, keyboard, and mouse attached and the NAS 200 engine passes POST, one beep sounds. If the NAS 200 fails POST, a series of beeps sound (see “POST beep code descriptions” on page 101 for more details) and an error message appears on the monitor screen.
3. When the message F2 for Diagnostics appears, press **F2**. If a POST error is encountered, a series of beeps sound and an error message appears on the monitor screen.
4. Type in the appropriate password, then press **Enter**. If a system error is encountered, the Configuration/Setup screen appears. Press **Esc** to start the Diagnostic program.

Note: To run the diagnostic programs, you must start the NAS 200 with the highest level password that is set. That is, if an administrator password is set, you must enter the administrator password, not the power-on password, to run the diagnostic programs.

5. Select either **Extended** or **Basic** from the top of the screen. (*PC-Doctor 2.0* with a copyright statement appears at the bottom of this screen.)
6. When the Diagnostic Programs screen appears, select the test to run from the list that appears; then, follow the instructions on the screen.

Notes:

- a. Press **F1** while running the diagnostic programs to obtain Help information. Also press **F1** from within a help screen to obtain online documentation from which you can select different categories. To exit Help and return to where you left off, press **Esc**.
- b. If the NAS 200 engine stops during testing and you cannot continue, restart the NAS 200 engine and try running the diagnostic programs again.
- c. If you run the diagnostic programs with either no mouse or a USB mouse attached to your NAS 200 engine, you will not be able to navigate between test categories using the **Next Cat** and **Prev Cat** buttons. All other functions provided by mouse-selectable buttons are also available using the function keys.
- d. You can test the USB keyboard by using the regular keyboard test. The regular mouse test can test a USB mouse. Also, you can run the USB hub test only if there are no USB devices attached.
- e. You can view NAS 200 engine configuration information (such as system configuration, memory contents, interrupt request (IRQ) use, direct memory access (DMA) use, device drivers, and so on) by selecting **Hardware Info** from the top of the screen.
- f. You cannot use the diagnostics program to test adapters. Use the procedure outlined in “Adapter troubleshooting and diagnostics” on page 74.

When the tests have completed, you can view the Test Log by selecting **Utility** from the top of the screen.

If the hardware checks out OK but the problem persists during normal NAS 200 operations, a software error might be the cause. If you suspect a software problem, refer to the information that comes with the software package.

Viewing the test log

The test log will not contain any information until after the diagnostic program has run.

Note: If you already are running the diagnostic programs, begin with Step 4

To view the test log:

1. Ensure a monitor, keyboard, and mouse is connected to the NAS 200.
 2. Power on the NAS 200 engine and watch the screen.
If the NAS 200 engine is on, shut down your operating system and restart the engine.
 3. When the message F2 for Diagnostics appears, press **F2**.
If a power-on password or administrator password is set, you will be prompted for it. Type in the appropriate password, then press **Enter**.
 4. When the Diagnostic Programs screen appears, select **Utility** from the top of the screen.
 5. Select **View Test Log** from the list that appears; then, follow the instructions on the screen.
- The system maintains the test-log data while the NAS 200 is powered on. When you turn off the power to the NAS 200, the test log is cleared.

Diagnostic error message tables

Table 19 describes the error messages that might appear when you run the diagnostic programs.

Important: If diagnostic error messages that are not listed in Table 19 appear, make sure that your appliance has the latest levels of BIOS, Integrated System Management Processor, ServeRAID, and diagnostics microcode.

In the following error codes, if *XXX* is 000, 195, or 197, *do not* replace a part. These error codes have the following meanings:

000 The test passed.

195 **Esc** was pressed to end the test.

197 This is a warning error and might not indicate a hardware failure.

For all other error codes, replace the part or perform the actions indicated.

Table 19. Diagnostic error messages

Error Code	Meaning	FRU/action
001-XXX-000	Failed core tests	System board
001-XXX-001	Failed core tests	System board
001-250-000	Failed System board ECC	System board
001-250-001	Failed Processor board ECC	1. Processor/PCI board 2. System board
005-XXX-000	Failed Video test	System board
011-XXX-000	Failed COM1 Serial Port test	System board
011-XXX-001	Failed COM2 Serial Port test	System board
014-XXX-000	Failed Parallel Port test	System board
015-XXX-001	Failed USB test	System board

Table 19. Diagnostic error messages (continued)

Error Code	Meaning	FRU/action
015-XXX-015	Failed USB external loopback test	<ol style="list-style-type: none"> 1. Make sure parallel port is not disabled 2. Re-run USB external loopback test 3. System board
015-XXX-198	USB device connected during the USB test	<ol style="list-style-type: none"> 1. Remove USB devices from USB1 and USB2 2. Re-run USB external loopback test 3. System board
020-XXX-000	Failed PCI Interface test	System board
020-XXX-001	Failed Hot-Swap Slot 1 PCI Latch test.	<ol style="list-style-type: none"> 1. PCI hot-swap latch assembly 2. System board
020-XXX-002	Failed hot-swap slot 2 PCI latch test	<ol style="list-style-type: none"> 1. PCI hot-swap latch assembly 2. System board
020-XXX-003	Failed hot-swap slot 3 PCI latch test	<ol style="list-style-type: none"> 1. PCI hot-swap latch assembly 2. System board
020-XXX-004	Failed hot-swap slot 4 PCI latch test	<ol style="list-style-type: none"> 1. PCI hot-swap latch assembly 2. System board
030-XXX-000	Failed internal SCSI interface test	System board
035-XXX-099	No adapters were found	If the adapter is installed, recheck the connection.
035-XXX-S99	Failed RAID test on PCI slot S	<p>Note: Check the System Error Log before replacing a part.</p> <ol style="list-style-type: none"> 1. Adapter 2. SCSI backplane 3. Cable
035-XXX-SNN	NW = SCSI ID of failing hard disk	<p>Note: Check the System Error Log before replacing a part.Hard disk drive with SCSI ID NW on RAID adapter in PCI slot S.</p>
035-253-S99	RAID adapter initialization failure; ServeRAID Adapter in slot S is not configured properly	<ol style="list-style-type: none"> 1. Obtain the basic and extended configuration status and refer to the <i>ServeRAID Hardware Maintenance Manual</i> for more information 2. Adapter 3. SCSI backplane 4. Cable
075-XXX-000	Failed power supply test	Power supply
089-XXX-001	Failed microprocessor test	<ol style="list-style-type: none"> 1. VRM 1 for microprocessor 1 2. Microprocessor 1
089-XXX-002	Failed test for optional microprocessor	<ol style="list-style-type: none"> 1. VRM 2 2. Optional microprocessor 2
166-250-000	System Management failed: (I2C cable is disconnected. Reconnect I2C cable between Remote Supervisor Adapter and system board.)	<ol style="list-style-type: none"> 1. Reseat the I2C cables between Remote Supervisor Adapter (in PCI slot 1/J44) and system board (J45) 2. I2C cables

Table 19. Diagnostic error messages (continued)

