IBM TotalStorage™ NAS 200
Model 25T

User's Reference

IBM

First Edition (October 2002)

This edition applies to the IBM 5194 TotalStorage NAS 200 (Model 25T) (product number 5194–25T) 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 NAS 200 (Model 25T), hereafter referred to as the NAS 200.

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

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* GA27–4322

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

- *User's Reference* GA27–4323

  This book describes such operational and administrative activities as:
  - Using the configuration utilities
  - Administering the NAS 200
  - Troubleshooting
  - Using the Recovery and Supplementary CD-ROMs
- *Storage Unit Installation and User's Guide* GA27–4324

  This book provides instructions for installing and replacing components in your IBM 5194 TotalStorage NAS 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* GA27–4322
- *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:

- *NAS 200 Hardware Installation Guide* GA27–4322
- *NAS 200 Hardware Service Guide* GY27–0415
- *NAS 200 EXP Storage Unit Installation and User's Guide* GA27–4324
- *NAS Gateway 300, NAS 200, and NAS 100 Planning Guide* GA27–4261
- The following information is provided on the Documentation CD-ROM that came with the appliance:
  - ServeRAID Adapter Installation and User's Guide
  - UM Services User's Guide

Accessibility

The softcopy version of this manual and other related publications are accessibility-enabled for the IBM Home Page Reader.

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 NAS 200 (5194 Models 25T 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 201, 226, and EXP. Enhancements provided by the new models include:
- Greater granularity in configuring storage size
- More options in configuring Ethernet connections
- More options for tape backup
- Faster processor
- Gigabit Ethernet connection
- Faster adapters

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.

The Model 25T features:
- Compact tower configuration
- One 2.4-GHz processor; second (dual) processor optional
- 512 MB (two 256 MB) of ECC memory standard; up to 4.5 GB available
- One integrated 10/100/1000 Ethernet connection
- Two redundant hot-swap 270 watt power supplies
- Three to six 36.4 GB Ultra160 hard disk drives or 72.8 GB hard disk drives (three to nine 36.4 GB hard disk drives or 72.8 GB hard disk drives with IBM Netfinity 3-Pack Ultra320 Hot-Swap Expansion Kit)
- Six PCI adapter slots for plugging in additional adapters, including four high-performance slots
- Optional adapters:
  - Alacritech 100x4 Quad-Port Server Accelerated Adapter
  - IBM Gigabit Ethernet SX Server Adapter
  - PRO/1000 XT Server Adapter by Intel
  - Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter
  - Qlogic 2340 1-port Fibre Channel adapter
  - IBM PCI Ultra160 SCSI adapter (LVD/SE)
  - Remote Supervisor Adapter
  - IBM ServeRAID-5i Ultra320 SCSI Controller
  - IBM ServeRAID-4Mx Ultra160 SCSI Controller
  - IBM ServeRAID-4H Ultra160 SCSI Controller

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 adapter.

Intel PROSet II
> Provides diagnostics for the Intel Ethernet adapters.

Alacritech® SLICuser
> Provides diagnostics for the Alacritech quad-port and accelerated Ethernet adapters.

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).

Services for NetWare
> Provides interoperability within the Novell environment and a complete set of new interoperability services and tools for integrating the NAS 200 into existing NetWare environments. Only Netware V5.0 Print and File services are included in the preloaded code and is required for supporting Netware File system protocol.

Storage Manager for SAK
> A storage management tool that includes storage reports, directory quotas, and file screening functions.

Roadmap for setting up and configuring the NAS 200

> **A suggestion for first-time users . . .**
>
> Your understanding of the NAS 200 and your ability to use it will be greatly enhanced if you first proceed to the NAS Setup Navigator tutorial.
>
> The NAS Setup Navigator maps out the initial configuration tasks and leads you through the tasks in the proper order. The tool detects which NAS appliance it is running on and adjusts the menu and content appropriately. You can follow links to more in-depth information and to the configuration panels used to perform the steps. You can also tailor the instructions to fit your needs by selecting optional topics. The Navigator not only presents information on functions and features, but also allows you to enable the functions and features. To start the NAS Setup Navigator, click on the NAS Setup Navigator icon on the desktop.
>
> After you have become familiar with the NAS 200, you can refer to this book for more details.
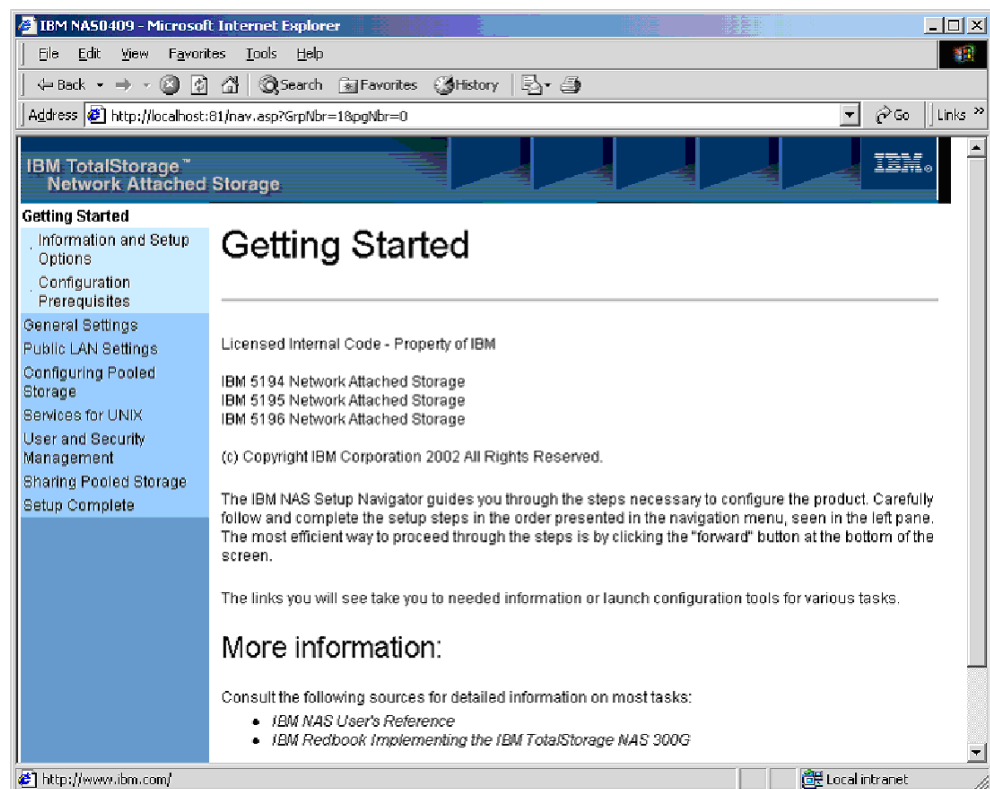
Figure 1. Opening screen of the NAS Setup Navigator

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 setting up 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 3, "Configuration and administration tools" on page 11 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 8.

See Chapter 2, "Getting started" on page 7 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 35).

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. 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" on page 15.
  - **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 8.
- 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 8.

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" on page 8.

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 13.)
- 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 20.)

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"
- "Setting up the network"

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 that 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 these 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 3. 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-ROM, 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-ROM 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 12 and page 13)

  This tool enables you to remotely administer the appliance.
- IBM Advanced Appliance Configuration Utility (IAACU, page 12 and page 14)

  You can use the IAACU to set up and configure the network configuration on the appliance.
- Universal Manageability Services (page 12 and page 17)

  This tool allows you to remotely manage your appliance using a Web browser.
- Windows 2000 for Network Attached Storage (page 12 and page 20)

  This is a Web-based GUI for administrators who are not familiar with Windows.

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 21)
- Simple Network Management Protocol (SNMP) support (page 21)

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.

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 13 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 14 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 17 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 20 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 "Universal Manageability Services" 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-ROM 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, type the IP address or the computer name of the NAS 200. The computer name is predefined as IBM5194-*xxxxxxx*, where *xxxxxxx* 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 opens.
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. After 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 IAACU configures and reports the TCP/IP settings of the first adapter on each appliance only. The first adapter is typically the integrated Ethernet controller. Be sure to connect the integrated Ethernet connector to the same physical network as your systems-management console.

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

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 IAACU console application from the Supplementary CD-ROM.

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.

Install the IAACU console application from the Supplementary CD-ROM 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 IAACU icon will be placed on the workstation desktop.

After you install the IAACU console application, the following steps will take you to the point where you can administer the appliance.
1. Start the IAACU console application by clicking its icon.
2. On the left pane of the IAACU 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 **Start Web Management** 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".

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 host name, 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 "Installing the IBM Advanced Appliance Configuration Utility".

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 host names.
- 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:

- **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. The Tree View Pane also includes groups for appliances 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.

- **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, host name, serial number, and so on) about each of the NAS 200 appliances that have been discovered by the IAACU console.

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.

Appliance
        Use the Appliance menu to remove a previously discovered appliance from a group.

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

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 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-ROM 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 MMC 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 *xxxxxxx* 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.
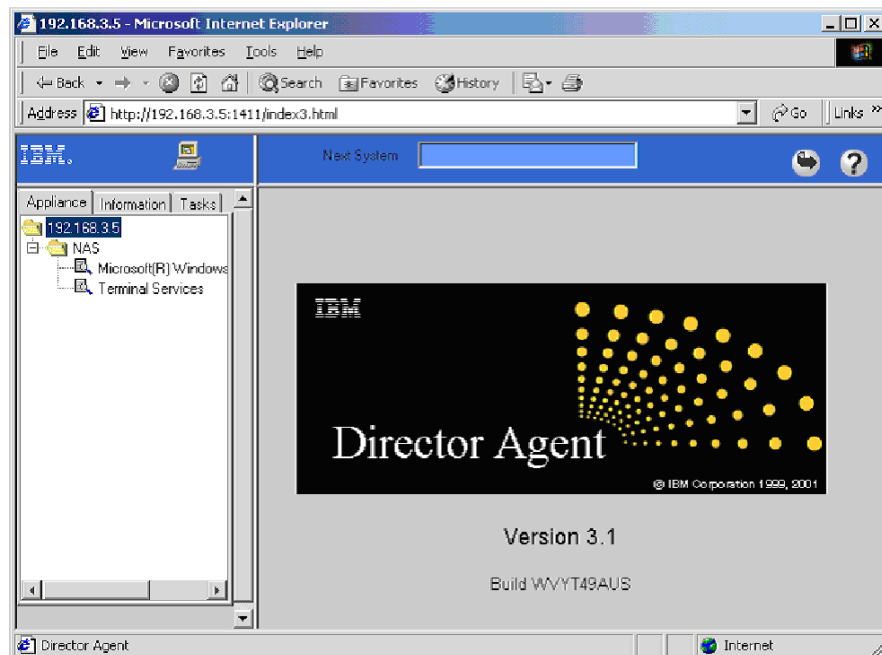
Figure 2. UM Services default page

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. When 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 13.

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 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 **Start Web-Based Management**.

   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 18 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-ROM 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 13 for more information.

To start Windows 2000 for NAS, use one of these methods:
- Through UM Services, as described in Step 3 on page 19
- 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.

Determining the tool to use

Table 1 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	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: • 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	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: • 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	Provides in-depth administration of all aspects of NAS 200. Provides all of the Windows 2000 for NAS GUI functions above, plus these capabilities:
	• 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:
	  – Create RAID arrays and LUNs
	  – Add additional RAID or storage enclosure after initial purchase
	• Diagnose system problems on storage and adapters

Administration tool	Main functions
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-ROM 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-ROM. 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-ROM. 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.

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, and so on) supported by the components.

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 adapters.

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 controller publication, which is included on the Documentation CD-ROM that came with your appliance.

Table 2 shows the standard features of the IBM ServeRAID-4Mx Ultra160 SCSI Controller, IBM ServeRAID-4H Ultra160 SCSI Controller, and IBM ServeRAID-5i Ultra320 SCSI Controller.

Table 2. Standard features of ServeRAID-5i, ServeRAID-4H, and ServeRAID-4Mx controllers

Feature	IBM ServeRAID-5i Ultra320 SCSI Controller	IBM ServeRAID-4H Ultra160 SCSI Controller	IBM ServeRAID-4Mx Ultra160 SCSI Controller
Arrays (maximum)	8	8	8
Battery-backup cache	Yes	Yes	Yes
Cache memory	128 MB	128 MB	64 MB
Hard disk drives (maximum)	30	60	15
Logical drives (maximum)	8	8	8
Microprocessor	100 MHz	266 MHz	100 MHz
SCSI channels	2 (see note)	4	2
SCSI transfer speed (maximum)	320 MB/sec	160 MB/sec	160 MB/sec
Supported RAID levels	0, 1, 5, Enhanced-1 (1E), 00, 10, 1E0, and 50	0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50	0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50
System PCI data bus	64 bit at 33 MHz	64 bit at 33 MHz	64 bit at 33 to 66 MHz
Note: There are no external connectors on this controller, but when it is used in the appliance, it enables two SCSI channels within the appliance. The first of these channels is used for controlling the six hot-swap drives. The second channel is used to control the IBM Netfinity 3-Pack Ultra320 Hot-Swap Expansion Kit, if one is installed, or connected to an external connector at the back of the appliance for controlling a JBOD.			

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*.

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 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 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 controller problems

For a complete description of how to diagnose ServeRAID controller problems, see Chapter 18, "Solving ServeRAID problems" in the ServeRAID 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 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 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 "Formatting the logical drives".

Formatting 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 and array/LUN management software, 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 an array. You can do this only with array/LUN management software such as Storage Manager Application. DiskPart cannot change the size of the drive that the external storage has configured; it can only change how much of the drive that Windows can use.

Attention: It is highly recommended that you always perform a backup of your data before using the DiskPart utility.

To perform LUN expansion, use the following two DiskPart commands:

select This command focuses on (selects) 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 are useful when you expand the LUN:

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

You can use several commands 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 can 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 can 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 might be unsuccessful on x-86-based computers.

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

convert basic changes an empty dynamic disk to basic.

list

You can use several commands 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.

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 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. Type 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 that 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. Type group name and description (optional).
4. Click **Members**.
5. For each user that you want 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 that 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 35.

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, and then perform the following tasks:

1. Click **Network**.

2. Click **Identification**.

3. Select the radio button labeled **Domain**, and specify the name of the domain being joined.

4. Specify a user name and password that can be used to log on to the domain.

5. Click **OK**.

6. 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 35.

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, should be able to 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.

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, and then press the F1 key to open the online documentation for Services for UNIX in a separate window.

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 that 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 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, type 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, or can be copied to the c:\winnt\system32\drivers\etc directory.

   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, type 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 can 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 or these files can be copied to the c:\winnt\system32\drivers\etc directory.

    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**, type the required information, and then click **OK**.

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.

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`

16. Next, delete all special users and groups, leaving just the actual users and groups that will be used in accessing NFS resources. 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.

17. Click **Apply**.

18. 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.

19. To configure simple maps, select the **Simple maps** check box and continue with Step 20.

    To configure advanced maps, clear the **Simple maps** check box and continue with Step 21.

20. Under Simple maps, select the Windows domain name from the drop-down list, and then continue with Step 22 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.)