Error Code	Meaning	FRU/action
166-198-000	System Management aborted: (Unable to communicate with the Remote Supervisor Adapter. It may be busy. Run the test again). (Communication with the Remote Supervisor Adapter has failed).	<ol style="list-style-type: none"> 1. Re-run the Diagnostic Test 2. Fix other error conditions and retry. These include other Failed System Management tests and items logged in the optional Remote Supervisor Adapter's System Error Log 3. Disconnect all server and option power cords from the unit, wait 30 seconds, reconnect, and retry. 4. Remote Supervisor Adapter, if installed 5. System board
166-201-001	System Management failed: (I2C Bus Error(s)) (ISMP indicates I2C errors on bus 0. Potential FRUs: Memory DIMMs, system board)	<ol style="list-style-type: none"> 1. If installed, reseal I2C cable between Remote Supervisor Adapter (in PCI slot 1/J44) and system board 2. Reseat memory DIMMs 3. Memory DIMMs 4. System board
166-201-002	System Management failed: (I2C Bus Error(s)) (ISMP indicates I2C errors on bus 2. Potential FRUs: LED front panel, system board).	<ol style="list-style-type: none"> 1. Reseat I2C cable between operator information panel and system board (J39) 2. Operator information panel 3. System board
166-201-003	System Management failed: (I2C Bus Error(s)) (ISMP indicates I2C errors on bus 3. Potential FRUs: power backplane, system board).	<ol style="list-style-type: none"> 1. Reseat cables between power backplane and system board 2. Operator information panel 3. System board
166-201-004	System Management failed: (I2C Bus Error(s)) (ISMP indicates I2C errors on bus 4. Potential FRUs: DASD backplane, system board).	<ol style="list-style-type: none"> 1. If installed, reseal I2C cable between IBM Netfinity 3-Pack Ultra160 Hot-Swap Expansion Kit and DASD backplane and DASD I2C on system board (J0) 2. System board
166-201-005	System Management failed: (I2C Bus Error(s)) (ISMP indicates I2C errors on bus 0, 1, or 5. Potential FRUs: Memory DIMMs, CPUs, system board).	<ol style="list-style-type: none"> 1. Reseat Memory DIMMs 2. Reseat processors 3. Memory DIMMs 4. Processors 5. System board
166-260-000	System Management failed: (Unable to restart Remote Supervisor Adapter). Restart Remote Supervisor Adapter Error. After restarting, Remote Supervisor Adapter communication was lost. Unplug and cold boot to reset the Remote Supervisor Adapter).	<ol style="list-style-type: none"> 1. Disconnect all server and option power cords from server, wait 30 seconds, reconnect, and retry. 2. Reseat the Remote Supervisor Adapter in PCI slot 1/J44. 3. Remote Supervisor Adapter

Table 19. Diagnostic error messages (continued)

Error Code	Meaning	FRU/action
166-342-000	System Management failed: Remote Supervisor Adapter BIST indicate failed tests).	<ol style="list-style-type: none"> 1. Ensure that the latest firmware levels for the Remote Supervisor Adapter and BIOS 2. Disconnect all server and option power cords from the unit, wait 30 seconds, reconnect, then retry. 3. Remote Supervisor Adapter
166-400-000	System Management failed: System management hardware on system board failed) (ISMP Self Test Result failed tests: x where x = Flash, RAM, or ROM).	<ol style="list-style-type: none"> 1. Re-flash or update firmware for ISMP 2. System board
180-XXX-000	Diagnostics LED failure	Run the diagnostics LED test for the failing LED.
180-XXX-001	Failed front LED panel test	
180-XXX-002	Failed diagnostics LED panel test	<ol style="list-style-type: none"> 1. System board 2. Power-switch assembly
180-XXX-005	Failed SCSI backplane LED test	<ol style="list-style-type: none"> 1. SCSI backplane 2. SCSI backplane cable 3. System board
180-XXX-006	Memory Board LED test	Suspected part: <ol style="list-style-type: none"> 1. Memory 2. Processor/PCI board 3. System board
180-361-003	Failed fan LED test	<ol style="list-style-type: none"> 1. Fans 2. System board
201-XXX-0NN	Failed Memory test	<ol style="list-style-type: none"> 1. DIMM Location DIMM1 - DIMM4 where NN can be a value from 01 to 04. 01 = DIMM2, 02 = DIMM1, 03 = DIMM4, 04 = DIMM3 2. System board
201-XXX-999	Multiple DIMM failure; see error text for failing DIMMs	<ol style="list-style-type: none"> 1. See error text for failing DIMMs 2. System board
202-XXX-001	Failed system cache test	<ol style="list-style-type: none"> 1. VRM 1 2. Microprocessor 1
202-XXX-002	Failed system cache test	<ol style="list-style-type: none"> 1. VRM 2 2. Microprocessor 2
206-XXX-000	Failed diskette drive test	<ol style="list-style-type: none"> 1. Cable 2. Diskette drive 3. System board
215-XXX-000	Failed IDE CD-ROM test	<ol style="list-style-type: none"> 1. CD-ROM drive cables 2. CD-ROM drive 3. System board
217-198-XXX	Could not establish drive parameter	<ol style="list-style-type: none"> 1. Check cable and termination 2. SCSI backplane 3. Fixed disk

Table 19. Diagnostic error messages (continued)

Error Code	Meaning	FRU/action
217-XXX-000	Failed BIOS hard disk drive test Note: If RAID is configured, the hard disk drive number refers to the RAID logical array.	Hard disk drive 1
217-XXX-001	Failed BIOS hard disk drive test Note: If RAID is configured, the hard disk drive number refers to the RAID logical array.	Hard disk drive 2
217-XXX-002	Failed BIOS hard disk drive test. Note: If RAID is configured, the hard disk drive number refers to the RAID logical array	Hard disk drive 3
217-XXX-003	Failed BIOS hard disk drive test Note: If RAID is configured, the hard disk drive number refers to the RAID logical array.	Hard disk drive 4
217-XXX-004	Failed BIOS hard disk drive test Note: If RAID is configured, the hard disk drive number refers to the RAID logical array.	Hard disk drive 5
217-XXX-005	Failed BIOS Fixed Disk test Note: If RAID is configured, the hard disk drive number refers to the RAID logical array.	Hard disk drive 6
264-XXX-0NN	Failed tape-drive test	<ol style="list-style-type: none"> 1. Tape cartridge, if user executed the read/write tape drive test (XXX = 256) 2. SCSI or power cable connected to tape drive with SCSI ID <i>NN</i>. 3. Tape drive with SCSI ID <i>NN</i> (Refer to the Help and Service Information appendix of the tape drive's user guide). 4. System board or SCSI Controller (Run SCSI controller diagnostic to determine if the SCSI bus is functioning correctly.)
264-XXX-999	Errors on multiple tape drives	See error messages/text in the PC Doctor error log for detailed information on each individual tape drive error.
301-XXX-000	Failed Keyboard test	Keyboard
405-XXX-000	Failed Ethernet test on controller on the system board	<ol style="list-style-type: none"> 1. Verify that Ethernet is not disabled in BIOS 2. System board

Table 19. Diagnostic error messages (continued)

Error Code	Meaning	FRU/action
405-XXX-00N	Failed Ethernet test on adapter in PCI slot N	<ol style="list-style-type: none"> 1. Adapter in PCI slot N. 2. System board
415-XXX-000	Failed modem test	Suspected part: <ol style="list-style-type: none"> 1. Cable 2. Modem Note: Ensure that the modem is present and attached to appliance. 3. System board

Appendix D. Adapter placement information

This section contains information on the proper placement of the various adapters.

The following abbreviations for adapter names are used in the tables:

Tape	In the Model 200, a SCSI SE adapter, a SCSI LVD/SE adapter, or a SCSI HVD. In the Model 225, a SCSI SE adapter, a SCSI LVD/SE adapter, a SCSI HVD adapter, or a Fibre Channel adapter
RSA	Remote Supervisor Adapter
Quad	10/100 Quad-Port Ethernet Adapter
ServeRAID	ServeRAID controller (ServeRAID-4Lx Ultra160 SCSI controller standard in the Model 200; ServeRAID-4H Ultra160 SCSI controller standard in Model 225, or ServeRAID-4Mx Ultra160 SCSI optional in Model 200)
Ethernet	IBM 10/100 Ethernet adapter
Gigabit	IBM Gigabit Ethernet SX Server adapter
PRO/1000	PRO/1000 XT Server adapter

Note: You can install a maximum of two IBM Gigabit Ethernet SX Server adapters, two PRO/1000 XT Server adapters, or one of each. You cannot install two IBM Gigabit Ethernet SX Server adapters **and** two PRO/1000 XT Server adapters.

Table 20. None or one-adapter configuration

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
(None)			ServeRAID		
Gigabit			ServeRAID		Gigabit
PRO/1000			ServeRAID		PRO/1000
Quad			ServeRAID		Quad
Tape		Tape	ServeRAID		
Ethernet	Ethernet		ServeRAID		
RSA	RSA		ServeRAID		

Table 21. Two-adapter configuration

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
Gigabit, Gigabit			ServeRAID	Gigabit	Gigabit
Gigabit, PRO/1000			ServeRAID	PRO/1000	Gigabit
Gigabit, Tape		Tape	ServeRAID		Gigabit
Gigabit, Quad			ServeRAID	Quad	Gigabit
Gigabit, Ethernet	Ethernet		ServeRAID		Gigabit
Gigabit, RSA	RSA		ServeRAID		Gigabit
PRO/1000, Tape		Tape	ServeRAID		PRO/1000

Table 21. Two-adapter configuration (continued)

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
PRO/1000, Quad			ServeRAID	Quad	PRO/1000
PRO/1000, Ethernet	Ethernet		ServeRAID		PRO/1000
PRO/1000, RSA	RSA		ServeRAID		PRO/1000
PRO/1000, PRO/1000			ServeRAID	PRO/1000	PRO/1000
Tape, Quad		Tape	ServeRAID		Quad
Tape, Ethernet	Ethernet	Tape	ServeRAID		
Tape, RSA	RSA	Tape	ServeRAID		
Quad, Ethernet	Ethernet		ServeRAID		Quad
Quad, RSA	RSA		ServeRAID		Quad
Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID		
Ethernet, RSA	RSA	Ethernet	ServeRAID		

Table 22. Three-adapter configuration

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
Gigabit, Gigabit, Tape		Tape	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Quad		Quad	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Ethernet	Ethernet		ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, RSA	RSA		ServeRAID	Gigabit	Gigabit
Gigabit, PRO/1000, Tape		Tape	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Quad		Quad	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Ethernet	Ethernet		ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, RSA	RSA		ServeRAID	PRO/1000	Gigabit
Gigabit, Tape, Quad		Tape	ServeRAID	Quad	Gigabit
Gigabit, Tape, Ethernet	Ethernet	Tape	ServeRAID		Gigabit
Gigabit, Tape, RSA	RSA	Tape	ServeRAID		Gigabit
Gigabit, Quad, Ethernet	Ethernet		ServeRAID	Quad	Gigabit
Gigabit, Quad, RSA	RSA		ServeRAID	Quad	Gigabit
Gigabit, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID		Gigabit
Gigabit, Ethernet, RSA	RSA	Ethernet	ServeRAID		Gigabit
PRO/1000, PRO/1000, Tape		Tape	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Quad		Quad	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Ethernet	Ethernet		ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, RSA	RSA		ServeRAID	PRO/1000	PRO/1000
PRO/1000, Tape, Quad		Tape	ServeRAID	Quad	PRO/1000
PRO/1000, Tape, Ethernet	Ethernet	Tape	ServeRAID		PRO/1000
PRO/1000, Tape, RSA	RSA	Tape	ServeRAID		PRO/1000
PRO/1000, Quad, Ethernet	Ethernet		ServeRAID	Quad	PRO/1000

Table 22. Three-adapter configuration (continued)

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
PRO/1000, Quad, RSA	RSA		ServeRAID	Quad	PRO/1000
PRO/1000, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID		PRO/1000
PRO/1000, Ethernet, RSA	RSA	Ethernet	ServeRAID		PRO/1000
Tape, Quad, Ethernet	Ethernet	Tape	ServeRAID		Quad
Tape, Ethernet, Ethernet	Ethernet	Tape	ServeRAID	Ethernet	
Tape, Ethernet, RSA	RSA	Tape	ServeRAID	Ethernet	
Quad, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID		Quad
Quad, Ethernet, RSA	RSA	Ethernet	ServeRAID		Quad
Ethernet, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Ethernet	
Ethernet, Ethernet, RSA	RSA	Ethernet	ServeRAID	Ethernet	

Table 23. Four-adapter configuration

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
Gigabit, Gigabit, Tape, Quad	Tape	Quad	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Tape, Ethernet	Ethernet	Tape	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Tape, RSA	RSA	Tape	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Quad, Ethernet	Ethernet	Quad	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Quad, RSA	RSA	Quad	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Gigabit	Gigabit
Gigabit, Gigabit, Ethernet, RSA	RSA	Ethernet	ServeRAID	Gigabit	Gigabit
Gigabit, PRO/1000, Tape, Quad	Tape	Quad	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Tape, Ethernet	Ethernet	Tape	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Tape, RSA	RSA	Tape	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Quad, Ethernet	Ethernet	Quad	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Quad, RSA	RSA	Quad	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	PRO/1000	Gigabit
Gigabit, PRO/1000, Ethernet, RSA	RSA	Ethernet	ServeRAID	PRO/1000	Gigabit
Gigabit, Tape, Quad, Ethernet	Ethernet	Tape	ServeRAID	Quad	Gigabit
Gigabit, Tape, Quad, RSA	RSA	Tape	ServeRAID	Quad	Gigabit
Gigabit, Tape, Ethernet, Ethernet	Ethernet	Tape	ServeRAID	Ethernet	Gigabit
Gigabit, Tape, Ethernet, RSA	RSA	Tape	ServeRAID	Ethernet	Gigabit
Gigabit, Ethernet, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Ethernet	Gigabit
Gigabit, Ethernet, Ethernet, RSA	RSA	Ethernet	ServeRAID	Ethernet	Gigabit
Gigabit, Quad, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Quad	Gigabit
Gigabit, Quad, Ethernet, RSA	RSA	Ethernet	ServeRAID	Quad	Gigabit
PRO/1000, PRO/1000, Tape, Quad	Tape	Quad	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Tape, Ethernet	Ethernet	Tape	ServeRAID	PRO/1000	PRO/1000

Table 23. Four-adapter configuration (continued)

Configuration	PCI slot-1 (32-bit, 33-MHz)	PCI slot-2 (64-bit, 33-MHz)	PCI slot-3 (64-bit, 33-MHz)	PCI slot-4 (64-bit, 66-MHz)	PCI slot-5 (64-bit, 66-MHz)
PRO/1000, PRO/1000, Tape, RSA	RSA	Tape	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Quad, Ethernet	Ethernet	Quad	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Quad, RSA	RSA	Quad	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	PRO/1000	PRO/1000
PRO/1000, PRO/1000, Ethernet, RSA	RSA	Ethernet	ServeRAID	PRO/1000	PRO/1000
PRO/1000, Tape, Quad, Ethernet	Ethernet	Tape	ServeRAID	Quad	PRO/1000
PRO/1000, Tape, Quad, RSA	RSA	Tape	ServeRAID	Quad	PRO/1000
PRO/1000, Tape, Ethernet, Ethernet	Ethernet	Tape	ServeRAID	Ethernet	PRO/1000
PRO/1000, Tape, Ethernet, RSA	RSA	Tape	ServeRAID	Ethernet	PRO/1000
PRO/1000, Quad, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Quad	PRO/1000
PRO/1000, Quad, Ethernet, RSA	RSA	Ethernet	ServeRAID	Quad	PRO/1000
Tape, Quad, Ethernet, Ethernet	Ethernet	Tape	ServeRAID	Ethernet	Quad
Tape, Quad, Ethernet, RSA	RSA	Tape	ServeRAID	Ethernet	Quad
Tape, Ethernet, Ethernet, Ethernet	Ethernet	Tape	ServeRAID	Ethernet	Ethernet
Tape, Ethernet, Ethernet, RSA	RSA	Tape	ServeRAID	Ethernet	Ethernet
Ethernet, Ethernet, Ethernet, Ethernet	Ethernet	Ethernet	ServeRAID	Ethernet	Ethernet
Ethernet, Ethernet, Ethernet, RSA	RSA	Ethernet	ServeRAID	Ethernet	Ethernet
Ethernet, Ethernet, Ethernet, Quad	Ethernet	Ethernet	ServeRAID	Ethernet	Quad
Ethernet, Ethernet, Quad, RSA	RSA	Ethernet	ServeRAID	Ethernet	Quad

Glossary of terms and abbreviations

Note: This glossary of terms and abbreviations is under construction. Some entries might not be complete.