21. Under Advanced maps, perform the following steps.
    a. Define user mappings:
       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 that you selected.
       4) Click **Show UNIX Users** to display all of the UNIX user names in the NIS domain that you selected.
       5) Type a Windows user name, or select one from the list of Windows user names.

      6) Type 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:

      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 that 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**.

22. Click **Apply**.

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
```

You can now continue with "Creating shares" on page 35.

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 a Microsoft Server for NIS).

1. To open the IBM NAS Administration console, double-click 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, type `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, type the NIS domain name. You can also type the name of a specific NIS server in the NIS server box.
   c. Continue with Step 10 on page 35.

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, type the NIS domain name. You can also type 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) Select a Windows user name from the list of Windows user names.
      7) Select a UNIX user name to be mapped to the Windows user name that you specified.
      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, type the NIS domain name. You can also type 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 that you selected.
      5) Click **Show UNIX Groups** to display all of the UNIX group names in the NIS domain that you selected.

6) Select a Windows group name from the list of Windows group names.
7) Select a UNIX group name to be mapped to the Windows group name that you specified.
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 the access permissions that you want. (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 the access permissions that you want. (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 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 that you install creates unresolvable problems for your system, you can regain the stable system that 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 42, accessed through IBM NAS Admin icon
- "Persistent Images" on page 44, accessed through the Windows 2000 for Network Attached Storage user interface

IBM Director

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

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-ROM provides this feature. Applying the Recovery CD-ROM 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.

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 are automatically discovered by the Rack Manager task for drag-and-drop rack construction. This enhancement is part of the IBM Director Server Service Pack 3.1.1; the service pack must be loaded on the IBM Director server before you can take advantage of this new category. 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 200 Engine Model 25T
- 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
- NAS Gateway 300 Engine Model 7RY

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.

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-ROM.

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 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**. When you select this option, a logon prompt appears. Log on as a user who has backup operator privileges (an administrator or backup administrator). If a logon prompt does not appear, right-click the **IBM NAS Backup Assistant** link, and select refresh. After 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 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 **Import File...**; 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 that 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 that you determined in Step 2 on page 43.
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 NT Backup 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 **Start Restore**.

14. At the prompt, begin the restore. Click **Advanced** to select advanced options (see the NT Backup online help for details); then click **OK** to begin the restore.

Persistent Images

A persistent image is a copy that 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 that 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 that 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.

When 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 is 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:

Table 3. Persistent image global settings

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, as shown in Table 4.

Table 4. Persistent image volume settings

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)

Notes:

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

2. Cache size (as a percent of volume size) and deletion threshold must be tuned to meet the heaviest load placed on the system. NAS 200 appliances that receive heavy write traffic for sustained periods will correspondingly generate more cached data per persistent image, as the system preserves old data from being overwritten. Very high traffic systems can devote as much as 40% of a production volume to PSM cache, although 15% (the default) or 20% will meet the needs of most users. The cache-full persistent image deletion threshold must also be tuned to automatically delete persistent images in time to free cache space before the cache fills up. Management of the cache must be tuned carefully to avoid filling the cache completely, as any missed and uncached old data renders all the persistent images for a volume inconsistent, and PSM will automatically delete them.

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 using 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

the volumes to select them. 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 (other higher and lower values 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 using 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. After a scheduled persistent image is created, certain properties of that persistent image can be modified using the Persistent Images panel, independently of other persistent images created according to the schedule.

When 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 volumes, and so on. For a schedule, you can name the persistent images based on a pattern that you configure. Format specifiers (defined on the New Persistent Image Schedule panel under the Persistent image names 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 when 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 using 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 that 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 or unbootable. Should the hard disk drive fail completely, you would need to use the Recovery CD-ROM as described in "Using the Recovery Enablement Diskette and Recovery CD-ROM Set" on page 99 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 **Modify Settings** to open the Disaster Recovery Settings page. Modify the settings that you want for backup. Do not include spaces in the *Backup name* field. When you have modified the settings, click **OK** to save the changes.

On the Disaster Recovery page, click **Start Backup** 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 when 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 that 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 through 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: After 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 or diskettes 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 accessible only through 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 that your network uses. Change the IPAddress value to match the IP address that 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
```

Restoring the system drive using the PSM recovery diskette

If you need to restore the system drive from a backup image created using the PSM Disaster Recovery panel as described above, you must use a recovery diskette created using the Disaster Recovery panel. If you did not create a PSM recovery diskette, then you must use the Recovery CD-ROM as described in "Using the Recovery Enablement Diskette and Recovery CD-ROM Set" on page 99 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. When 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-ROM Set" on page 99.

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 when 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-ROM as described in "Using the Recovery Enablement Diskette and Recovery CD-ROM Set" on page 99.

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 the persistent image mount point that you want, select **Sharing**, then specify sharing as appropriate. 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 appropriate.

   Note: The share settings are maintained in a persistent image. Therefore, granting access to all end-users permits only 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 that 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 (when 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 using 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 45). 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.

- PSM uses several system level files, one of which has a command line interface. Use of this interface is only supported for IBM-provided applications and services, as well as IBM support technician assisted debugging efforts. All PSM function including sophisticated scheduling and automation of remote management is provided by the Windows 2000 for NAS Web-based GUI.

Attention: The recovery process invalidates persistent images and leaves them in an inconsistent state. So, if you plan to use the Recovery CD-ROM, 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-ROM, see "Using the Recovery Enablement Diskette and Recovery CD-ROM Set" on page 99.

Storage Manager for SAK

The NAS 200 includes Storage Manager for SAK, a storage management tool that includes the following functions:

- Storage reports
- Directory quotas
- File screening

Storage reports address disk usage, wasted storage space, file ownership, security, and administration. Reports can run interactively, scheduled on a regular basis, or run as part of a storage resource management policy when disk-space utilization reaches a critical level.

Directory quotas allow the administrator to add, delete, monitor, and change disk-space limits for selected directories on the NAS appliance. Directory quotas provide disk-space monitoring and control in real time and supports active and passive limits with two real-time space alarms.

File screening allows the blocking of any file type such as MP3, graphics files, VBS viruses, and executables from writing to the NAS appliance.

Uninterruptible power supply support

The NAS 200 includes support for uninterrupted power supplies (UPS). UPS devices provide emergency backup power for a specific period of time when the local power fails. This power comes from batteries housed within the UPS. High-performance surge suppression helps protect your appliance from electrical noise and damaging power surges. During a power failure, the UPS is designed to instantly switch your appliance to emergency battery-backup power. After you have installed a UPS for your appliance, you can set options for its operation using the UPS task on the Maintenance page. The UPS task enables you to control how the UPS service works on your appliance. The available UPS settings depend on the specific UPS hardware installed on your system. Before you use your UPS device, type the following information on the UPS Configuration page:

* UPS device manufacturer
* UPS device model
* The serial port to which the UPS device is connected

To configure the UPS service, click **UPS** on the Maintenance page.

To help protect your server appliance from power failures, test it by simulating a power failure by disconnecting the main power supply from the UPS device. Do **not** perform this test during production use. Your appliance and peripherals connected to the UPS device should remain operational, messages should be displayed, and events should be logged. Wait until the UPS battery reaches a low level to ensure that a proper shutdown occurs. Restore the main power to the UPS device, and check the event log to verify that all actions were logged and there were no errors. All detected power fluctuations and power failures are recorded in the event log, along with UPS service start failures and appliance shutdown initiations. Critical events might change the status of the appliance.

IBM Netfinity 3-Pack Ultra320 Hot-Swap Expansion Kit support

The current ServeRAID Configuration Reset diskette does not support additional drives on the ServeRAID controller IBM ServeRAID-5i Ultra320 SCSI Controller, IBM ServeRAID-4Mx Ultra160 SCSI Controller, or IBM ServeRAID-4H Ultra160 SCSI Controller). Attempts to reset to the original configuration will fail if IBM Netfinity 3-Pack Ultra320 Hot-Swap Expansion Kit drives are present. The ServeRAID Configuration Reset diskette will return the system to the factory defaults and leave the drives in the 3-Pack Expansion and any NAS EXP units unconfigured (see Table 5 on page 55 for the factory default configuration). Any data on these drives will be lost. If you have changed your configuration from the factory default, including any of the following, follow the procedure for ServeRAID array restoration and data restoration (see "Backup and restoration of ServeRAID storage configuration" on page 55):

* Added NAS EXP units
* Added 3-Pack Expansion
* Reconfigured the drives in the engine from the factory default configuration

Table 5. RAID Array A factory default configuration

Number of disks in base engine	Logical Drive 1 Seen as C: (System) in Windows Powered OS	Logical Drive 2 Seen as D: (Maintenance) in Windows Powered OS	Logical Drive 3 Seen as E: (User Data) in Windows Powered OS	Hot spare available
	|————————— RAID Array A —————————|		
3	6199 MB RAID 1E across disks 1-2-3	12288 MB RAID 1E across disks 1-2-3	remaining free space RAID 5 across disks 1-2-3	No
4	6199 MB RAID 1E across disks 1-2-3	12288 MB RAID 1E across disks 1-2-3	remaining free space RAID 5 across disks 1-2-3	Yes: disk 4
5	6199 MB RAID 1E across disks 1-2-3-4	12288 MB RAID 1E across disks 1-2-3-4	remaining free space RAID 5 across disks 1-2-3-4	Yes: disk 5
6	6199 MB RAID 1E across disks 1-2-3-4-5	12288 MB RAID 1E across disks 1-2-3-4-5	remaining free space RAID 5 across disks 1-2-3-4-5	Yes: disk 6

Notes:
1. Disk size will affect size of remaining free space only in E: user data drive.
2. It is recommended that all disks in a logical array be the same size. If different sized drives are used, only the smaller increment of storage will be available for use. For example, if both 36.4-GB and 73.4-GB drives are used, only 36.4 GB of storage will be available on the 73.4-GB drives.

If 36.4-GB or 73.4-GB drives are installed in addition to the 3-Pack Expansion on the ServeRAID controller, the ServeRAID Configuration Reset diskette logic detects these drives as part of a potential drive array. But because these drives were not part of the original drive configuration file (the .IPS file), attempting to reconfigure the original drive might fail.

The three drives in the 3-Pack Expansion do not have to be the same size as the drives in the appliance where it is installed. The drives in a logical array do not have to be the same size, but it is recommended.

Backup and restoration of ServeRAID storage configuration

You should save any changes that alter the factory settings of the ServeRAID storage configuration on a diskette for archival purposes. In the event of disaster, your custom configuration can be restored; for example, if you have added a NAS EXP expansion unit or 3-Pack Expansion, or reconfigured the drives in your NAS 200, you will be able to recover to that configuration instead of the factory default. Refer to the ServeRAID controller *User's Reference* for a detailed description of the ServeRAID configuration backup and restoration process.

Backing up ServeRAID configuration

Backing up the ServeRAID configuration can be accomplished in two ways: from a command window in the Microsoft® Windows operating system or from a bootable DOS diskette. The method that you use depends on the current state of the appliance. If the storage configuration was changed using ServeRAID Manager, it might be more convenient to back up your configuration from the command window instead of rebooting the appliance. However, in the event of disaster, it might be impossible to start the operating system first and you need to use a bootable DOS diskette.

Backing up from the command window:

1. After you finish reconfiguring your storage, close ServeRAID Manager and start a command window. Click **Start → Programs → Accessories → Command Prompt**. Change to the C:\ipsadm folder by entering `cd \ipsadm`.
2. Configuration backup is performed using the IPSSEND command. To save your present ServeRAID configuration, type:

   `ipssend backup controller_number filename noprompt`

   where *filename* is the path and file name where you want the configuration to be saved (it is recommended that you save the file to a diskette) and *controller_number* is the controller you want to back up. The **noprompt** parameter is an optional parameter that overrides the user prompt.

Backing up from a bootable DOS diskette:

1. Create a bootable DOS diskette with the IPSSEND command available. You can do this in two ways:
   - Create the diskette from the ServeRAID Support CD-ROM. In the \diskette folder of the support CD-ROM is a file called dos.img. Use an image extraction tool (available on the support CD-ROM in the \diskette\tools folder) to create the bootable diskette.
   - Create the diskette using the ServeRAID Configuration Reset diskette. The ServeRAID Configuration Reset diskette image is available as a self-extracting utility on the NAS Supplementary CD-ROM. See Chapter 8, "Using the Recovery and Supplementary CD-ROMs" on page 99 for instructions for creating the disk.
2. Boot the diskette you created in Step 1. If you are using the diskette created using the ServeRAID Support CD-ROM, the IPSSEND command is run without parameters from the autoexec.bat file each time the disk is booted. If you are using the ServeRAID Configuration Reset diskette, you are given a choice to either continue with the configuration reset process or exit. You must choose to exit the process. This will place your cursor at a DOS prompt, and the IPSSEND command is now available.
3. To save your present ServeRAID configuration, type:

   `ipssend backup controller_number filename noprompt`

   where *filename* is the path and file name where you want the configuration to be written (it is recommended that you save the file to a diskette) and *controller_number* is the controller you want to back up. The **noprompt** parameter is an optional parameter that overrides the user prompt.

Restoring the RAID configuration

If you saved your custom configuration using the **backup** option with the IPSSEND command (see "Backing up ServeRAID configuration"), you can use the restore function to load the configuration. This operation overwrites the existing

configuration information and BIOS settings stored for the ServeRAID controller.

1. Boot the NAS appliance with the ServeRAID Configuration Reset diskette.
2. When prompted to continue or exit, click **Exit**.
3. To restore your saved configuration, type:

   ```
   ipssend restore controller_number filename noprompt
   ```

   where *filename* is the path and file name where the configuration was saved and *controller_number* is the controller you want to back up. The **noprompt** parameter is an optional parameter that overrides the user prompt.
4. When the IPSSEND command completes, continue the recovery procedure described in the section titled "Using the Recovery Enablement Diskette and Recovery CD-ROM Set" in Chapter 8 of the *User's Reference*.

If you did not save your configuration using the IPSSEND command, use the standard ServeRAID Configuration Reset diskette procedure. Note that this procedure will reset your system to the factory default configuration (see Table 5 on page 55 for the factory default configuration).

MES support for IBM ServeRAID-4Mx Ultra160 SCSI Controller and IBM ServeRAID-4H Ultra160 SCSI Controller

If you install an optional IBM ServeRAID-4Mx Ultra 160 SCSI controller or replace your current ServeRAID adapters with an IBM ServeRAID-4H Ultra 160 SCSI controller, it is recommended that you create a backup copy of your RAID configuration file before installing this option by following the procedure found in "Backing up ServeRAID configuration" on page 56. In the event that disaster recovery is required, the recovery process will recreate your configuration based on the controller configuration that existed before this option was installed. By following the procedure for using the backup-up file as explained in "Restoring the RAID configuration" on page 56, you can quickly restore your previous configuration. It is also recommended that after this option is installed and configured that you create a backup copy of this new RAID configuration file for use in the event that disaster recovery is required in the future.

Enabling Ethernet adapter teaming

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

The Ethernet adapters that you install in the PCI slots of the NAS 200 nodes support *adapter teaming* (also known as load balancing). 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.

The NAS 200 uses two different Ethernet vendors, Intel (PRO/1000 XT Server Adapter by Intel and IBM Gigabit Ethernet SX Server Adapter) and Alacritech (Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter and Alacritech 100x4 Quad-Port Server Accelerated Adapter). Each vendor offers different means of implementing teaming, and teaming cannot be done between adapters of different vendors. There might also be restrictions on what functions are supported with adapters from the same vendor.