This glossary includes terms and definitions from:

- *The American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018. Definitions are identified by the symbol (A) after the definition.
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- *The Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.

Numerics

10BASE2. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using RG 58 A/U and RG 58 C/U coaxial cable and BNC connectors. 10BASE2 is sometimes called thin Ethernet or thinnet.

10BASE5. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using a 50-ohm coaxial cable with Type N connectors over a distance of up to 500 m (1640 ft) without using repeaters. 10BASE5 is sometimes called thick Ethernet or thicknet.

10BASE-FL. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using optical fiber.

10BASE-T. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using two twisted-pair wires (Category 3 telephone wiring). 10BASE-T is the most widely deployed 10-Mbps Ethernet transmission protocol in use today.

100BASE-T. The IEEE 802.3 Ethernet standard that supports a transmission rate of 100 Mbps using 2 twisted-pair wires (Category 5 telephone wiring).

A

access control. In computer security, the process of ensuring that the resources of a computer system can be accessed only by authorized users in authorized ways.

access control list (ACL). (1) In computer security, a collection of all access rights for one object. (2) In computer security, a list associated with an object that identifies all the subjects that can access the object and their access rights; for example, a list associated with a file that identifies users who can access the file and identifies their access rights to that file.

accessory. An IBM designation for a separately orderable part that (a) has no type number, (b) is for purchase only, and (c) does not receive normal IBM maintenance.

active-backup. A type of bond group that provides high availability. Two or more ports are combined under a logical bond group with one link active and the other link or links left idle. The idle links are ready to take over in the event that the currently active link fails. See bond group.

active dispatcher node. The engine within a load-balancing group that functions as the load balancer for that group. Because each NAS engine can have multiple physical and bonded interfaces, there can be more than one load-balancing engine per set of engines. Each load-balancing engine acts as an active backup for another load-balancing engine within that set. Alternatively, there can be only one active load-balancing engine per set of engines and one passive backup (standby) load-balancing engine.

actual data transfer rate. The average number of bits, characters, or blocks per unit of time transferred from a data source and received by a data sink.

adapter address. The hexadecimal digits that identify an adapter.

adaptive cut-through switching. A mode of operation for LAN switches in which they will automatically alternate between cut-through switching and store-and-forward switching depending on user-configurable, per port, error-rate thresholds.

advertise. To pass routing reachability information along from one router to another.

all-routes broadcast frame. A frame that has bits in the routing information field set to indicate that the frame is to be sent to all LAN segments in the network (across all bridges, even if multiple paths allow multiple copies of the frame to arrive at some LAN segments). The destination address is not examined and plays no role in bridge routing.

all-stations broadcast frame. A frame whose destination address bits are set to all ones. All stations on any LAN segment on which the frame appears will copy it. The routing information, not the destination address, determines which LAN segments the frame appears on. All-stations broadcasting is independent of all-routes broadcasting; the two can be done simultaneously or one at a time.

alternate adapter. In a personal computer that is used on a LAN and that supports installation of two network adapters, the adapter that uses alternate (not standard or default) mapping between adapter-shared RAM, adapter ROM, and designated computer memory segments. The alternate adapter is usually designated as adapter 1 in configuration parameters. Contrast with primary adapter.

alternate memory mapping. The mapping between adapter-shared RAM, adapter ROM, and the designated computer memory segments for an alternate network adapter.

assigned disk. A disk that is mapped to a logical drive.

asynchronous. A class of data transmission service whereby all requests for service contend for a pool of dynamically allocated ring bandwidth and response time.

asynchronous data transfer. A physical transfer of data to or from a device that occurs without a regular or predictable time relationship following execution of an I/O request. Contrast with synchronous data transfer.

asynchronous transfer mode (ATM). A transfer mode in which the information is organized into cells; it is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic. ATM is specified in international standards such as ATM Forum UNI 3.1.

asynchronous transmission. A method of transmission in which the time intervals between characters do not have to be equal. Start and stop bits are added to coordinate the transfer of characters.

ATM. See asynchronous transfer mode.

attach. To make a device a part of a network logically. Not to be confused with connect, which implies physically connecting a device to a network. Contrast with connect.

attachment. A port or a pair of ports, optionally including an associated optical bypass, that are managed as a functional unit. A dual attachment includes two ports: a port A, and a port B. A single attachment includes a Port S.

attachment feature. (1) The circuitry by which some host processors or controllers are connected to a LAN access unit or connection point. (2) A feature that can be added to enhance the capability, storage capacity, or performance of a product, but is not essential for its basic work; for example, an adapter that allows a device to attach to a network.

attachment unit interface (AUI). Also known as thick Ethernet, thicknet or 10BASE5. This type of Ethernet connector has a 15-pin D type connector.

attention (ATTN). An occurrence external to an operation that could cause an interruption of the operation.

AUI. See attachment unit interface.

authentication. In computer security, verification of the identity of a user or the user's eligibility to access an object.

auto-removal. The removal of a device from data-passing activity without human intervention. This action is accomplished by the adapter in the device, and can be initiated by a network management program.

B

balun. A transformer used to connect balanced cables, such as twisted-pair cables, to unbalanced cables, such as coaxial cables, by matching the electrical characteristics of the cables.

bandwidth aggregation. The ability to establish more than one communication channel per connection.

bandwidth augmentation. The ability to add another communication channel to an already existing communication channel.

bandwidth-distance product. The parameter specified for bulk fiber that defines the distance that a signal at a defined frequency can be transmitted with a specified loss, usually half the power at zero frequency. Use of a fiber with a bandwidth-distance product of 500 MHz-km would support 250 MHz for a distance of 2 km.

baseband LAN. A local area network in which data are encoded and transmitted without modulation of a carrier (T).

Basic Input/Output System. The personal computer code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

baud. (1) A unit of signaling speed equal to the number of discrete conditions or signal events per second; for example, one baud equals one-half dot cycle per second in Morse code, one bit per second in a train of binary signals, and one 3-bit value per second in a train of signals each of which can assume one of eight different states (A). Contrast with bits per second. (2) In asynchronous transmission, the unit of modulation rate corresponding to one unit interval per second; that is, if the duration of the unit interval is 20 milliseconds, the modulation rate is 50 baud.