Alacritech Ethernet adapter teaming

Alacritech uses SLIC (Session-Layer Interface Card) technology, which incorporates hardware assistance for TCP processing. Most, but not all, of the processing overhead for TCP/IP is removed from the NAS engine. This is an optional feature and can be disabled if required.

Alacritech offers four methods of teaming:

Cisco Fast EtherChannel (Fast EtherChannel and Gigabit EtherChannel compatible)

> Fast EtherChannel (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 balance only outbound traffic. Fast EtherChannel and Gigabit EtherChannel (FEC/GEC) requires a FEC/GEC compatible switch. The same teaming also must be enabled on the connected switch ports.

> **Note:** FEC requires an Ethernet switch with FEC capability. The FEC implementation on the Alacritech 100x4 Quad-Port Server Accelerated Adapter does not support the optional Port Aggregation Protocol (PAgP) feature of FEC-capable Ethernet switches. Likewise, The FEC/GEC implementation on the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter does not support the optional PAgP feature of FEC/GEC-capable Ethernet switches.

> The following are the valid teaming configurations and restrictions for Cisco EtherChannel teaming with Alacritech adapters:

> - Two Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed together.
> - No Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed with any port of the Alacritech 100x4 Quad-Port Server Accelerated Adapters.
> - One Alacritech 100x4 Quad-Port Server Accelerated Adapter can have two or more of its ports teamed.
> - Two Alacritech 100x4 Quad-Port Server Accelerated Adapters can have any ports on any card teamed (limited to four ports per team). For example, two ports on one card can be teamed with two ports on a second card.

IEEE 802.3ad Link Aggregation Group

> 802.3ad is an IEEE industry-standard similar to the Cisco FEC/GEC. 802.3ad requires an Ethernet switch with 802.3ad capability. Alacritech does not support the optional Port Aggregation Protocol (PAgP) feature of some FEC switches or the 802.3ad LACP protocol. PAgP/LACP facilitates the automatic creation of link aggregation groups. All EtherChannel and Link Aggregation groups must be manually configured.

> The following are the valid teaming configurations and restrictions for IEEE 802.3ad teaming with Alacritech adapters:

- Two Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed together.
- No Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed with any port of the Alacritech 100x4 Quad-Port Server Accelerated Adapters.
- One Alacritech 100x4 Quad-Port Server Accelerated Adapter can have two or more of its ports teamed.
- Two Alacritech 100x4 Quad-Port Server Accelerated Adapters can have any ports on any card teamed (limited to four ports per team). For example, two ports on one card can be teamed with two ports on a second card.

Send-Only Load Balancing

This is an inexpensive way to do load balancing when using a Ethernet switch that does not support FEC or 802.3ad. However, if TCP/IP acceleration is used with this method, all ports that are teamed must be on the same physical adapter. There is no load balancing when receiving. The following are valid teaming configurations and restrictions when doing send-only load balancing are:

- Two Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed together; however, acceleration is disabled.
- No Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed with any port of the Alacritech 100x4 Quad-Port Server Accelerated Adapters.
- One Alacritech 100x4 Quad-Port Server Accelerated Adapter can have two or more of its ports teamed, with acceleration enabled.
- Two Alacritech 100x4 Quad-Port Server Accelerated Adapters can have any ports on any card teamed (limited to four ports per team). For example, two ports on one card can be teamed with two ports on a second card. Acceleration will be disabled because the ports are on different adapter cards.

Hot Standby Failover

This technique does no load balancing but does allow failover and redundancy. One port is put online while the remaining ports in the team are offline. If the link for the online ports fails, it is taken offline and one of the other ports takes its place. It is not required that the ports in the team be on the same adapter. It is also not required that they be the same speed, although it is recommended. The following are valid teaming configurations:

- Two Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed together.
- No Alacritech 1000x1 Single-Port Server and Storage Accelerated adapters can be teamed with any port of the Alacritech 100x4 Quad-Port Server Accelerated Adapters.
- One Alacritech 100x4 Quad-Port Server Accelerated Adapter can have two or more of its ports teamed.
- Two Alacritech 100x4 Quad-Port Server Accelerated Adapters can have any ports on any card teamed (limited to four ports per team). For example, two ports on one card can be teamed with two ports on a second card.

To configure adapter teaming with the Alacritech adapters, perform the following steps:

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

Intel Ethernet adapter teaming

Intel offers five teaming modes:

Adapter Fault Tolerance (AFT)

Adapter Fault Tolerance (AFT) is similar to Hot-Standby Failover for the Alacritech adapters. 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.

An AFT team consists of between two and eight ports. In the NAS 200, the maximum number of ports is four, because all Intel adapters are single port and the total number of network cards is four. All adapters in the team should be connected to the same hub or switch with Spanning-Tree Protocol (STP) set to OFF. The team members can be different speeds or different adapters.

The following are valid teaming configurations for AFT with Intel adapters:

- Two IBM Gigabit Ethernet SX Server Adapters
- Two PRO/1000 XT Server Adapter by Intels
- One to two IBM Gigabit Ethernet SX Server Adapters with one to two PRO/1000 XT Server Adapter by Intels

Switch Fault Tolerance (SFT)

Two adapters connected to two switches to provide network availability of a second switch and adapter if the first switch, adapter, or cabling fails. STP must be set to ON. The following are valid teaming configurations for Intel SFT:

- Two IBM Gigabit Ethernet SX Server Adapters
- Two PRO/1000 XT Server Adapter by Intels
- One IBM Gigabit Ethernet SX Server Adapter with one PRO/1000 XT Server Adapter by Intel

Adapter Load Balancing (ALB)

Adapter Load Balancing (ALB) is similar to Send-Only Load Balancing for Alacritech adapters. 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 supported only for adapter teams consisting of only one type of adapter; different types of adapters cannot be combined in a load-balancing team.

Two to eight ports from any Intel adapters are combined in a team that allows increased network bandwidth when sending. AFT is also included. When receiving, only the port identified as primary receives data. There are no special switch requirements.

The following are valid teaming configurations for ALB with Intel adapters:
- Two IBM Gigabit Ethernet SX Server Adapters
- Two PRO/1000 XT Server Adapter by Intels
- One to two IBM Gigabit Ethernet SX Server Adapters with one to two PRO/1000 XT Server Adapter by Intels

Cisco Fast Etherchannel (FEC/GEC compatible)
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 balance only outbound traffic. FEC/GEC requires a FEC/GEC compatible switch. The same teaming must also be enabled on the connected switch ports.

Note: FEC requires an Ethernet switch with FEC capability.

The following are valid teaming configurations for Cisco FEC/GEC with Intel adapters:
- Two IBM Gigabit Ethernet SX Server Adapters
- Two PRO/1000 XT Server Adapter by Intels
- One to two IBM Gigabit Ethernet SX Server Adapters with one to two PRO/1000 XT Server Adapter by Intels

IEEE 802.3ad Link Aggregation Group
802.3ad is an IEEE industry-standard similar to the Cisco FEC/Gigabit Etherchannel (GEC). 802.3ad requires an Ethernet switch with 802.3ad capability. PAgP/LACP facilitates the automatic creation of link aggregation groups. All EtherChannel/Link Aggregation groups must be manually configured.

For the Intel adapters, there are two implementations of the standard. Static is equivalent to Etherchannel and requires a FEC/GEC, 802.3ad or Intel Link Aggregation capable switch. Dynamic requires 802.3ad dynamic capable switches.

The following are valid teaming configurations for IEEE 802.3ad with Intel adapters:
- Two IBM Gigabit Ethernet SX Server Adapters
- Two PRO/1000 XT Server Adapter by Intels
- One to two IBM Gigabit Ethernet SX Server Adapters with one to two PRO/1000 XT Server Adapter by Intels

To configure adapter teaming with the Intel adapters, use Intel PROSet II, which is preloaded on the NAS 200, as follows:
1. Physically connect the adapters that you want to team to the same IP subnetwork.

2. Access the NAS 200 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 13).

3. From the NAS 200 desktop, click **Start** → **Settings** → **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 nonresident 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 → **Add to Team** → **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 click **Next**.

10. Verify that these settings are correct, and then click **Finish**.

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.

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. Purchase any of the 5194 memory field-upgrade feature codes from your IBM representative:
   0300 512 MB memory upgrade
   0301 1 GB memory upgrade
   0302 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 that 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 CD-ROMs" on page 99), 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 common problems that might occur with your appliance.

Use Table 6 as an index to this information.

Table 6. Troubleshooting index

Topic	Located on page
Diagnostic tools	67
Identifying problems using LEDs	68
POST diagnostics	71
Diagnostic programs	72
Troubleshooting adapters	75
Power checkout	92

Powering on and shutting down the appliance

This section describes steps for powering on and off the appliance.

Powering on the NAS 200 and the 5194-EXP storage units

This section describes three different procedures required to power on the NAS 200, depending on the options that are installed. Make sure that you follow the correct procedure. To power on the NAS 200 and the NAS EXP:

1. Verify that:
   - There is no visible damage, in the event of an emergency powering off. If there is damage, have the unit serviced.
   - All cables are correctly attached.
   - All power cords are plugged into the back of the NAS 200 engine (2 cords) and optional 5194-EXP Storage Expansion Unit (2 cords).
   - All hard disk drives are locked securely in place.
   - All switches on the optional 5194-EXP Storage Expansion Unit are set correctly: the internal option switches 1 through 4, external option switches 1 through 5, and the unit ID switch. For more information on these switch settings, refer to the *IBM TotalStorage NAS 200 Model EXP Storage Unit Installation and User's Guide*.
2. Wait at least 20 seconds after connecting the power cords.
3. Power on the appropriate device:
   - If you are restarting the engine when all optional NAS EXPs are already recognized by the ServeRAID controller (for example, after a power failure), power on the devices in this order:
     a. NAS EXPs
        1) Switch on both power supplies in the back of the NAS EXP.

           The NAS EXP might take a few seconds to power on. During this time, you might see the fault (amber) and the power (green) LEDs on the NAS EXP turn on and off intermittently.

2) When the power-on sequence is complete, verify that only the power (green) LEDs on the front and back are on. If one or more fault (amber) LEDs remain on, refer to the *IBM TotalStorage NAS 200 Model EXP Storage Unit Installation and User's Guide*.

   Attention: If you have data stored on the drives, label the drives before you remove them. Then, when you replace the drives, install each of the drives back into the same drive bay from which you removed it. Failure to do so will result in a loss of data.

b. Engine
   1) Press the power button on the front of the engine to power on the appliance.

      Attention: The first time you start the appliance, a series of configuration and system preparation programs that finish configuring the *Network Operating System* (NOS) run automatically. These programs must complete before you use any included applications to connect to or configure your appliance. Wait at least 5 minutes before connecting to or configuring the appliance after the initial system start.

   2) Verify that the the Power-on LED is *on* and the Information LED and System Error LED are both *off*.

      Note: Depending on the system status, other LEDs might be on.

1	Power-on LED
2	POST complete (OK) LED
3	Hard disk drive activity LED
4	Information LED
5	System error LED
6	Ethernet transmit/receive activity (TX/RX[1]) LED
7	System locator LED

- If you are not using a NAS EXP, power on the engine using the procedure in step 3b.
- If you are adding one or more new NAS EXPs, then power on the devices in the following order:
  a. Already recognized NAS EXPs. These are any NAS EXPs that are already recognized by the ServeRAID controller (see Step 3a on page 65 for instructions explaining how to start the NAS EXPs).
  b. Engine (see Step 3b for instructions explaining how to start the engine).
  c. New NAS EXPs. These are all NAS EXPs that are new to the configuration and not recognized by the ServeRAID controller (see Step 3a on page 65 for instructions explaining how to start the NAS EXPs).

Shutting down the appliance

CAUTION:
<2–19> The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

Note: For translations of this safety notice, refer to *IBM TotalStorage Network Attached Storage Translated Safety Notices*, which can be found on the Documentation CD-ROM that was shipped with your appliance.

Attention: Powering off the appliance using the power button can result in a loss of data. Instead, it is recommended you use the following procedure to shut down.

To shut down the appliance:

1. If you have a monitor, keyboard, and PS/2 mouse attached, select **Shut Down...** from the Windows Start Menu.

   If you are connecting through Terminal Services, use the Terminal Services Client and select **Start → Shutdown → Shutdown (from the dropdown menu) → OK**.

   If you are connecting through a web browser:
   - Enter **http://**ip_address**:8099** or **http://**computer_name**:8099**
   - Log on to the appliance.
   - Access the shutdown option on the Maintenance tab of the GUI and then select **Maintenance → Shutdown → Shutdown → OK**.

2. Disconnect the appliance power cords from the electrical outlets.

   Note: Wait approximately 15 seconds after disconnecting the power cords for your appliance to stop running. Watch for the Power-on LED on the operator information panel to stop blinking.

Diagnostic tools overview

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

- **Light-path diagnostics**

  LEDs help you identify problems with engine components. These LEDs are part of the light-path diagnostics that are built into your engine. Using the LEDs, you can quickly identify the type of system error that occurred. See "Identifying problems using LEDs" on page 68 for more information.

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

  The POST generates the beep codes and messages to indicate successful test completion or the detection of a problem. See "POST diagnostics" on page 71 for more information.

- **Diagnostic programs and error messages**

The Base System Diagnostics are stored in upgradable read-only memory (ROM) on the system board, on CD-ROMs, and in the software. These programs are the primary method of testing the major components of your engine. See "Diagnostic programs" on page 72 for more information.

Note: You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely. See "Powering on and shutting down the appliance" on page 65 for more information on shutting down and powering on the appliance.

Identifying problems using LEDs

Each NAS 200 has LEDs to help you identify problems with some engine components. These LEDs are part of the light-path diagnostics built into the engine. By following the *path of lights*, you can identify the type of system error that occurred. There are three sources of LED information:
- Operator information panel
- Power supply
- Diagnostics panel

Operator information panel

The operator information panel on the front of the appliance contains status LEDs.
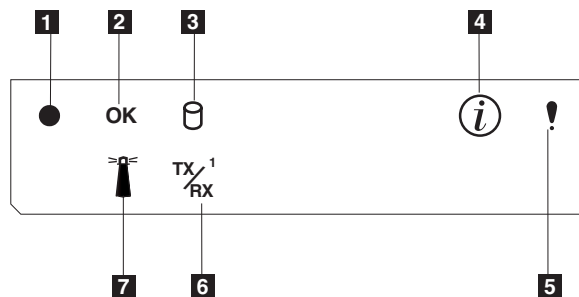
Figure 3. Operator information panel

1	**Power-on LED**: This green LED is on when system power is present in the appliance. When this LED flashes, the appliance is in standby mode (the system power supply is turned off and ac power is present). If this LED is not on, the power cord is not connected, the power supply has failed, or this LED has failed.
2	**POST complete (OK) LED**: This green LED is on when when POST completes without any errors.
3	**Hard disk drive activity LED**: This green LED is on when there is activity on the internal hard disk drive.
4	**Information LED**: This amber LED is on when the information log contains information about certain conditions in your appliance that might affect performance. For example, the LED is on if your appliance does not have functioning redundant power. An LED on the diagnostic panel on the system board will also be on.

5 **System error LED**: This amber LED is on when a system error occurs. An LED on the diagnostic panel on the system board will also be on to further isolate the error.

6 **Ethernet transmit/receive activity (TX/RX[1]) LED**: This green LED is on when there is transmit or receive activity to or from the appliance on the integrated Ethernet port.

7 **System locator LED**: This blue LED can be turned on remotely to identify a specific engine.

Power-supply LEDs

The AC Power LED and DC Power LED on the power supply provide status information about the power supply. Figure 4 and Figure 5 show the location of the power-supply LEDs.
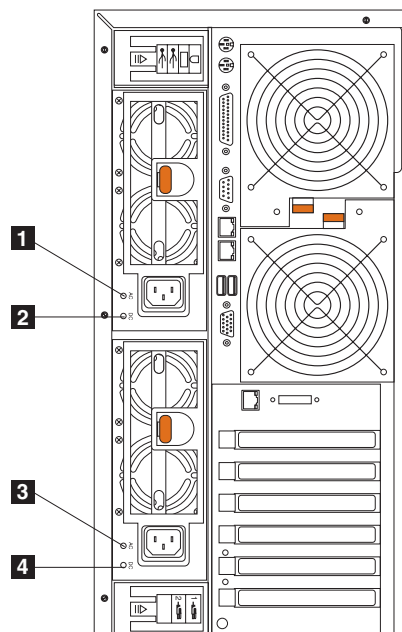
Figure 4. Location of the power-supply LEDs (Model 25T)
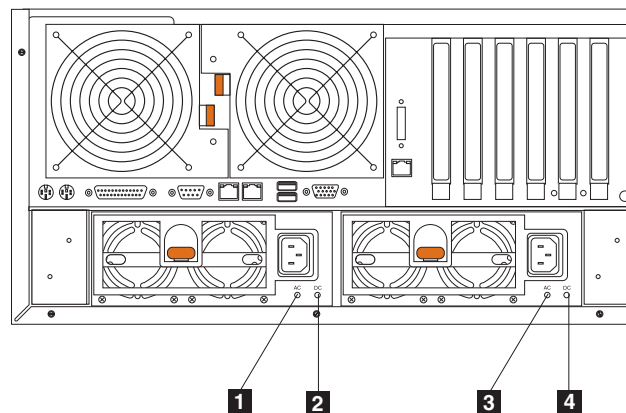
Figure 5. Location of the power-supply LEDs Model 25T with the rack-mount conversion feature

1 Power supply 1 AC power LED (green)

	2	Power supply 1 DC power LED (green)
	3	Power supply 2 AC power LED (green)
	4	Power supply 2 DC power LED (green)

See "Power error messages" on page 131 for error messages.

Table 7. Power supply LED errors

AC Power LED	DC Power LED	Description and recommended actions
Off	Off	No power to system or ac problem **Action:** Check ac power to appliance.
On	Off	Standby mode or dc problem **Action:** 1. Check processor-board cable connector, J33. by moving the jumper on the J32 extension cable to pins 2 and 3 to bypass power control. If the DC Good LED comes on, press Ctrl-Alt-Delete. Watch the screen for any POST errors. 2. Check the System Error log for any listed problems. 3. If the appliance powers on with no errors: check the power switch assembly or system board. 4. Remove the adapters, and disconnect the cables and power connectors to all internal and external devices. Power on the system. If the DC Power LED comes on, replace the adapters and devices one at a time until you isolate the problem.
On	On	Power is OK

Diagnostics panel LEDs

You can use the light-path diagnostics to quickly identify the type of system error that occurred. The diagnostics panel is under the cover. If your configuration is a Model 25T with the rack-mount conversion feature, you can also view the diagnostics panel through the cover by partially sliding the engine out of the rack. Each engine is designed so that any LEDs that are on, remain on when the engine shuts down if the ac power source is good and the power supplies can supply +5 V dc current to the engine. This feature helps isolate the problem if an error causes the engine to shut down.

Figure 6 on page 71 shows the LEDs on the diagnostics panel.

Note: You might have to remove the cover to view these LEDs. (For more information on removing the cover, refer to "Removing the cover" in Chapter 3 of the hardware installation guide.) See Table 23 on page 120 for more information on the LEDs.
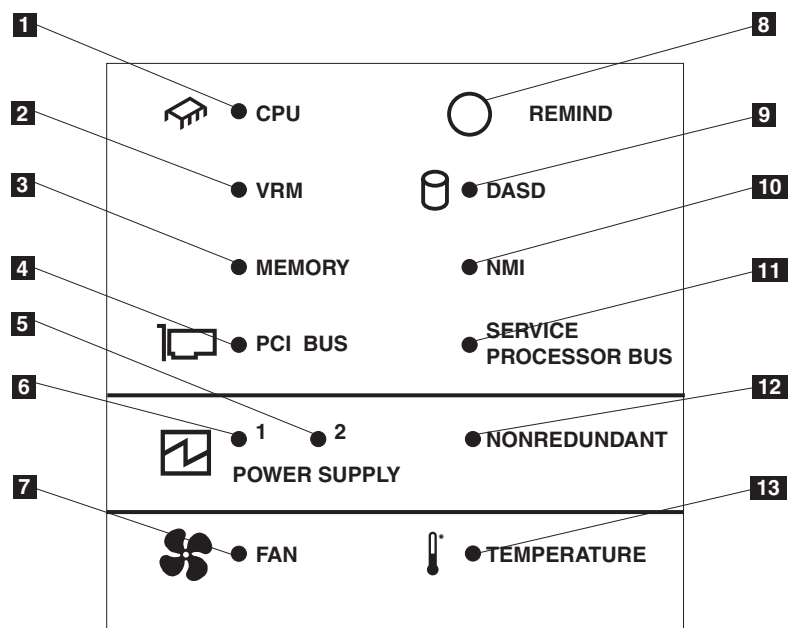
Figure 6. LED diagnostics panel

1	CPU LED
2	VRM LED
3	Memory LED
4	PCI Bus LED
5	Power supply 1 LED
6	Power supply 2 LED
7	Fan LED
8	Remind button
9	DASD LED
10	NMI LED
11	Service Processor Bus LED
12	Nonredundant LED
13	Temperature LED

POST diagnostics

> **Note:** You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely.

When you switch on the appliance, it performs a series of tests to check the operation of appliance components and some of the options installed in the appliance. This series of tests is called the power-on self-test (POST).

If POST finishes without detecting any problems, a single beep sounds.

If POST detects a problem, more than one beep sounds and an error message appears on your screen. See "Beep symptoms" on page 109 and "POST error codes" on page 125 for more information.

Notes:

1. If you have a power-on password or administrator password set, you must type the password and press **Enter**, when prompted, before POST will continue.

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.

Event and 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.

To view the contents of the error logs:

1. Attach a keyboard and monitor to the appliance.
2. Restart the appliance.
3. Press **F1** to enter the Configuration/Setup Utility.
4. Follow the on-screen prompts.

You can also access the error logs using the optional Remote Supervisor Adapter. See the *Remote Supervisor Adapter User's Guide* provided on the Documentation CD-ROM.

Diagnostic programs

Note: You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely.

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

Diagnostic error messages indicate that a problem exists; they are not intended for use in identifying a failing part.

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.

Format of an error code

The error code format is as follows:

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

where:

fff   is 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   is the three-digit failure code that indicates the exact test failure that was encountered.

iii   is the three-digit device ID.

date   is the date when the diagnostic test was run and the error recorded.

cc   is the check digit that is used to verify the validity of the information.

text message
            is the diagnostic message that indicates the reason for the problem.

            The diagnostic text message format is as follows:

            `Function Name: Result (test-specific string)`

            where:

            Function Name
                    is 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 have one of the following values:

                    Passed
                            The diagnostic test completed without any errors.

                    Failed The diagnostic test discovered an error.

                    User Aborted
                            You stopped the diagnostic test before it was 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 was to be tested was not installed.

                    Test-specific string
                            is additional information that you can use to analyze the problem.

Starting the diagnostic programs

To start the diagnostic programs:

1. Power on the appliance.
2. When the message `F2 for Diagnostics` appears, press **F2**.

   Note: To run the diagnostic programs, you must start the appliance 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.

3. Type the appropriate password; then, press **Enter**.
4. Select either **Extended** or **Basic** from the top of the panel.
5. When the Diagnostic Programs panel appears, select the test you want to run from the list that appears; then, follow the instructions on the panel.

Notes:

1. You can also press **F1** while running the diagnostic programs to obtain Help information, or press **F1** from within a help window to obtain online documentation. To exit Help and return to where you left off, press **Esc**.

2. If the appliance stops during testing and you cannot continue, restart the appliance and try running the diagnostic programs again.

3. The keyboard and mouse (pointing device) tests assume that a keyboard and mouse are attached to the appliance.

4. If you run the diagnostic programs with no mouse attached to your appliance, you will not be able to navigate between test categories using Next Cat and Prev Cat. All other functions provided by mouse-selectable buttons are also available using the function keys.

5. You can view appliance 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 panel.

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

If the hardware tests complete successfully, but the problem persists during normal appliance operations, an error might be the cause.

Viewing the test log

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

Note: If you are already running the diagnostic program, begin with Step 3.

To view the test log:

1. Power on the appliance.

   If the appliance is on, shut down your operating system and restart the appliance.

2. When the message `F2 for Diagnostics` appears, press **F2**.

   If a power-on password or administrator password is set, the appliance prompts you for it. Type in the appropriate password; then, press **Enter**.

3. When the Diagnostic Programs panel appears, select **Utility** from the top of the panel.

4. Select **View Test Log** from the list that appears; then, follow the instructions on the panel.

   The system maintains the test-log data while the appliance is powered on. When you shut down the appliance, the test log is cleared.

Diagnostic error-message tables

The tables in "Diagnostic error codes" on page 112 provide descriptions of the error messages that might appear when you run the diagnostic programs.

Note: If diagnostic error messages appear that are not listed in the tables, make sure that your appliance has the latest levels of BIOS, Integrated System Management (ISM) Processor, and diagnostic microcode installed.

Troubleshooting adapters

This section explains how to troubleshoot adapters. When troubleshooting adapters, check the status indicators and run the diagnostics.

Ethernet adapters

Refer to these sections when troubleshooting the Ethernet adapter.

Gigabit Ethernet controller troubleshooting chart

Use the following troubleshooting chart to find solutions to Gigabit Ethernet controller problems that have definite symptoms.

Table 8. Ethernet controller troubleshooting chart

Ethernet controller problem	Suggested action
Ethernet-link status light is not on.	• Ensure that the engine is powered on. • Check all connections at the Ethernet controller. • If you manually configured the duplex mode, ensure that you also manually configured the speed. • Run Base System Diagnostics on the LEDs. If the problem remains, go to "Starting the diagnostic programs" on page 73 to run all of the diagnostic programs.
The Ethernet transmit/receive activity light is not on.	**Note:** The Ethernet Transmit/Receive Activity LED is on only when data is sent to or by this Ethernet controller. • Ensure that you have loaded the network device drivers. • The network might be idle. Attempt to send data from this workstation. • Run Base System Diagnostics on the LEDs. • 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 is incorrect or sporadic.	• Ensure that you are using Category 5 cabling when operating the NAS 200 at 100 Mbps or 1000 Mbps. • Make sure that the cables do not run close to noise-inducing sources, such as fluorescent lights.
The Ethernet controller stopped working when another adapter was added to the NAS 200.	• Ensure that the cable is connected to the Ethernet controller. • Ensure that your PCI system BIOS is current. • Reseat the adapter. • Ensure that the adapter you are testing is supported by the NAS 200. If the problem remains, go to "Starting the diagnostic programs" on page 73 to run the diagnostic programs.
The Ethernet controller stopped working without apparent cause.	• Run Base System Diagnostics for the Ethernet controller. • Reinstall the device drivers. Refer to your operating-system documentation. If the problem remains, go to "Starting the diagnostic programs" on page 73 to run the diagnostic programs.

IBM Gigabit Ethernet SX Server Adapter troubleshooting chart

Use the troubleshooting chart in Table 9 on page 76 to find solutions to the IBM Gigabit Ethernet SX Server Adapter problems that have definite symptoms.

Table 9. IBM Gigabit Ethernet SX Server Adapter troubleshooting chart

IBM Gigabit Ethernet SX Server Adapter problem	Suggested action
LINK LED is not on.	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 buffered repeater or switch port is configured for 1000 Mbps and full-duplex. 5. Change the auto-negotiation setting on the link partner, if possible.
RX or TX LED is not on.	1. Check the cables. 2. Ensure that you have loaded the adapter driver. 3. The network might be idle; log in from a workstation. 4. The adapter is not transmitting or receiving data; use another adapter.
No Link or TX/RX activity.	If you cannot link to your switch: 1. Check the following LED lights on the adapter: **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. • Check all connections at the adapter and link partner • Make sure the link partner is set to 1000 Mbps and full-duplex • Ensure that 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. 2. 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 engine cannot find the IBM Gigabit Ethernet SX Server Adapter.	1. Verify that the adapter is seated firmly in the slot. 2. Try a different IBM Gigabit Ethernet SX Server Adapter. 3. Try a different slot to verify that the slot on the system board is not the problem.
Diagnostics pass but the connection fails.	Ensure that the network cable is securely attached.
Another adapter stopped operating correctly after you installed the IBM Gigabit Ethernet SX Server Adapter.	1. Verify that the cable is connected to the IBM Gigabit Ethernet SX Server Adapter and not to another adapter. 2. Check for a resource conflict indicated by a problem icon in the Device Manager. To access Device manager: a. Right-click on My Computer, and and select *Manage*. b. Select *Device Manager*. 3. Ensure that both adapters are seated firmly in the slot. 4. Check all cables.

Table 9. IBM Gigabit Ethernet SX Server Adapter troubleshooting chart (continued)

IBM Gigabit Ethernet SX Server Adapter problem	Suggested action
The adapter stopped working without apparent cause.	1. Check the cables. 2. Reseat the adapter. 3. The network driver files might be damaged or deleted. Reinstall the drivers. 4. Use a different IBM Gigabit Ethernet SX Server Adapter.

PRO/1000 XT Server Adapter by Intel troubleshooting chart

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

Table 10. PRO/1000 XT Server Adapter by Intel troubleshooting chart

PRO/1000 XT Server Adapter by Intel problem	Suggested action
The NAS 200 cannot find the PRO/1000 XT Server Adapter by Intel.	1. Verify that the adapter is seated firmly in the slot. 2. Reboot the engine. 3. Try a different PRO/1000 XT Server Adapter by Intel.
Diagnostics pass but the connection fails.	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 by Intel.	1. Verify that the cable is securely connected to the PRO/1000 XT Server Adapter by Intel and not to another adapter.
	2. Check for a resource conflict indicated by a problem icon in the Device Manager. To access Device manager:
	  a. Right-click on My Computer, and and select *Manage*.
	  b. Select *Device Manager*.
	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 by Intel is unable to connect at 1000 Mbps, instead it connects at 100 Mbps.	1. Ensure that the cable is CAT-5 or better. 2. Try another cable.