BIOS. See Basic Input/Output System.

bit-time. (1) The time required to transmit 1 bit on the network. For example, the IBM PC Network bit-time equals 500 nanoseconds (ns). (2) The reciprocal of the line data rate (or network data transfer rate).

bits per second (bps). The rate at which bits are transmitted per second. Contrast with baud.

block delay time. The time delay permitted for received frames to be assembled into blocks for retransmission.

bond group. A logical collection of two or more physical ports (on a per engine basis only) that becomes one interface on the network. You can create two kinds of bond groups in the NAS appliance: aggregated links (see link aggregation) and active-backup.

bonded interface. See bond group.

bonding. The act of combining two or more physical ports to create one logical network interface with one associated IP address. Bonding can improve performance by either increasing bandwidth (see link aggregation) or providing port backup (see active-backup).

bootstrap. (1) A sequence of instructions whose execution causes additional instructions to be loaded and executed until the complete computer program is in storage (T). (2) A technique or device designed to bring itself into a desired state by means of its own action, for example, a machine routine whose first few instructions are sufficient to bring the rest of itself into the computer from an input device (A).

bps. See bits per second.

broadcast frame. A frame that is simultaneously transmitted to more than one destination. A broadcast frame is forwarded by all bridges, unless otherwise restricted.

broadcast topology. A network topology in which all attaching devices are capable of receiving a signal transmitted by any other attaching device on the network.

buffer storage. (1) A special-purpose storage or storage area allowing, through temporary storage, the data transfer between two functional units having different transfer characteristics. A buffer storage is used between non-synchronized devices, or where one is serial and the other is parallel or between those having different transfer rates. Synonymous with buffer (T). (2) In word processing, a temporary storage in which text is held for processing or communication (T).

building cable. The permanently installed cable within a building that interconnects offices to wiring closets, wiring closets to wiring closets, and wiring closets to computer rooms of building entrances.

building entrance. The entry point in a building where external communication cables are interconnected with internal building cables.

C

cache. A high-speed buffer storage that contains frequently accessed instructions and data to reduce access time.

cascade. To connect in a series or in a succession of stages so that each stage derives from or acts upon the product of the preceding stage.

catenet. A network in which hosts are connected to networks and the networks are interconnected by gateways. The Internet is an example of a catenet.

CDDI. See Copper Distributed Data Interface.

Challenge Handshake Authorization Protocol (CHAP). A password protection protocol that describes how to authenticate incoming data calls. The password is encrypted over the access line.

CHAP. See Challenge Handshake Authorization Protocol.

CIFS. See Windows networking.

client. A computer system or process that requests access to the data, services, or resources of a server (another computer system or process). Multiple clients may share access to a common server. Synonym for requester.

client-server model. A common way to describe network services and the model user processes (programs) of those services.

closed network. Synonym for closed path.

closed path. A network in which all of the cable paths and wiring closets are directly or indirectly connected. Synonymous with closed network.

cluster. In high-availability cluster multiprocessing (HACMP), a set of independent systems (called nodes) that are organized into a network for the purpose of sharing resources and communicating with each other. .

collision avoidance. In carrier sense multiple access with collision avoidance (CSMA/CA), the action of sending a jam signal and waiting for a variable time before transmitting data, to avoid two or more simultaneous transmissions.

Common Internet File System (CIFS). A protocol that enables collaboration on the Internet by defining a remote file-access protocol that is compatible with the way applications already share data on local disks and network file servers (MS).

configuration list. In a LAN, a list of all of the names and addresses of stations attached to a LAN segment.

connect. In a LAN, to physically join a cable from a station to an access unit or network connection point. Contrast with attach.

connection-oriented. The communication process that proceeds through three well-defined phases: connection establishment, data transfer, and connection release. Examples are: X.25, Internet TCP, and ordinary telephone calls.

connection-oriented network. A network that requires a setup procedure to be executed to establish an information channel between two logical nodes before they can interchange information.

control port. An alternate port that you can use to access the configuration when the data ports are not available.

control unit. A processor electronics assembly in a storage controller that exposes LUNs to the storage network and connects internally to the storage controllers' disk drives. A storage controller can have 1 to n , but typically has one for each path group.

Copper Distributed Data Interface (CDDI). A proposed ANSI standard that defines a dual counter-rotating ring which operates at a rate of 100 Mbps over Category 5 copper wire.

coprocessor. A secondary processor used to speed up operations by handling some of the workload of the main CPU.

CRC. See cyclic redundancy check.

CRU. See customer-replaceable unit.

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

cyclic redundancy check (CRC). (1) A redundancy check in which the check key is generated by a cyclic algorithm (T). (2) A system of error checking performed at both the sending and receiving station after a block-check character has been accumulated.

D

daemon. A program that runs unattended to perform a standard service. Some daemons are triggered automatically to perform their task; others operate periodically.

data port. Ethernet ports used for storage-traffic and configuration purposes.

DASD queue. A queue that resides on a direct access storage device (DASD).

data store. An abstraction for a repository where data is kept, independent of underlying implementation. Data stores can be block based (a LUN or set of LUNs); file based (a local or remote file system); or relational (a database). Since IBM TotalStorage™ NAS family appliances are file based, all of their datastores must be kept in file systems, directories, or files which are kept on LUNs.

data bus. A bus used to communicate data internally and externally to and from a processing unit, storage, and peripheral devices (A).

data integrity. (1) The condition that exists as long as accidental or intentional destruction, alteration, or loss of data does not occur (T). (2) Preservation of data for its intended use.

DDP. See distributed data processing.

default route. A route, in the routing table, that is used when no other route is specified or appropriate.

device address. (1) In data communication, the identification of any device to which data can be sent or from which data can be received. (2) The first subchannel address recognized by a channel-attached device.

device identifier (ID). An 8-bit identifier that uniquely identifies a physical I/O device.

device parity protection. A function that protects data stored on a disk unit subsystem from being lost because of the failure of a single disk unit in the disk unit subsystem. When a disk unit subsystem has device parity protection and one of the disk units in the subsystem fails, the system continues to run. The disk unit subsystem reconstructs the data after the disk unit in the subsystem is repaired or replaced. See RAID.

DHCP. See Dynamic Host Configuration Protocol.

diagnostic diskette. A diskette containing diagnostic modules or tests used by computer users and service personnel to diagnose hardware problems.

direct access storage device (DASD). A mass-storage medium on which a computer stores data. Contrast with random access memory (RAM).

Direct Memory Access (DMA). A technique in which an adapter bypasses a computer's CPU, and handles the transfer of data between itself and the system's memory directly.

distributed data processing (DDP). Synonym for distributed processing.

DLR. See dynamic link routine.

DMA. See Direct Memory Access.

DNS. See domain name system.

Domain Name System (DNS). In the Internet suite of protocols, the distributed database system used to map domain names to IP addresses.

drive bay. A receptacle into which you insert a disk drive module in an appliance. The bays are in storage units that can be physically located in a separate rack from the appliance.

dual inline memory module (DIMM). A small circuit board with memory-integrated circuits containing signal and power pins on both sides of the board.

Dynamic Host Configuration Protocol (DHCP). A protocol defined by the Internet Engineering Task Force (IETF) that is used for dynamically assigning IP addresses to computers in a network.

dynamic link routine (DLR). A program or routine that can be loaded by an application or as part of a program.

E

EIA. See Electronic Industries Association.

EISA. See Extended Industry Standard Architecture.

ELAN. See emulated LAN.

electromagnetic interference. A disturbance in the transmission of data on a network resulting from the magnetism created by a current of electricity.

Electronic Industries Association (EIA). An organization of electronics manufacturers that advances the technological growth of the industry, represents the views of its members, and develops industry standards.

Electronic Industries Association (EIA) unit. A unit of measure equal to 4.45 cm (1.75 in).

electrostatic discharge (ESD). An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

EMC. Electromagnetic compatibility.

emulate. To imitate one system with another, primarily by hardware, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system (A).

emulated LAN (ELAN). A specific implementation of a virtual LAN, as it relates to LAN Emulation in ATM networks. An ELAN consists of one or more LAN Emulation clients (LECs) that share the same LAN Emulation Server and Broadcast and Unknown Server (LES/BUS). LECs gain membership in an ELAN based on configurable policies. Like devices on traditional LANs, each ELAN member has a MAC address and can use the LES/BUS to send unicast and broadcast packets to other members based on MAC addresses.

emulation. (1) The use of a data processing system to imitate another data processing system, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system.