The adapter stopped working without apparent cause.	1. Reseat the adapter.
	2. The network driver files might be damaged or deleted. Reinstall the drivers using Device Manager. To access Device manager:
	  a. Right-click on My Computer, and and select *Manage*.
	  b. Select *Device Manager*.
	  c. Select *Update Drivers*.
	  d. Reload the appropriate driver found in c:\drivers.
	3. Reboot the engine.
	4. Try a different cable.
	5. Use a different PRO/1000 XT Server Adapter by Intel.

PRO/1000 XT Server Adapter by Intel problem	Suggested action
LINK LED is off.	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.	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.	1. Ensure that the cable is securely attached. 2. Ensure that the drivers are loaded. 3. Try accessing a server. 4. Try another PRO/1000 XT Server Adapter by Intel.
Operating system message: Unable to remove PROSet in SAFE mode.	If the engine hangs after configuring the adapters with the PROSet utility, perform the following steps: 1. Start Windows in Safe mode. 2. Access the Device Manager and disable the network adapters and teams. 3. Restart the engine. 4. Windows should operate normally if the disabled adapters were causing the problem.
LED indicators	• ACT/LNK **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. • 10=OFF 100=GRN 1000=YLW **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

Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter troubleshooting chart

Use the troubleshooting chart in Table 11 on page 79 to find solutions to the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter problems that have definite symptoms.

Table 11. Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter troubleshooting chart

Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter problem	Suggested action
Error message: "Setup cannot find OEMSETUP.INF or OEMSETNT.INF"	• Make sure that you are installing from the Adapters tab of the Network Control Panel Applet. • Make sure that you are specifying the correct drive letter for your CD-ROM drive.
Error message: "No SLIC adapters found"	Make sure that the adapter has been correctly installed in the PCI slot and that the PCI slot is enabled.
Event log reports "SLIC <x> Has determined that the adapter is not functioning properly"	• Run the diagnostics Network Control Panel Applet. • Replace the adapter.
Event log reports "SLIC <x>: Could not find an adapter"	• Ensure that the card was not moved from its original slot. • Uninstall the adapter from the adapters tab of the Network Control Panel Applet, reboot, and then reinstall.
Event log reports "The Alacritech 100 or 1000 Series Server Adapter service failed to start due to the following error: The system cannot find the file specified."	Update the drivers with the drivers found at: www.ibm.com/storage/support
There is no connectivity with other computers on the network. Pinging does not work.	• Make sure that the cables are attached securely at both RJ-45 connections (adapter and switch) and that the network cable is functional. • Check the LEDs on the adapter. These LEDs help indicate if there are problems with the adapter, switch, or cable.
TCP connections can be established to other systems on the same subnet, but connections cannot be established to systems on the other side of a router.	If you have a Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter and an adapter from another manufacturer installed on your system, **and** your network is configured such that the route from your system to the remote system is different than the route from the remote system back to your system (a routing loop), then it might not be possible to establish a TCP connection. To solve this problem, perform one of the following solutions: • Replace the existing adapter with an Alacritech 100 or 1000 Series Server Adapter, or • Reconfigure the network to eliminate the routing loop, or • Disable TCP/IP Offload on the interfaces associated with the routing loop by completing this procedure: **Note:** Disabling SLI TCP/IP Offload will disable the performance benefits of the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter on that interface. Complete these steps only when required. 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.

Table 11. Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter troubleshooting chart (continued)

Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter problem	Suggested action
IPSEC does not function through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter interface.	In order to use IPSEC with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interface through which you want to establish the IPSEC connection. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.
QOS does not work through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter interface	In order to use QOS with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interface through which you want to establish the QOS connection. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.
Network monitoring does not function through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter.	Network monitoring applications require packet access to the network, and are incompatible with the session layer interface provided by the SLIC TCP/IP Offload. In order to use network monitoring with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interface through which you want to use network monitoring. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.
Firewall software does not work through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter interface.	Firewall applications require packet access to the network, and are incompatible with the session layer interface provided by the SLIC TCP/IP Offload. In order to use network monitoring with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interface through which you want to use for a firewall. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.

Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter problem	Suggested action
Microsoft Network Load Balancing does not work through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter interface.	In order to use Microsoft Network Load Balancing with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interfaces which you want to use for Microsoft Network Load Balancing. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.
Point-to-Point Tunneling Protocol (PPTP) does not work through the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter interface.	PPTP connections cannot be established through a SLIC TCP/IP Offload-enabled interface. In order to use PPTP with the Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter, disable SLIC TCP/IP Offload on the interfaces through which you want to establish a PPTP connection. To disable the SLIC TCP/IP Offload, complete these steps: 1. From the start menu, open the Network & Dial-up Connections folder located in the *Settings* menu. 2. Double-click the LAN connection of the interface you want to disable TCP Offload. 3. Click the Properties button. Clear the box labeled *Alacritech TCP Fast-path driver*. Click **OK**. 4. Restart the engine.
When uninstalling the Alacritech TCP Fast-path driver, an error message appears with the message: ″Could not uninstall the Alacritech TCP Fast-path driver component. The error is 0x800F020B″	No corrective action is necessary.

Alacritech 100x4 Quad-Port Server Accelerated Adapter

Table 12 displays the LED definitions for the Alacritech 100x4 Quad-Port Server Accelerated Adapter LED definitions.

Table 12. Alacritech 100x4 Quad-Port Server Accelerated 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.

ServeRAID controller troubleshooting chart

Table 13 shows some common troubleshooting error messages when using the ServeRAID controller.

Table 13. ServeRAID troubleshooting messages

Message	Explanation and possible recovery actions
A new drive was installed.	Explanation: When the ServeRAID controller detects a new drive that is not part of the current configuration, the following message appears: `x new Ready drives found` where *x* is the number of Ready drives found. Action: This is an information message. No action is required.
Auto rearrange.	Explanation: Auto rearrange is enabled or disabled. Action: This is an information message. No action is required.
Battery-backup cache not responding	Explanation: BIOS code detected a bad or failed battery-backup cache. Action: Press F9 to remove the battery-backup cache from the configuration, or press F10 to exit without change.
Battery-backup cache replacement	Explanation: The ServeRAID controller detects that the battery-backup cache is defective. Action: If the battery-backup cache must be replaced, contact your IBM service representative. Press F8 if you replaced the battery-backup cache, or press F10 if you have not replaced the battery-backup cache.

Table 13. ServeRAID troubleshooting messages (continued)

Message	Explanation and possible recovery actions

Configured drives are missing.	Explanation: When the ServeRAID controller detects that a previously configured drive is missing, the following message appears:
	
	` x Online drives not responding or found at new location(s)`
	
	where *x* is the number of drives not responding.
	
	After pressing F2, a more detailed message appears:
	
	`Online Drive on Channel x SCSI ID y is not responding.`
	
	where *x* is the channel ID and *y* is the SCSI ID.
	
	Action: Press one of the following keys:
	
	F2 Detailed description. Press this key for a detailed description of the problem, such as the example message above.
	
	F4 Retry. Press this key after correcting a problem. For example, press F4 after you turn on the external storage enclosure that contains the physical drive.
	
	F5 Change the configuration and set the drives to defunct. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct or empty.
	
	You can also press F5 when you must remove a drive. RAID level-1 and RAID level-5 logical drives are present, and performance in a degraded mode is acceptable. The ServeRAID controller will assign the drive a state of defunct, but the server can complete startup. However, the array will remain in critical mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner.
	Note: A physical drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
	1. All cables are connected correctly to the backplane and to the physical drive. Also, ensure that all cables inside the engine are connected correctly.
	2. The hot-swap drive trays are seated correctly in the drive bay.
	3. If multiple drives fail in separate arrays (one physical drive per array), then replace each of the defunct physical drives. If multiple physical drives fail at the same time within the same array, contact your IBM service representative. See "Rebuilding a defunct drive" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information.
	
	After you perform these steps, if the physical drive does not function correctly, replace the drive.
	
	F10 Continue starting without changing the configuration. Press this key to continue without change to the configuration.

Table 13. ServeRAID troubleshooting messages (continued)

Message	Explanation and possible recovery actions

Configured drives are not in the configured location.	Explanation: When the ServeRAID controller detects that a previously configured drive is present, but the drive is in a new location, the following message appears:
	
	`x Online drive has been rearranged`
	
	where *x* is the number of drives that have been rearranged.
	
	After pressing F2, a more detailed message appears:
	
	`Online Drive on Channel w SCSI ID x moved to Channel y SCSI ID z`
	
	where *w* and *y* are the channel numbers, and *x* and *z* are the SCSI IDs.
	
	Action: Press one of the following keys:
	
	F2 — Detailed description. Press this key for a detailed description of the problem, such as the example messages above.
	
	F4 — Retry. Press this key after correcting a problem. For example, press F4 after you move the physical drive to its previously assigned location.
	
	F5 — Change the configuration and set the drive to defunct. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct or empty.
	Note: A physical drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
	1. All cables are connected correctly to the backplane and to the physical drive. Also, ensure that all cables inside the server are connected correctly.
	2. The hot-swap drive trays are seated correctly in the drive bay.
	3. If multiple drives fail in separate arrays (one physical drive per array), then replace each of the defunct physical drives. If multiple physical drives fail at the same time within the same array, contact your IBM service representative. See "Rebuilding a defunct drive" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information.
	
	After you perform these steps, if the physical drive does not function correctly, replace the drive.
	
	F6 — Change the configuration and accept the rearrangement. Press this key to change the configuration to match the current drive location.
	
	You might remove the hot-swap drives from the server for security or maintenance reasons. If you replace the drives but install them in different drive bays, you can press F6 to accept the new locations, and the ServeRAID controller will update the configuration.
	
	F10 — Continue startup without changing the configuration. Press this key to continue without change to the configuration.

Controller is not responding to commands. No logical drives are installed.	Explanation: The ServeRAID controller is not operational. Action: Have the engine serviced.

Table 13. ServeRAID troubleshooting messages (continued)

Message	Explanation and possible recovery actions
Error: Cannot disable this controller BIOS.	Explanation: The ServeRAID controller was unable to prevent an extra copy of its BIOS code from being stored on the engine. This condition occurs when the server contains multiple ServeRAID controllers. Action: Have the engine serviced.
Installation stopped.	Explanation: The engine cannot access the ServeRAID controller. Action: This is a follow-on message to a preceding message. Follow the Action instructions for the preceding message to resolve the problem.

New controller installed in a configured server or drives are imported.	Explanation: When the ServeRAID controller detects that the identifiers of the drives do not match the controller configuration information, the following message appears:
	
	`x Online drive(s)found with incorrect configuration`
	
	where *x* is the number of drives found with incorrect configuration.
	
	After pressing F2, a more detailed message appears:
	
	`Configuration mismatch Channel x with Host ID y`
	
	where *x* is the channel number, and *y* is the Host ID.
	
	Action: Press one of the following keys:
	
	F2 Detailed description. Press F2 for a detailed description of the problem, such as the example message above.
	
	F4 Retry. Press F4 after correcting a problem. For example, press F4 after you power on the external storage enclosure that contains the physical drive.

Table 13. ServeRAID troubleshooting messages (continued)

Message	Explanation and possible recovery actions
New controller installed in a configured server or drives are imported *(continued)*	**F5** Change the configuration and set the drives to defunct. Press F5 to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct or empty. You can also press F5 when you must remove a drive. RAID level-1 and RAID level-5 logical drives are present, and performance in a degraded mode is acceptable. The ServeRAID controller will assign the drive a state of defunct, but the server can complete startup. However, the array will remain in Critical mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner. **Note:** A physical drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that: 1. All cables are connected correctly to the backplane and to the physical drive. Also, ensure that all cables inside the engine are connected correctly. 2. The hot-swap drive trays are seated correctly in the drive bay. 3. If multiple drives fail in separate arrays (one physical drive per array), then replace each of the defunct physical drives. If multiple physical drives fail at the same time within the same array, contact your IBM service representative. See "Rebuilding a defunct drive" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information. If the physical drive does not function correctly after you perform these steps, replace the drive. **F7** Import configuration information from drive. Press F7 to restart the engine. Use F7 to import the configuration information from the drive and to update the configuration information for the ServeRAID controller. This choice is useful when you replace the ServeRAID controller in an existing ServeRAID subsystem. You also might press F7 if you replace a whole set of drives with drives that were configured in another server with a ServeRAID controller. **Note:** When you install drives in a server that has no logical drives defined, the F7 choice will not appear. The ServeRAID controller does not contain any logical drives in its factory configuration. Therefore, F7 will not appear. In this case, do the following: 1. Restart the engine and press Ctrl+I to enter the Mini-Configuration program. (See "Using the Mini-Configuration program" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information.) 2. Select **Advanced Functions**. 3. Select **Copy the Configuration from Drives to the Controller** and follow the instructions on the screen.

Table 13. ServeRAID troubleshooting messages (continued)

Message	Explanation and possible recovery actions
Recoverable configuration error	Explanation: The configuration data stored in NVRAM does not match the configuration data stored in the EEPROM. Action: 1. Press Ctrl+I to access the ServeRAID Mini-Configuration menu. (See "Using the Mini-Configuration program" in the *IBM ServeRAID User's Reference* on the Documentation CD-ROM for more information.). 2. Select **Advanced Functions** from the Main Menu. 3. select **Copy the Configuration from Drives to the Controller**. (See "Using the advanced configuration functions" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information.)
Unrecoverable configuration error	Explanation: The configuration data stored in NVRAM does not match the configuration data stored in the EEPROM. Action: 1. Press Ctrl+I to access the ServeRAID Mini-Configuration menu. (See "Using the Mini-Configuration program" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information.) 2. Select **Advanced Functions** from the Main Menu. **Attention:** Restoring to factory default settings sets all online drives in an array to ready. You must import the configuration from the drives or diskette. Otherwise, you must create a new array and logical drives. When you create new logical drives, they are automatically initialized. All data is lost and you must re-install the operating system and data. 3. Select **Restore to the Factory Default Settings**. (See "Using the advanced configuration functions" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information).
WARNING: *n* logical drives are critical; *n* logical drives are offline.	Explanation: One or more physical drives have failed. Action: Replace the defunct drives as soon as possible to prevent data loss.
Your server has an error due to a Blocked Logical Drive.	Explanation: One or more logical drives are blocked. A blocked logical drive cannot be accessed. See "Logical drive-state descriptions" in the *IBM ServeRAID User's Reference* on the Documentation CD for more information. Action: Press F4 to unblock the logical drive, or press F5 to continue without unblocking.

Running adapter diagnostics

This section describes how to test the adapter using the diagnostics. Note that running the adapter diagnostics will disrupt the network connection.

Ethernet adapters
This section explains how to test Ethernet adapters.

Intel PROSet II utility: The NAS 200 is equipped with the Intel PROSet II utility for:

- Monitoring the status of the Ethernet adapter PCI cards
- Testing the Ethernet adapter to see if there are any problems with the adapter hardware, the cabling, or the network connection
- Isolating problems during troubleshooting

To access the PROSet utility, you must first go into Terminal Services. For instructions on how to invoke Terminal Services, see "Terminal Services and the IBM NAS Administration console" on page 13. Within Terminal Services perform the following steps:

1. Double-click the **INTEL PROSet II** icon in the Control Panel to start the Intel PROSet II utility.
2. In Intel PROSet II, select the Ethernet adapter you want to test (IBM Gigabit Ethernet SX Server Adapter, integrated Gigabit Ethernet controller, or the PRO/1000 XT Server Adapter by Intel).
3. Select the **Diagnostics** tab. A list of available tests is displayed.
4. Select **Run Tests**.