Emulation is usually achieved by means of hardware or firmware (T). (2) The use of programming techniques and special machine features to permit a computing system to execute programs written for another system.

engine. The unit that contains the processors that respond to requests for data from clients. This is where the operating software for the TotalStorage Model 200 appliance resides.

equivalent paths. A collection of paths to the storage device. The paths have no switchover time penalty when changing from one path group to another while accessing the storage device.

error. A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition (A) (I).

ESD. See electrostatic discharge.

ESM. See environmental service monitor.

Ethernet. A standard protocol for a 10-Mbps baseband local area network (LAN) that allows multiple access and handles contention by using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as the access method.

Ethernet network. A baseband LAN with a bus topology in which messages are broadcast on a coaxial cable using a carrier sense multiple access/collision detection (CSMA/CD) transmission method.

event message. Synonym for call-progress event message.

executable statement. A statement that specifies one or more actions to be taken by a computer program at execution time; for example, instructions for calculations to be performed, conditions to be tested, flow of control to be altered (T).

expansion slot. In personal-computer systems, one of several receptacles in the rear panel of the system unit into which a user can install an adapter.

extended configuration services. Configuration services that reside outside a CP processor. Extended configuration services keeps a local cache of transmission group locations. Extended configuration services do not handle activation and deactivation. See configuration services.

Extended Industry Standard Architecture (EISA). The PC bus standard that extends the AT bus (ISA bus) to 32 bits and provides busmastering. It was announced in 1988 as a 32-bit alternative to the Micro Channel that would preserve investment in existing boards. PC and AT cards (ISA cards) can plug into an EISA bus.

F

failback. The restoration of the appliance to its initial configuration after detection and repair of a failed network or appliance component.

failover. (1) The automatic recovery of resources in the event of a network outage, or failure of the hardware or software. (2) A cluster event where the primary database server or application server switches over to a backup system due to the failure of the primary server.

failover group. A type of virtual network interface. It is a collection of physical and bonded interfaces that provide backup for each other. Each member of the failover group must have the same front-end and backend connectivity.

failure. (1) The termination of the ability of a functional unit to perform its required function. (2) An uncorrected hardware error. Failures are either recoverable or not recoverable by the software or the operator. The operator is always notified when failures occur. Contrast with error.

Fast Ethernet. An Ethernet standard that provides a data rate of 100 Mbps.

feature code. A code used by IBM to process hardware and software orders.

Federal Communications Commission (FCC). A board of commissioners appointed by the President under the Communications Act of 1934, having the power to regulate all interstate and foreign communications by wire and radio originating in the United States.

fiber optic cable. See optical cable.

Fiber Optic Inter-Repeater Link (FOIRL). An IEEE standard for fiber optic Ethernet.

FIC. See File Image Capture.

field-replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit may contain other field replaceable units. Contrast with customer-replaceable unit (CRU).

File Image Capture (FIC). Function that takes a file system clone and a read-only copy of the certain read-write (active) file system. File Image Capture reflects the state of the file system at the time it was created.

File Image Restore. Function that allows a file system to revert to the state and contents of a previous File Image Capture. This function can be used to recover a corrupted file system.

File Transfer Protocol (FTP). In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts.

FIR. See File Image Restore

firewall. A logical barrier around systems in a network. A firewall consists of hardware, software, and a security policy that control the access and flow of information between secure or trusted systems and nonsecure or untrusted systems.

fixed-length record. A record having the same length as all other records with which it is logically or physically associated.

flash memory. A memory chip that holds its content without power but must be erased in fixed blocks rather than single bytes.

floating virtual connection (FVC). The ability to resume a virtual connection on a port other than the port connection on which the original virtual connection was established.

frame alignment error. An error in a frame, indicated by a frame check sequence (FCS) indicator. When excessive or missing bits occur during the reception of a frame, the frame is misaligned.

free disk. A physical disk that is not assigned as a hot-spare, as a standby hot-spare, or to a logical drive.

FRU. See field-replaceable unit.

FTP. See File Transfer Protocol.

FVC. See floating virtual connection.

G

gateway. A device that acts as a router, but occurs at the transport layer, to transfer packets between networks.

group definition. A list of directory numbers.

group definition ID. The identifier of a group definition.

group SAP. A single address assigned to a group of service access points (SAPs).

group separator (GS) character. The information separator intended to identify a logical boundary between groups.

H

hard failure. An error condition on a network that requires that the network be reconfigured or that the source of the error be removed before the network can resume reliable operation. Synonym for hard error.

hertz (Hz). A unit of frequency equal to one cycle per second.

Note: In the United States, line frequency is 60 Hz or a change in voltage polarity 120 times per second; in Europe, line frequency is 50 Hz or a change in voltage polarity 100 times per second.

higher level. In the hierarchical structure of a data station, the conceptual level of control or processing logic, above the data link level that determines the performance of data link level functions such as device control, buffer allocation, and station management.

host. (1) In TCP/IP, any system that has at least one internet address associated with it. A host with multiple network interfaces may have multiple internet addresses associated with it. The host can be (a) a client, (b) a server, or (c) both a client and a server simultaneously. (2) In Fibre Channel, any system that has at least one worldwide name associated with it. A host with multiple network interfaces may have multiple worldwide names associated with it.

host application program. An application program processed in the host computer.

host attachment. A mode of SNA communication in which the processor acts as a secondary SNA device.

host computer. (1) In a computer network, a computer that usually performs network control functions and provides end users with services such as computation and database access (T). (2) The primary or controlling computer in a multiple computer installation or network. (3) A computer used to prepare programs for use on another computer or on another data processing system; for example, a computer used to compile, link edit, or test programs to be used on another system. (4) Synonym for host processor.

hot-spare disk. A physical disk that is automatically mapped to a logical drive if one of the logical drive's disks goes offline.

HTTP. See Hypertext Transfer Protocol.

Hypertext Transfer Protocol. In the Internet suite of protocols, the protocol that is used to transfer and display hypertext documents.

I

IBM Disk Operating System (DOS). A disk operating system based on MS-DOS that operates with all IBM-compatible personal computers.

IETF. See Internet Engineering Task Force.

iLUN. iSCSI client logical-unit number.

initial microcode load (IML). The action of loading the operational microcode.

initialize. In a LAN, to prepare the adapter (and adapter support code, if used) for use by an application program.

inoperative. The condition of a resource that has been active, but is no longer active. The resource could have failed or could have been suspended while a reactivate command was being processed.

interference. (1) The prevention of clear reception of broadcast signals. (2) The distorted portion of a received signal. (3) In optics, the interaction of two or more beams of coherent or partially coherent light.

Internet Engineering Task Force (IETF). The task force of the Internet Architecture Board (IAB) that is responsible for solving the short-term engineering needs of the Internet. The IETF consists of numerous working groups, each focused on a particular problem. Internet standards are typically developed or reviewed by individual working groups before they can become standards.

Internet Protocol (IP). A protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network.

Internetwork Packet Exchange (IPX). The routing protocol used to connect Novell's servers or any workstation or router that implements IPX with other workstations. Although similar to TCP/IP, it uses different packet formats and terminology.

interrupt level. The means of identifying the source of an interrupt, the function requested by an interrupt, or the code or feature that provides a function or service.

IOPS. Input/output operations.

IP. See Internet Protocol.

IPX. Internetwork Packet Exchange

IRQ. Interrupt request.

iSCSI. A technology that enables the SCSI transport protocol over an IP network by connecting clients (initiators) and servers to storage.

iSCSI client. A device that creates and sends SCSI commands to the target IBM IP Storage appliance.

iSCSI client logical-unit number (iLUN). A unique number that is assigned to each VLUN. The iLUN for a single client starts at zero and increments sequentially.

J

jumper. A connector between two pins on a network adapter that enables or disables an adapter option, feature, or parameter value.

jumper cable. Synonym for patch cable.