   You can also select or clear individual tests with the check boxes. If an error is detected, information about the error is displayed.
5. Repeat Steps 2 through 4 for each Ethernet adapter installed in the engine.

Alacritech 100x4 Quad-Port Server Accelerated Adapter and Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter: Note that running these diagnostic tests will disrupt all ports of the adapter.

Use the following procedure to run diagnostic tests on this adapter:

1. Open the Control Panel.
2. In the Network dialog box, select the *Adapters* tab.
3. Select one of the Alacritech 100x4 Quad-Port Server Accelerated Adapter or Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter ports.
4. Click **Properties**.
5. Select the *Diagnostics* tab.
6. Click **Run**. The adapter will complete the self-test of the IPP and the selected port of the adapter.
7. Close the Network Control Panel by clicking **OK**.

Fibre Channel adapter

Note: The Fibre Channel adapter diagnostics utility that was used in earlier versions was FAStT Check.

Each engine has FAStT MSJ for viewing the status of your Fibre Channel connection as well as testing the adapter. To use FAStT MSJ utility, you must first go into Terminal Services. For instructions on how to invoke Terminal Services, see "Terminal Services and the IBM NAS Administration console" on page 13.

Access FAStT MSJ by going into the IBM NAS Admin console and selecting **NAS Management —> Storage —> NAS Utilities —> FAStT MSJ**. Then select **Connect**. A diagnostic panel displays the following general information related to your Fibre Channel adapter, which can be useful if you need to place a support call:

- Node name (the world-wide name or MAC address of the Fibre Channel adapter)
- Loop ID
- BIOS version
- Firmware version number
- Device-driver version number
- PCI slot number

Note: Ensure that there is no adapter activity before running the test or data can be lost.

To test the Fibre Channel adapter, select the adapter and then select **Diagnostic**.

Remote Supervisor Adapter

1. Insert the Remote Supervisor Adapter Support CD-ROM 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. The main menu contains 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 reports on the Advanced System Management devices in the NAS 200 in the following manner:

   ```
           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
   ```

ServeRAID controller

This section applies to the IBM ServeRAID-5i Ultra320 SCSI Controller, IBM ServeRAID-4H Ultra160 SCSI Controller, or IBM ServeRAID-4Mx Ultra160 SCSI Controller, unless otherwise noted.

Error codes and messages display on the screen at power-on 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. Refer to "POST (ISPR) error procedures" on page 90 and correct the problem.

If there is no POST Error or Configuration Error message, the BIOS screen messages resemble the sample shown below. Note that your version might be different from the one shown.

```
_____
IBM ServeRAID BIOS
Copyright IBM Corp. 1995, 2001
Ver: 3.00.12 08/14/2000, 2001

_____
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.
ServeRAID Firmware Version:2.82.00
No logical drives found; none are installed.
Non-Disk SCSI Devices Found: CD-ROM 0, Tape 0, Removable-media 0, Other 1.

BIOS not loaded no devices found - Installation stopped.
```

If there is a POST Error message, the BIOS screen resembles the sample shown below. Refer to "POST (ISPR) error procedures" on page 90 and correct the problem. Note that your version might be different from the one shown. The characters *XXXX* indicate the POST (ISPR) error.

```
_____
IBM ServeRAID BIOS
Copyright IBM Corp. 1995, 2001
Ver: 3.00.12 08/14/2000, 2001

_____
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

BIOS not loaded no devices found - Installation stopped.
```

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

```
IBM ServeRAID BIOS
Copyright IBM Corp. 1995, 2001
Ver: 3.00.12 08/14/2000, 2001

_____
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
```

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 "ServeRAID" on page 133.

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.

   Attention: Do not press F5, as this 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. Identify which channel is causing the error by the second digit (Z) of the original ISPR code as indicated in Table 14:

   Note: IBM ServeRAID-4H Ultra160 SCSI Controllers have four channels. IBM ServeRAID-5i Ultra320 SCSI Controllers have two channels, one internal and one external channel located on the back of the engine. The IBM ServeRAID-4Mx Ultra160 SCSI Controllers have 2 channels.

Table 14. SCSI identifier

Code (*z*)	Channel
1	1
2	2
3	1 and 2
4	3
5	1 and 3
6	2 and 3
7	1, 2, and 3
8	4
9	1 and 4
A	2 and 4
B	1, 2, and 4
C	3 and 4
D	1, 3, and 4
E	2, 3, and 4
F	1, 2, 3, and 4

   b. Confirm that any channels are the cause of the error by verifying that the error presents itself *only* when the offending channel is reconnected.
   c. Check termination of identified channel.
   d. Check for correct backplane jumper configuration.
   e. Check for correct cabling configuration in systems that use DASD status cables. Reconnect all cables that you disconnected at the beginning of this procedure.
   f. Disconnect one drive at a time attached to the channel you previously identified Table 14, then reboot to determine which drive is causing the error.
   g. Replace the SCSI cable.
   h. Replace the SCSI backplane.

FFFF (or other code not listed)

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

   Attention: Do not press F5. Doing so changes the configuration. If the 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. Check the termination of the channel you identified in step 1a.
   c. Disconnect one drive at a time attached to the identified channel and reboot each time to determine which drive is causing the problem.
   d. Replace the SCSI cable attached to the identified channel.
   e. Replace the 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

SCSI messages

If you receive a SCSI error message while using the SCSISelect Utility, use the following list to determine the cause of the error and the action to take.

One or more of the following conditions might be causing the problem:

- A failing SCSI adapter or drive
- An incorrect SCSI configuration
- Duplicate SCSI IDs in the same SCSI chain
- An incorrectly installed SCSI terminator
- A defective SCSI terminator
- An incorrectly installed cable
- A defective cable

Verify that:

- The external SCSI devices are powered on. External devices must be powered on before the engine.
- The cables or all external SCSI devices are connected correctly.
- The last device in each SCSI chain is terminated correctly.
- The SCSI devices are configured correctly.

You will receive these messages only when running the SCSISelect Utility.

Power checkout

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

A general procedure for troubleshooting power problems is as follows:

1. Shut down (see "Powering on and shutting down the appliance" on page 65) the system and disconnect the ac cords.

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 system is at the minimum configuration required for power-on (see page 132).

4. Reconnect the ac cord and power on the system. If the system powers on successfully, replace adapters and devices one at a time until the problem is isolated. If the system does not power on from minimal configuration, replace parts of the minimal configuration one at a time until the problem is isolated.

To use this method it is important to know the minimum configuration required for a system to start (see page "Power-supply LED errors" on page 132). For specific problems, see "Power error messages" on page 131.

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 safety guidelines.

CAUTION:
<2–16> When replacing the lithium battery, use only IBM Part Number 33F8354 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.

Note: For translated versions of this safety notice, refer to *Translated Safety Notices*, which is on the publications CD-ROM that was shipped with your appliance.

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 correct manner. To order replacement batteries, call 1 800-772-2227 within the United States.

Before you begin:
- Review the information in the section "Before you begin" in Chapter 3 of the hardware installation guide that came with this appliance, and any special handling and installation instructions supplied with the replacement battery.

- Attach a monitor and keyboard.

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

To replace the battery:
1. Shut down (see "Powering on and shutting down the appliance" on page 65) the appliance and peripheral devices, and disconnect all external cables and power cords.
2. Remove the cover (see "Removing the cover" in Chapter 3 of the hardware installation guide that came with this appliance).
3. Lift the adapter-retention clip on top of the adapter-support bracket (see "Adapter-support bracket" in Chapter 3 of the hardware installation guide that came with this appliance).
4. Remove all of the full-length adapters and plastic dividers (refer to "Adapters" in Chapter 3 of the hardware installation guide that came with this appliance).

   Attention: Note the location of the adapters. You must replace each adapter in the same slot from which it was removed.

   Note: You do not need to unplug the internal adapter cables.
5. Locate the battery (connector BH1) on the system board using Figure 7 on page 95.
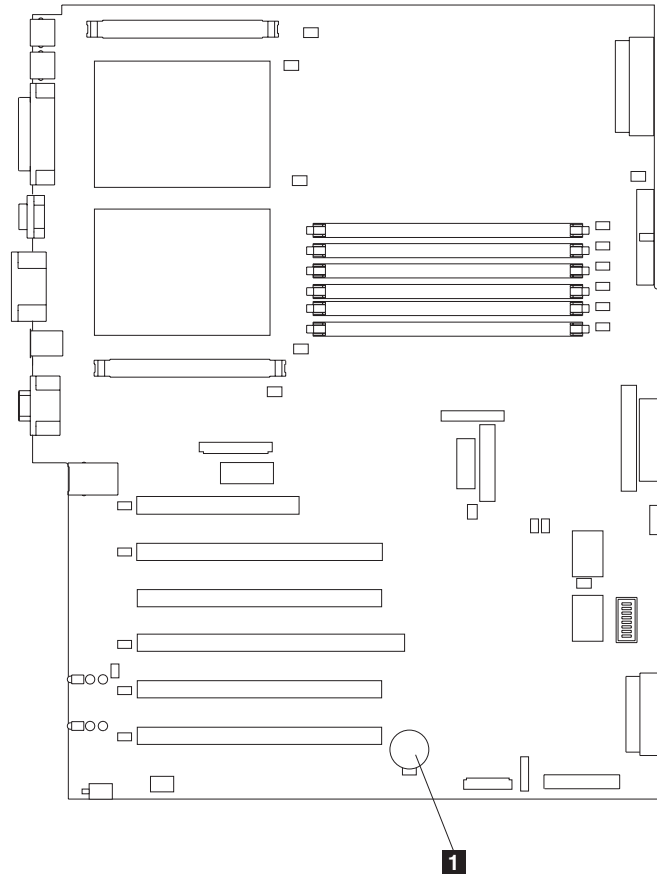
1   Battery

Figure 7. Replacing the battery

6. Remove the plastic cover on the system board.
7. Remove the battery:
   a. Use one finger to press the top of the battery clip away from the battery until the battery releases upward from the socket as shown in Figure 8.
   b. Lift and remove the battery from the socket.

Figure 8. Releasing the battery

8. Insert the new battery:

> **Note:** Ensure that the polarity of the battery is correct. The positive (+) side must face up.

> a. Tilt the battery so that you can insert it into the socket on the side opposite the battery clip.

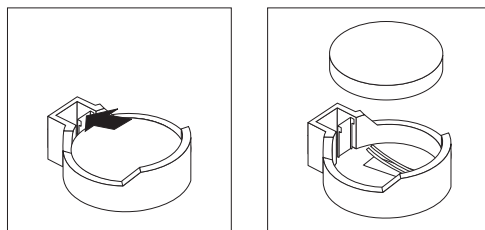> b. Press the battery down into the socket until it clicks under the battery clip, as shown in Figure 9.
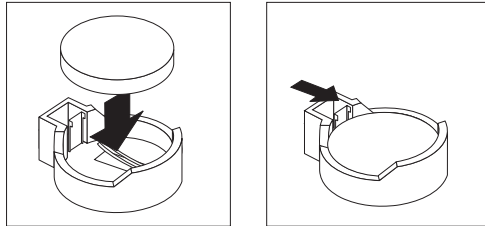
Figure 9. Inserting the new battery

9. Reinstall the adapters and plastic dividers in the same slots from where they were removed, and reconnect any internal cables that were disconnected (see "Adapters" in Chapter 3 of the hardware installation guide that came with this appliance).

10. Replace the adapter-support bracket (see "Adapter-support bracket" in Chapter 3 of the hardware installation guide that came with this appliance).

> **Note:** You must reinstall the air-baffle assembly when you reinstall the adapter-support bracket. Make sure that no cable is under the adapter-support bracket or interferes with the center fans.

> **Important:** To ensure correct cooling and engine operation, you must keep the air-baffle cover closed.

11. Reinstall the engine cover, and connect the power cords and external cables.

> **Note:** Wait approximately 20 seconds after you plug the power cords of your appliance into electrical outlets for the power button to become active.

12. Power on the appliance.

13. Start the Configuration/Setup Utility program and set configuration parameters:
    - Set the system date and time
    - Set the power-on password
    - Reconfigure your appliance

Temperature checkout

Cooling of the system is important for correct operation and system reliability. Make sure that:

- Each of the drive bays has either a drive or a filler panel installed.
- Each of the power supply bays has either a power supply or a filler panel installed.
- The top cover is in place during normal operation.
- There is at least 50 mm (2 in.) of ventilated space at the sides of the appliance and 100 mm (4 in.) at the rear of the appliance.
- The top cover is removed for no longer than 30 minutes while the appliance is operating.

- The processor housing cover covering the processor and memory area is removed for no longer that 10 minutes while the appliance is operating.
- A removed hot-swap drive is replaced within 2 minutes of removal.
- Cables for optional adapters are routed according to the instructions provided with the adapters (ensure that cables are not restricting air flow).
- The fans are operating correctly and the air flow is good.
- A failed fan is replaced within 48 hours.

In addition, ensure that the environmental specifications for the system are met. Refer to "Specifications" in Chapter 1 of the hardware installation guide.

For more information on specific temperature error messages, see "Temperature error messages" on page 137.

Chapter 8. Using the Recovery and Supplementary CD-ROMs

This chapter describes the applications included on the Supplementary and Recovery CD-ROMs, 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-ROM, 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-ROM Set to restore the preloaded software image.

As an alternative to using the Recovery CD-ROM 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 49 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-ROM Set as described in this chapter.

Using the Recovery Enablement Diskette and Recovery CD-ROM Set

The Recovery CD-ROM Set (four CD-ROMs, labeled as "Recovery CD-ROM 1," "Recovery CD-ROM 2," "Recovery CD-ROM 3," and "Recovery CD-ROM 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-ROM 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-ROM 1 will, without visually prompting the user, automatically destroy all data on the system drive. Use the Recovery Enablement Diskette and Recovery CD-ROM 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-ROM 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-ROM 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 panel, 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 that asks if you want 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 CD-ROMs 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 panel, 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 can now remove Recovery CD-ROM 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 IACCU 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-ROM 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-ROM Set.

Using the Supplementary CD-ROM

The Supplementary CD-ROM contains documentation and copies of key software applications that are preinstalled on your NAS 200. Table 15 and Table 16 include the names of the directories found on the Supplementary CD-ROMs and a description of the contents of the directory.

Table 15. Supplementary CD-ROM 1 directories

Directory name	Contents
DB2	• EnableDB2Support.exe • DisableDB2Support.exe These files enable and disable support for Linux- and Solaris-based DB2® clients using NFS shares.
DiskImages	This directory contains a diskette image for the Recovery Enablement Diskette and diskette image for a bootable diskette that automatically configures the ServeRAID controller and drives. To create the Recovery Enablement Diskette, run enablement_diskette25.exe and insert a HD 1.44 floppy diskette into drive A: when prompted. To create the bootable diskette to automatically configure the ServeRAID controller and drives, run IBM_NAS_AutoRAID_diskette_2.5.EXE and insert a HD 1.44 floppy diskette into drive A: when prompted.
diskpart Samples	This directory contains an example script for use with the DiskPart utility. This script will clean disk 2, convert it to dynamic, partition it, and assign drive letters to the partitions. This script is unsupported and should be used with extreme caution.
IBM Advanced Appliance Configuration	Run Setup.exe on the machine from which you will administer the appliance. The agent is preinstalled on the appliance.
IBM NAS Extensions For IBM Director	The IBM NAS extensions to IBM Director provide capabilities to IBM Director that are specific to the IBM NAS appliances.
Zip Tools	This directory contains compression tools used for sending information to IBM technical support.
readme.txt	This text file describes the contents of the Supplementary CD-ROMs.

Table 16. Supplementary CD-ROM 2 directories

Directory name	Contents
AoP	This is the add-on pack for the Server Appliance Kit.
SFU_2073.1	Microsoft Services for UNIX (SFU) Version 2.2 support files: • QFE 320175 for performance enhancements • QFE 321096 for SAK and SFU performance enhancements readme_SFN5.txt: Instructions for installing Microsoft File and Print Services for NetWare 5.0.
Terminal Services Client	Microsoft Terminal Services Client install files.
w2ksp2	Windows 2000 Service Pack 2.

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 17 lists some of these pages.

Table 17. 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 107 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

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- 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 NAS 200. Also, be sure to read the information in any README files that come with your software.

Your NAS 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. Symptom-to-part index

This index lists symptoms, errors, and the possible causes. Use this symptom-to-part index to help you decide which parts to have available when servicing the product.

The POST BIOS displays POST error codes and messages on the panel.

Table 18. Error-symptoms index

Symptom	Located on page
Beep symptoms	109
No beep codes	112
Diagnostic error codes	112
Error	121
POST error codes	125
Fan error messages	131
Power error messages	131
Power supply	132
SCSI error codes	133
ServeRAID error codes	133
Appliance shutdown	134
Bus fault messages	135
DASD checkout	136
Host built-in self test	136
Temperature error messages	137
Undetermined problems	137

Beep symptoms

A beep symptom is an audio signal consisting of a short tone or a series of short tones separated by pauses. For example, beep symptom **1-2-3** consists of:
- One beep
- A pause
- Two beeps
- A pause
- Three beeps

If the POST completes successfully, one beep indicates that the system is operating correctly.

Table 19 on page 110 describes the beep symptoms, the suspected parts to be replaced, and recommended actions.

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Table 19. Beep symptoms

Beep symptom	Description	Part/action
1-1-2	Microprocessor register test failed.	1. Optional microprocessor (if installed) 2. Microprocessor 3. System board
1-1-3	CMOS write/read test failed.	1. Battery 2. System board
1-1-4	BIOS EEPROM checksum failed.	1. Recover BIOS 2. 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	First 64K RAM test failed	DIMM
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
2-2-1	Interrupt vector loading 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.	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
3-1-1	Timer tick interrupt failed.	System board
3-1-2	Interval timer channel 2 failed.	System board

Table 19. Beep symptoms (continued)

Beep symptom	Description	Part/action
3-1-3	RAM test failed above address X'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 test failed.	1. Microprocessor 2. System board
3-2-3	Failure comparing CMOS memory size against actual.	1. DIMM 2. Battery
3-3-1	Memory size mismatch occurred.	1. DIMM 2. Battery
3-3-2	Critical SMBUS error occurred.	1. Disconnect the engine power cord from outlet, wait 30 seconds and retry. 2. System board. 3. DIMMs. 4. DASD backplane. 5. Power supply. 6. Power cage assembly. 7. I²C Cable.
3-3-3	No operational memory in system.	1. Install or reseat the memory modules, and then do a 3 boot reset. 2. DIMMs. 3. Memory board. 4. System board.
4-4-4	Optional Remote Supervisor Adapter not installed in slot 1 or not functioning correctly.	1. Verify that the adapter is installed in slot 1. 2. Adapter. 3. System board.
Two short beeps	Information only, the configuration has changed.	1. Run Base System Diagnostics. 2. Run the Configuration/Setup Utility program.
Three short beeps		1. DIMM 2. System board
One continuous beep		1. Microprocessor 2. Optional microprocessor (if installed) 3. System board
Repeating short beeps		1. Keyboard 2. System board
One long and one short beep		System board
One long and two short beeps		System board

Table 19. Beep symptoms (continued)

Beep symptom	Description	Part/action
One long and three short beeps		1. Monitor 2. System board
Two long and two short beeps		System board

Symptoms that have no beep codes

Table 20 describes the symptoms with no beep codes, the suspected parts to be replaced, and recommended actions.

Table 20. Symptoms that have no beep codes

No-beep symptom	Part/action
No beep and the system operates correctly.	1. Verify that the speaker cables are securely connected 2. Speaker. 3. System board.
No beeps occur after successfully completing POST (the power-on status is disabled)	1. Run the Configuration/Setup Utility program, and set the Start Options Power-On Status to enable. 2. Check the speaker connection. 3. System board.
No ac power (power supply ac LED is off)	1. Check the power cord. 2. Power supply. (If two are installed, swap them to determine if one is defective.) 3. Power cage assembly. 4. Hot-swap power ac inlet box.
No beep and no video	See "Undetermined problems" on page 137.
System will not start (power supply ac LED is on)	See "Power-supply LED errors" on page 132.

Diagnostic error codes

Note: 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 21 on page 113 describes diagnostic error codes, the suspected parts to be replaced, and recommended actions.

Table 21. Diagnostic error codes

Error code/symptom	Meaning	Part/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 system board ECC.	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	USB interface not found, board damaged.	System board
015-XXX-015	Failed USB external loopback test.	No action required. USB is not required for normal functioning.
015-XXX-198	USB device connected during USB test.	No action required. USB is not required for normal functioning.
020-XXX-000	Failed PCI interface test.	System board
020-XXX-001	Failed hot-swap slot 1 PCI latch test.	1. PCI hot-swap latch assembly 2. System board
020-XXX-002	Failed Hot-swap slot 2 PCI latch test.	1. PCI hot-swap latch assembly 2. System board
020-XXX-003	Failed hot-swap slot 3 PCI latch test.	1. PCI hot-swap latch assembly 2. System board
020-XXX-004	Failed hot-swap slot 4 PCI latch test.	1. PCI hot-swap latch assembly 2. System board
030-XXX-000	Failed internal SCSI interface test.	System board
035-XXX-099		1. No adapters were found. 2. If adapter is installed recheck connection.
035-XXX-S99	Failed RAID test on PCI slot *S*, where *S* = number of failing PCI slot. Check System Error Log before replacing a part.	1. Adapter 2. SCSI backplane 3. Cable
035-XXX-SNN	Check System Error Log before replacing a part. *s* = number of failing PCI slot, *nn* = SCSI ID of failing fixed disk.	Hard disk drive with SCSI ID *nn* on RAID adapter in PCI slot *s*.
035-253-S99	RAID adapter initialization failure.	1. ServeRAID adapter in slot *s* is not configured properly. Obtain the basic and extended configuration status and see the *ServeRAID User's Reference* on the documentation CD-ROM for more information. 2. Cable. 3. SCSI backplane. 4. Adapter.
075-XXX-000	Failed power supply test.	Power supply

Table 21. Diagnostic error codes (continued)

Error code/symptom	Meaning	Part/action
089-XXX-001	Failed microprocessor test.	1. VRM 1 for microprocessor 1 2. Microprocessor 1
089-XXX-002	Failed optional microprocessor test.	1. VRM 2 for optional microprocessor 2 2. Optional microprocessor 2
166-198-000 System Management: Aborted	Unable to communicate with ASM. It might be busy. Run the test again.	1. Run the diagnostic test again. 2. Correct other error conditions and retry. These include other failed system management tests and items logged in the System Error Log of the optional Remote Supervisor Adapter. 3. Disconnect all engine and option power cords from the engine, wait 30 seconds, reconnect, and retry. 4. Remote Supervisor Adapter, if installed. 5. System board.
166-201-001 System Management: Failed	I^{2}C bus error(s) See SERVPROC and DIAGS entries in event log.	1. If installed, reseat the I^{2}C cable between the Remote Supervisor Adapter (in PCI slot 1/J32) and the system board (J27). 2. Reseat memory DIMMs. 3. Memory DIMMs. 4. System board.
166-201-002 System Management: Failed	I^{2}C bus error(s) See SERVPROC and DIAGS entries in event log.	1. Reseat I^{2}C cable between the operator information panel and the system board (J24). 2. Reseat I^{2}C cable between the diagnostics panel and the system board (J23). 3. Operator information panel. 4. Diagnostics panel. 5. System board.
166-201-003 System Management: Failed	I^{2}C bus error(s) See SERVPROC and DIAGS entries in event log.	1. Reseat cables between the system board and the power supply or power cage assembly. 2. Power cage assembly. 3. System board.
166-201-004 System Management: Failed	I^{2}C bus error(s) See SERVPROC and DIAGS entries in event log.	1. DASD backplane 2. System board
166-201-005 System Management: Failed	I^{2}C bus error(s) See SERVPROC and DIAGS entries in event log.	1. Reseat Memory DIMMs. 2. Reseat microprocessors. 3. Memory DIMMs. 4. Microprocessors. 5. System board.
166-250-000 System Management: Failed	I^{2}C cable is disconnected. Reconnect I^{2}C cable between Remote Supervisor Adapter and system board.	1. Reseat I^{2}C cable between the Remote Supervisor Adapter (in PCI slot 1/J32) and the system board (J27). 2. I^{2}C cables. 3. Replace the Remote Supervisor Adapter. 4. System board.

Table 21. Diagnostic error codes (continued)

Error code/symptom	Meaning	Part/action
166-260-000 System Management: Failed	Restart Remote Supervisor Adapter Error. After restarting, Remote Supervisor Adapter communication was lost. Unplug and cold boot to reset Remote Supervisor Adapter.	1. Disconnect all engine and option power cords from the engine, wait 30 seconds, reconnect, and retry. 2. Reseat the Remote Supervisor Adapter (in PCI slots 1/J32). 3. Remote Supervisor Adapter.
166-342-000 System Management: Failed	Remote Supervisor Adapter adapter BIST indicate failed tests.	1. Ensure that the latest firmware levels for Remote Supervisor Adapter and BIOS. 2. Disconnect all engine and option power cords from engine, wait 30 seconds, reconnect, and retry. 3. Remote Supervisor Adapter.
166-400-000 System Management: Failed	ISMP self test result failed tests: *x* where *x* = Flash, RAM, or ROM.	1. Reflash or update firmware for ISMP. 2. System board.
180-XXX-000	Diagnostics panel LED failure.	Run diagnostics panel LED test for the failing LED.
180-XXX-001	Failed front LED panel test.	1. Operator information panel 2. System board
180-XXX-002	Failed diagnostics LED panel test.	1. Diagnostics panel 2. System board
180-361-003	Failed fan LED test.	1. Fan(s) 2. System board
180-XXX-003	Failed system board LED test.	System board
180-XXX-005	Failed SCSI backplane LED test.	1. SCSI backplane 2. SCSI backplane cable 3. System board

201-XXX-0NN	Failed memory test.	1. DIMM Location slots 1-6 where *nn* = DIMM location.
		 Note: *nn* :
		     1=DIMM 1
		     2=DIMM 2
		     3=DIMM 3
		     4=DIMM 4
		     5=DIMM 5
		     6=DIMM 6.
		 2. System board

201-XXX-999	Multiple DIMM failure, see error text.	1. See error text for failing DIMMs. 2. System board.
202-XXX-001	Failed system cache test.	1. VRM 1 2. Microprocessor 1
202-XXX-002	Failed system cache test.	1. VRM 2 2. Microprocessor 2

Table 21. Diagnostic error codes (continued)

Error code/symptom	Meaning	Part/action
206-XXX-000	Failed diskette drive test.	1. Cable 2. Diskette drive 3. System board
215-XXX-000	Failed IDE CD-ROM drive test.	1. CD-ROM drive cables 2. CD-ROM drive 3. System board
217-198-XXX	Could not establish drive parameters.	1. Check cable and termination. 2. SCSI backplane. 3. Hard disk.
217-XXX-000	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 1
217-XXX-001	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 2
217-XXX-002	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 3
217-XXX-003	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 4
217-XXX-004	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 5
217-XXX-005	Failed BIOS hard disk test. **Note:** If RAID is configured, the hard disk number refers to the RAID logical array.	Logical drive 6
264-XXX-0NN	Failed tape drive test.	1. Tape cartridge, if user executed the Read/Write Tape Drive test (failure code of XXX = 256) 2. SCSI or power cable connected to tape drive with SCSI ID *nn* 3. Tape drive with SCSI ID *nn* (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 text for more information.	See error messages/text in the Base System Diagnostics error log for detailed information on each individual tape drive error.
301-XXX-000	Failed keyboard test.	Keyboard

Table 21. Diagnostic error codes (continued)

Error code/symptom	Meaning	Part/action
405-XXX-000	Failed Ethernet test on controller on the system board.	1. Verify that Ethernet is not disabled in BIOS. 2. System board.
405-XXX-00N	Failed Ethernet test on adapter in PCI slot *n*.	1. Adapter in PCI slot ***n*** 2. System board
415-XXX-000	Failed Modem test.	No corrective action. A modem is not required for correct operation.

System Error LED

The System Error LED is switched on when an error is detected. If the System Error LED is on, remove the cover and check the diagnostic-panel LEDs. Table 22 is a complete list of diagnostic-panel LEDs and recommended actions.

If a diagnostic-panel LED is on and the information LED panel System Error LED is off, there is probably an LED problem. Run the light-panel diagnostics by pressing **F2** (see "Diagnostics panel LEDs" on page 70).

Notes:
1. To locate the LEDs on the processor board see "Identifying problems using LEDs" on page 68.
2. Check the System Error Log for additional information before replacing a part.
3. The DIMM error LEDs, microprocessor error LEDs, and VRM error LEDs turn off when the system is shut down.

Table 22 describes diagnostic-panel LED symptoms, the suspected parts to be replaced, and recommended actions.

Table 22. Diagnostic-panel LED symptoms

Diagnostics panel LED	Part/action
All LEDs off (Check System Error Log for error condition, and then clear System Error Log when the problem is found.)	1. System Error Log is 75% full; clear the log. 2. PFA alert; check log for failure; clear PFA alert; remove ac power for at least 20 seconds, reconnect, and then power on the system. 3. Run light path diagnostics.
MEMORY LED on (The LED next to the failing DIMM is on.)	1. Failing DIMM 2. System board
CPU LED on (The LED next to the failing CPU is on.)	1. Microprocessor 1 or 2 2. System board
PCI BUS LED on	1. Remove all PCI adapters from slots on affected bus (refer to "Adapters" in Chapter 3 of the hardware installation guide). 2. System board.
VRM LED on (The LED next to the failing VRM is on.)	1. Voltage regulator module indicated by the lit VRM LED. 2. Microprocessor indicated by the microprocessor LED.