K

Kerberos. Pertaining to the security system of the Massachusetts Institute of Technology's Project Athena. It uses symmetric key cryptography to provide security services to users in a network.

L

LAN. See local area network.

local area network. A network in which a set of devices are connected to one another for communication and that can be connected to a larger network.

LAN emulation client (LEC). A LAN emulation component that represents users of the emulated LAN.

LAN emulation configuration server (LECS). A LAN emulation service component that centralizes and disseminates configuration data.

LAN multicast. Sending of a transmission frame that is intended to be accepted by a group of selected data stations on the same local area network.

LAN Segment Number. The identifier that uniquely distinguishes a LAN segment in a multi-segment LAN.

LAN-to-LAN. An access mode for connecting remote LAN sites.

large-scale integration (LSI). The process of integrating large numbers of circuits on a single chip of semiconductor material.

LBG. See load-balancing group.

LDAP. See Lightweight Directory Access Protocol.

Lightweight Directory Access Protocol. In TCP/IP, a protocol that enables users to locate people, organizations, and other resources in an Internet directory or intranet directory.

limited broadcast. Synonym for single-route broadcast.

link aggregation. A type of bond group that combines the bandwidth of two or more ports to serve as one IP address. The bond group distributes data across the bonded ports by using an algorithm. See bond group.

LIP. Loop initialization process

load-balancing group (LBG). A type of virtual network interface that comprises a set of physical and bonded interfaces. A set of nodes within a virtual server that has layer-2 front-end connectivity can be collectively identified by a unique IP address and grouped into a load-balancing group (LBG). The intent of such a grouping is to enable all

nodes in the LGB to share the file serving load. A unique IP address and DNS host name combination identify each load-balancing group. Depending on the front-end connectivity, you can configure a node to be a member of more than one load-balancing group.

locally administered address. In a local area network, an adapter address that the user can assign to override the universally administered address. Contrast with universally administered address.

logical connection. In a network, devices that can communicate or work with one another because they share the same protocol.

logical drive. A unit of virtual storage that is made available to the network through VLUNs and iLUNs. It is made up of one or more physical disks that are combined using RAID 0, 1, 1E, 5, or 5E technology.

logical node. Logical nodes exist and operate in the physical context of the primary devices. There are different types of logical nodes and each is associated with a specific protocol stack.

loop. A closed unidirectional signal path connecting input/output devices to a system.

low-smoke fire-retardant zero halogen. Describes materials that are not flammable and do not emit large amounts of smoke or toxic gasses when burnt.

low-smoke zero halogen. Describes materials that do not emit large amounts of smoke or toxic gasses when burnt.

LSFR0H. See low-smoke fire-retardant zero halogen.

LS0H. See low-smoke zero halogen.

M

macro. An instruction that causes the execution of a predefined sequence of instructions in the same source language.

main storage. Program-addressable storage from which instructions and other data can be loaded directly into registers for subsequent execution or processing (A) (I).

management information base (MIB). SNMP units of managed information that specifically describe an aspect of a system, such as the system name, hardware number, or communications configuration. A collection of related MIB objects is defined as a MIB.

megahertz (MHz). A unit of measure of frequency. One megahertz = 1 000 000 hertz.

MES. See miscellaneous equipment specification.

MIB. Management information base.

MIB browser. In the Simple Network Management Protocol (SNMP), a small PC or workstation application that can load MIB definitions, query or set data items in a managed node, and decode returned values and results in an easily readable form.

microinstruction. An instruction for operations at a level lower than machine instructions (T).

microprogram. A sequence of microinstructions. Microprograms are mainly used to implement machine instructions (T).

migrate. To move to a changed operating environment, usually to a new release or version of a program, system, or device.

miscellaneous equipment specification (MES). Any equipment that is added after the time of the initial order.

mode field diameter. A measure of the width of the guided optical power's intensity distribution in the core and the cladding of a single-mode fiber.

modulation. (1) The process by which a characteristic of a carrier is varied in accordance with a characteristic of an information-bearing signal (T). (2) The process by which a message signal is impressed upon a carrier signal so that the carrier is altered to represent the message signal.

multicast address. See LAN multicast.

multimode optical fiber. (1) A graded-index or step-index optical fiber that allows more than one bound mode to propagate (E). Contrast with single-mode optical fiber. (2) In FDDI, an optical fiber waveguide usually characterized by a core diameter of 50 to 100 micron that will allow a large number of modes to propagate.

multiplexing. In data transmission, a function that permits two or more data sources to share a common transmission medium so that each data source has its own channel (A) (I).

N

N. See Newton.

nanosecond (ns). One thousand millionth of a second.

NAS. Network-attached storage.

NDMP. See network data management protocol.

network-attached storage (NAS). A task-optimized storage device directly attached to a network that works independent of the general-purpose file servers.

network data management protocol (NDMP). An open standard protocol for enterprise-wide network-based backup for network attached storage.

Network File System (NFS). A protocol, developed by Sun Microsystems, Incorporated, that allows any host in a network to mount another host's file directories. After a file directory is mounted, it appears to reside on the local host.

network information services (NIS). A set of UNIX network services (for example, a distributed service for retrieving information about the users, groups, network addresses, and gateways in a network) that resolve naming and addressing differences among computers in a network.

newton (N). The force that when applied to a body having a mass of one kilogram gives it an acceleration of one meter per second per second (1 m/s²).

NFS. See network file system.

NI. See network interface.

NIS. See network information services.

non-broadcast frame. A frame containing a specific destination address and that can contain routing information specifying which bridges are to forward it. A bridge will forward a non-broadcast frame only if that bridge is included in the frame's routing information.

non-canonical. In this form, the most significant bit of an octet is transmitted first.

ns. See nanosecond.

O

ODI. See Open Data-Link Interface.

Open Data-Link Interface (ODI). A common interface for network drivers developed by Novell. It allows multiple transport protocols to run on one network adapter.

optical cable. A fiber, multiple fibers, or a fiber bundle in a structure built to meet optical, mechanical, and environmental specifications (E).

optical fiber. Any filament made of dielectric materials that guides light, regardless of its ability to send signals.

optical fiber coupler. (1) A device whose purpose is to distribute optical power among two or more ports (A). (2) A device whose purpose is to couple power between a fiber and a source or detector (A).

P

packet internet groper (PING). In Internet communications, a program used in TCP/IP networks to test the ability to reach destinations by sending the destinations an Internet Control Message Protocol (ICMP) echo request and waiting for a reply.

parity check. (1) A redundancy check by which a recalculated parity bit is compared to the pre-given parity bit (T). (2) A check that tests whether the number of ones (or zeros) in an array of binary digits is odd or even (A).

passive hub. A hub that adds nothing to the data being transmitted through it.

path. The connection between a storage port and the WWN (World Wide Name): target : LUN of a storage device.

path group. A collection of equivalent paths. Storage devices may have one, two or n path groups.

PCI. See Peripheral Component Interconnect.

PCNFSD. See personal-computer NFS daemon.

PCMCIA. See Personal Computer Memory Card International Association.

PDU. Power distribution unit.

Peripheral Component Interconnect (PCI). A local bus for PCs from Intel that provides a high-speed data path between the CPU and up to 10 peripherals (video, disk, network, and so on). The PCI bus coexists in the PC with the ISA or EISA bus. ISA and EISA boards still plug into an ISA or EISA slot, while high-speed PCI controllers plug into a PCI slot.

Persistent Storage Manager (PSM). Columbia Data Products software that creates multiple point-in-time persistent True Image data views of any or all system and data volumes residing on the NAS. All persistent images survive system a power loss or a planned or unplanned reboot. Each instance of PSM seamlessly handles 250 concurrent images of up to 255 independent volumes for a total of 63,750 independent data images.

personal-computer NFS daemon (PCNFSD). A daemon that manages user authentication and print spooling.

Personal Computer Memory Card International Association (PCMCIA). An organization that standardizes credit-card size memory and I/O adapters for personal computers.

PING. See packet internet groper.

pinout. Information that specifies which signal, signal line, or cable wire maps to each pin on a module, card, or cable connector. A module is usually keyed to allow for pin number identification.

primary adapter. In a personal computer that is used on a LAN and that supports installation of two network adapters, the adapter that uses standard (or default) mapping between adapter-shared RAM, adapter ROM, and designated computer memory segments. The primary adapter is usually designated as adapter 0 in configuration parameters. Contrast with alternate adapter.

promiscuous mode. In a local area network (LAN), a method of processing and monitoring LAN frames that does not discriminate based on address.

PSM. See Persistent Storage Manager.

Q

QoS. Quality of service.

R

RAID. See redundant array of independent disks.

RAM. See random access memory.

random access memory (RAM). A temporary storage location in which the central processing unit (CPU) stores and executes its processes. Contrast with direct access storage device.

redundant array of independent disks (RAID). A method of protecting data loss due to disk failure based on the Redundant Array of Independent Disks specification published by the University of California in 1987. See device parity protection.

remote procedure call (RPC). A facility that a client uses to request the execution of a procedure call from a server. This facility includes a library of procedures and an external data representation.

S

Samba. A UNIX implementation of CIFS that enables Windows networking-file-system protocol to communicate with UNIX operating systems.

SAN. Storage area network.

SCSI. See small computer system interface.

shared LAN. A LAN in which the total bandwidth is shared among all nodes attached to the LAN segment.

shared RAM. Shared memory provided by an adapter with onboard memory and requiring use of system CPU.

shielded twisted pair (STP). A cable medium consisting of a telephone wire wrapped in a metal sheath to eliminate external interference.

Simple Mail Transfer Protocol (SMTP). In the Internet suite of protocols, an application protocol for transferring mail among users in the Internet environment. SMTP specifies the mail exchange sequences and message format. It assumes that the Transmission Control Protocol (TCP) is the underlying protocol.

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

single system image (SSI). A system architecture in which a cluster of engines provides an external view of the system such that it appears as a single entity in terms of administration, client-side attachment or both.

single-mode optical fiber. An optical fiber in which only the lowest-order bound mode (which can consist of a pair of orthogonally polarized fields) can propagate at the wavelength of interest. Contrast with multimode optical fiber.

single-route broadcast. The forwarding of specially designated broadcast frames only by bridges which have single-route broadcast enabled. If the network is configured correctly, a single-route broadcast frame will have exactly one copy delivered to every LAN segment in the network. Synonym for limited broadcast.

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

SMTP. See Simple Mail Transfer Protocol.

SNMP. See Simple Network Management Protocol.

splitter. In a local area network (LAN), a passive device used at a node to connect two or more branches (T).

standby hot-spare disk. A physical disk that is automatically mapped to a logical drive when no suitable hot-spare disk is available.

storage area network (SAN). A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services.

storage controller. A device (such as a RAID Controller) that creates and manages other storage devices.

storage device. A LUN that terminates a collection of ports on the storage network.

storage network. Provides shared access to a set of LUNs across one to n storage client networks.

storage network device. A type of hub, switch, director or router on the Fibre Channel fabric that is directly connected to the storage client network. A storage network device is part of the fabric infrastructure, but does not directly provide LUNs.

storage client network. A classic interconnected Fibre Channel fabric with a single Fibre Channel fabric name.

storage port. A Model 200 engine's connection point to a storage client network. A storage port is a member of a single fabric.

storage unit. Hardware that contains one or more drive bays, power supplies, and network interface. Some storage units contain RAID controllers; their storage unit is accessed by the appliance.

store-and-forward. A mode of operation for a LAN switch in which it completely checks every frame before forwarding, so customers can use the switch to isolate erroneous frames generated on one segment so they do not traverse the switch onto another segment.

STP. See shielded twisted pair.

SVN. See switched virtual network.

switched LAN. A LAN that has a dedicated connection for each user whereby the full bandwidth is available to the workstation.

switched virtual networks (SVN). A comprehensive approach for building and managing switched-based networks. It combines the virtues of LAN switching, bridging, routing, ATM switching and other switched services.

synchronous data transfer. A physical transfer of data to or from a device that has a predictable time relationship with the execution of an I/O request.

synchronous transmission. A method of transmission in which characters are synchronized by the transmission of initial sync characters and a common clock signal.

T

tape device. A collection of tape units that come from one model type and serial number (such as all the LUNs of a tape library).

tape unit. A tape drive or a robotics controller that is visible over a storage network. A tape unit is a member of a single storage network (of 1 to n fabrics), but can have 1 to n equivalent paths.

target. A collection of logical units that are directly addressable on the network. The target corresponds to the server in a client-server model.

TCP. See Transmission Control Protocol.

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

Telnet. In the Internet suite of protocols, a protocol that provides remote terminal connection service. It allows users of one host to log on to a remote host and interact as directly attached terminal users of that host.

timeout. A time interval that is allotted for certain operations to occur, for example, a response to polling or addressing before system operation is interrupted and must be restarted.

Tivoli Storage Manager (TSM). A client/server product that provides storage management and data access services in a heterogeneous environment.

Transmission Control Protocol (TCP). In TCP/IP, a host-to-host protocol that provides transmission in an internet environment. TCP assumes Internet Protocol (IP) is the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP). The Transmission Control Protocol and the Internet Protocol, which together provide reliable end-to-end connections between applications over interconnected networks of different types.

True Image data view. A data view that allows the file to be restored in the event of accidental deletion. It consists of 'point-in-time' images that provide a near-instant virtual copy of an entire storage volume.

TSM. See Tivoli Storage Manager.

twinaxial cable. A three-conductor cable with the two inner conductors serving to carry the signal energy, and the outer conductor serving as ground. The three conductors are insulated from each other.

U

universal serial bus (USB). A serial interface standard for telephony and multimedia connections to personal computers.

unshielded twisted pair (UTP). A cable medium with one or more pairs of twisted insulated copper conductors bound in a single plastic sheath.

USB. See universal serial bus.

V

VLAN. See virtual local area network.

VLU. Volume logical unit.

VLUN. See virtual logical unit.

virtual connection. A connection set up between two points that appears to the user to be available as a dedicated connection. This phantom connection can be maintained indefinitely or can be ended at will. The three states of a virtual connection are up, down or suspended.

virtual local area network (VLAN). A logical association of switch ports based upon a set of rules or criteria such as MAC addresses, protocols, network address, or multicast address. This permits resegmentation of the LAN without requiring physical rearrangement.

virtual logical unit (VLUN). A subset of a logical drive.

virtual port. Logical construct that corresponds to a logical adapter for a switched network port. A virtual port organizes outgoing switched logical links by specifying incoming call acceptance criteria, by dynamically building and relating logical adapters with selected hardware adapter ports, and by specifying adapter-related data link control (DLC) profiles for use with those logical adapters.

VNI. Virtual network interface.

volume. (1) Unit of storage on disk, tape, or other data recording media. (2) A logical disk visible to the appliance over a storage network. A member of a single storage network of 1 to n fabrics. It can have 1 to n path groups of 1 to n equivalent paths.

W

Windows Internet Name Service (WINS). Program that provides a distributed database for registering and querying dynamic NetBIOS names to IP address mapping in a routed network environment.*

WINS. See Windows Internet Naming Service.

Windows networking. Networking file-system protocol for the Windows operating system.

X

Xmodem. A public-domain asynchronous data link control (DLC) protocol that provides packet numbering and checksum error control for the transfer of binary files.

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