Table 22. Diagnostic-panel LED symptoms (continued)

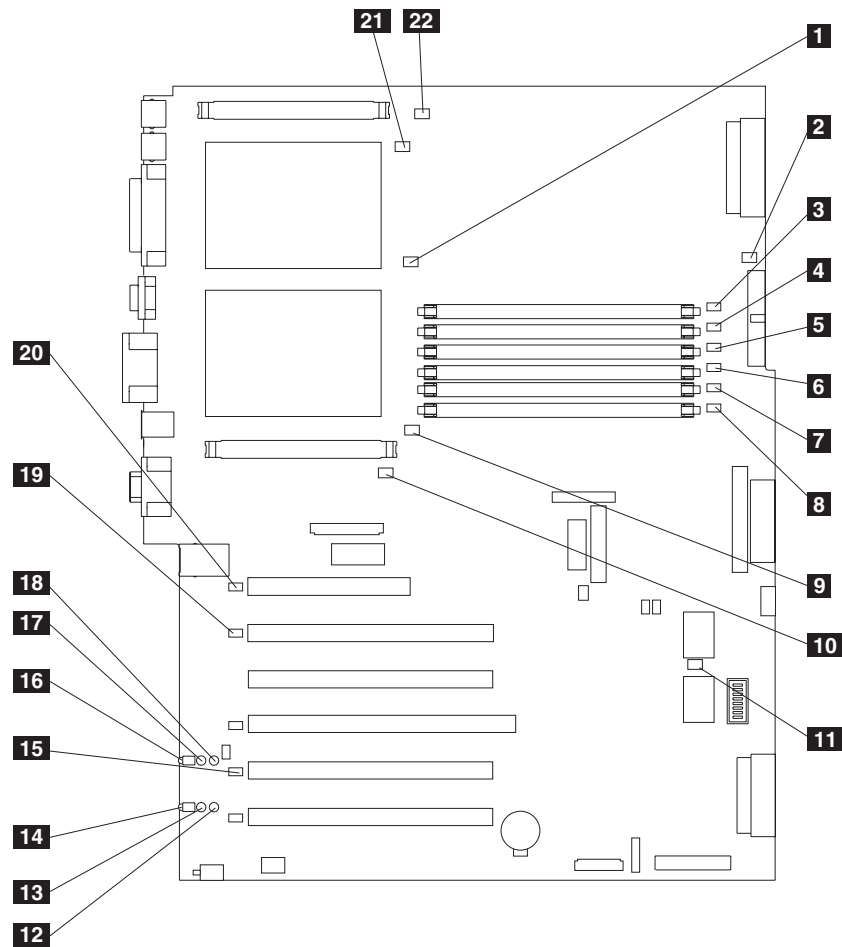| Diagnostics panel LED	Part/action
DASD LED on (The LED located next to the drive bay that the failing drive is installed in is lit. Check the amber drive LED for the failing hard drive.)	1. Be sure that the fans are operating correctly and the airflow is good. 2. If installed, reseat I²C cable between DASD backplane and DASD I²C on the system board (J10). 3. Failing drive. SCSI channel A has failed. (This is the SCSI channel for the hot-swap hard disk drives). 4. If the IBM Netfinity 3-Pack Ultra320 Hot-Swap Expansion Kit is installed, check SCSI channel B. 5. SCSI backplane.
SERVICE PROCESSOR BUS LED	1. Unplug the power supplies from the engine for 30 seconds, then plug in and retry. 2. Reflash or update firmware for ISMP, BIOS. 3. System board.
POWER SUPPLY 1 LED on	1. Check the dc power LED on power supply 1. If it is off, replace power supply 1. 2. Power cage assembly.
POWER SUPPLY 2 LED on	1. Check the dc power LED on power supply 2. If it is off, replace power supply 2. 2. Power cage assembly.
NONREDUNDANT LED on	1. Check the PS1 and PS2 LEDs and replace any indicated power supply. 2. Install an additional power supply or remove optional devices from the engine.
NMI LED on	1. Restart the engine. 2. Check the System Error Log.

TEMPERATURE LED on	1. Ambient temperature must be within normal operating specifications. Refer to "Specifications" in Chapter 1 of the hardware installation guide.
	2. Ensure filler panels are installed in all empty bays.
	3. Ensure fans are operating correctly by checking the fan LEDs.
	4. Examine System Error Log.
	   a. System over recommended temperature
	     • Information LED panel
	   b. DASD over recommended temperature (DASD LED also on)
	     1) Overheating hard drive
	     2) DASD backplane
	   c. System over recommended temperature for CPU x (where x is 1 or 2) (CPU LED is also on)
	     1) CPU x
	     2) System board
	5. If the CPU LED on the diagnostics panel is also on, one of the microprocessors has caused the error.

FAN LED on	1. Check individual fan LEDs. 2. Replace respective fan. 3. Fan cable. 4. System board. 5. Power cage assembly.

Figure 10. System-board LED locations

|	
1	CPU mismatch error LED (CR14)
2	Power error LED (CR15)
3	DIMM 1 error LED (CR16)
4	DIMM 2 error LED (CR17)
5	DIMM 3 error LED (CR18)
6	DIMM 4 error LED (CR20)
7	DIMM 5 error LED (CR22)
8	DIMM 6 error LED (CR23)
9	CPU 1 error LED (CR24)
10	VRM 1 error LED (CR33)
11	Service processor activity LED (CR67)
12	PCI-X slot 6 power LED (CR79)
13	PCI-X slot 6 internal attention LED (CR78) (Disabled)
14	PCI-X slot 6 external attention LED (CR77) (Disabled)
15	PCI-X bus C error LED (CR76)
16	PCI-X slot 5 external attention LED (CR74) (Disabled)
17	PCI-X slot 5 internal attention LED (CR73) (Disabled)
18	PCI-X slot 5 power LED (CR75)
19	PCI-X bus B error LED (CR68)
20	PCI bus A error LED (CR66)
21	CPU 2 error LED (CR4)
22	VRM 2 error LED (CR1)

Diagnostics-panel LEDs viewed with the cover off:
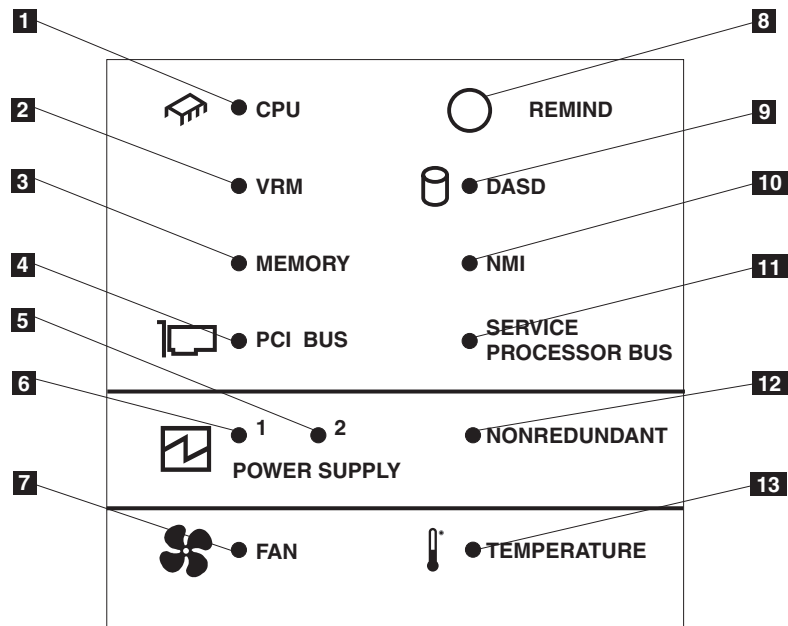
Figure 11. Diagnostics panel LEDs (viewed with the cover off)

Table 23. Diagnostics-panel LED descriptions

Index	Name	Meaning
1	CPU	Microprocessor failure. One or both microprocessors have failed.
2	VRM	Error on VRM or on integrated voltage regulator. The LED next to the affected VRM will also be on.
3	Memory	Memory failure. One or more memory DIMMs have failed.
4	PCI BUS	Error on the PCI bus or system board.
5	Power supply 2	Power supply 2 failure.
6	Power supply 1	Power supply 1 failure.
7	Fan	A fan failed or is operating slowly.
8	Remind button	Press this button to temporarily reset the LEDs on the diagnostics panel.
9	DASD	A hot-swap hard disk drive, backplane, or other part of SCSI channel A has failed. The amber LED next to the drive bay with the failing drive will also be on.
10	NMI	A nonmaskable interrupt occurred.
11	Service Processor bus	The system environmental monitor detected an error.
12	Nonredundant	Nonredundant power.
13	Temperature	The operating temperature inside the engine was exceeded.

Error symptoms

Table 24 describes the error symptoms, the suspected parts to be replaced, and recommended actions.

Table 24. Error symptoms

CD-ROM drive problems	
Symptom	**Part/action**

CD-ROM drive is not recognized.	1. Verify that:
	   • The primary IDE channel to which the CD-ROM drive is attached is enabled in the Configuration/Setup Utility program.
	   Note: On a engine with a single IDE channel, only the primary channel can be used.
	   • All cables and jumpers are installed correctly.
	   • The correct device driver is installed for the CD-ROM drive.
	2. Run CD-ROM drive diagnostics.
	3. CD-ROM drive.

Diskette drive problems	
Symptom	**Part/action**

Diskette drive activity LED stays on, or the system bypasses the diskette drive.	1. If there is a diskette in the drive, verify that:
	   • The diskette drive is enabled in the Configuration/Setup utility program.
	   • The diskette is good and not damaged. (Try another diskette if you have one.)
	   • The diskette is inserted correctly in the drive.
	   • The diskette contains the necessary files to start the engine.
	   • The software program is working properly.
	   • The cable is installed correctly (in the proper orientation).
	2. Run diskette drive diagnostics.
	3. Cable.
	4. Diskette drive.
	5. System board.

5194-EXP storage unit	
Symptom	**Part/action**

The 5194-EXP storage unit used to work but does not work now.	1. If the 5194-EXP storage unit is the only thing on the channel, verify that:
	   • The cables for all external SCSI options are connected correctly.
	   • The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly.
	   • Any external SCSI option is turned on. You must turn on 5194-EXP storage unit option before turning on the engine.
	2. For more information, see your 5194-EXP storage unit documentation.

Hard disk drive problems	
Symptom	**Part/action**
Not all drives are recognized by the hard disk drive diagnostic test (Fixed Disk test).	1. Remove the first drive not recognized and try the hard disk drive diagnostic test again. 2. If the remaining drives are recognized, replace the drive you removed with a new one.
System stops responding during hard disk drive diagnostic test.	1. Remove the hard disk drive being tested when the engine stopped responding and try the diagnostic test again. 2. If the hard disk drive diagnostic test runs successfully, replace the drive you removed with a new one.

Table 24. Error symptoms (continued)

Intermittent problems	
Symptom	**Part/action**

A problem occurs only occasionally and is difficult to detect.	1. Verify that:
	  • All cables and cords are connected securely to the rear of the engine and attached options.
	  • When the engine is turned on, air is flowing from the rear of the engine at the fan grill. If there is no airflow, the fan is not working. This causes the engine to overheat and shut down.
	  • Ensure that the SCSI bus and devices are configured correctly and that the last external device in each SCSI chain is terminated correctly.
	2. Check the system error log from Setup or through the diagnostics in the optional Remote Supervisor Adapter.

Keyboard, mouse, or point-device problems	
Symptom	**Part/action**

All or some keys on the keyboard do not work.	1. Verify that:
	  • The keyboard cable is securely connected to the system, and the keyboard and mouse cables are not reversed.
	  • The engine and the monitor are turned on.
	2. Keyboard.
	3. System board.

The mouse or pointing device does not work.	1. Verify that the mouse or pointing-device cable is securely connected, and that the keyboard and mouse cables are not reversed. 2. Mouse or pointing device. 3. System board.

Memory problems	
Symptom	**Part/action**

The amount of system memory displayed is less than the amount of physical memory installed.	1. Verify that:
	  • The memory modules are seated correctly.
	  • You have installed the correct type of memory.
	  • Ensure that the memory is in the correct slots (refer to "Memory modules" in Chapter 3 of the hardware installation guide).
	  • If you changed the memory, you updated the memory configuration with the Configuration/Setup Utility program.
	  • All banks of memory on the DIMMs are enabled. The engine might have automatically disabled a DIMM bank when it detected a problem or a DIMM bank could have been manually disabled.
	2. Check POST error log for error message 289:
	  • If the DIMM was disabled by a system-management interrupt (SMI), replace the DIMM.
	  • If the DIMM was disabled by the user or by POST:
	    a. Start the Configuration/Setup Utility program.
	    b. Enable the DIMM.
	    c. Save the configuration and restart the engine.
	3. DIMM.
	4. System board.

Microprocessor problems	
Symptom	**Part/action**

Table 24. Error symptoms (continued)

The engine emits a continuous tone during POST. Microprocessor 1 is not working correctly.)	1. Verify that the startup microprocessor is seated correctly. 2. Startup microprocessor.
Monitor problems	
Symptom	**Part/action**
Testing the monitor.	See the information that comes with the monitor for adjusting and testing instructions. (Some IBM® monitors have their own self-tests.)
The screen is blank.	1. Verify that: • The engine power cord is plugged into the engine and a working electrical outlet. • The monitor cables are connected properly. • The monitor is turned on and the Brightness and Contrast controls are adjusted correctly. **Important:** In some memory configurations, the 3-3-3 beep code might sound during POST followed by a blank display screen. If this occurs and the **Boot Fail Count** feature in the Start Options of the Configuration/Setup Utility program is set to **Enabled** (its default setting), you must restart the engine three times to force the system BIOS to reset the CMOS values to the default configuration (memory connector or bank of connectors enabled). 2. If you have verified these items and the screen remains blank, replace: a. Monitor b. System board
Only the cursor appears.	See "Undetermined problems" on page 137.
The monitor works when you turn on the engine but goes blank when you start some application programs.	1. Verify that: • The application program is not setting a display mode higher than the capability of the monitor. • You installed the necessary device drivers for the applications. 2. If you have verified these items and the screen remains blank, replace the monitor.
The screen is wavy, unreadable, rolling, distorted, or has screen jitter.	1. If the monitor self-tests show the monitor is working correctly, 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:** a. To prevent diskette drive read/write errors, be sure the distance between monitors and diskette drives is at least 76 mm (3 in.). b. Non-IBM monitor cables might cause unpredictable problems. c. An enhanced monitor cable with additional shielding is available for the 9521 and 9527 monitors. For information about the enhanced monitor cable, contact your IBM reseller or IBM marketing representative. 2. System board.
Wrong characters appear on the screen.	1. If the wrong language is displayed, update the BIOS code with the correct language. 2. System board.
Option problems	

Table 24. Error symptoms (continued)

Symptom	Part/action

An IBM option that was just installed does not work.	1. Verify that:
	  • You followed the installation instructions that came with the option.
	  • The option is installed correctly.
	  • You have not loosened any other installed options or cables.
	  • You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or an option is changed, you must update the configuration.
	2. Option you just installed.

An IBM option that used to work does not work now.	1. Verify that all of the option hardware and cable connections are secure.
	2. If the option comes with its own test instructions, use those instructions to test the option.
	3. If the failing option is a SCSI option, verify that:
	  • The cables for all external SCSI options are connected correctly.
	  • The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly.
	  • Any external SCSI option is turned on. You must turn on an external SCSI option before turning on the engine.
	4. Failing option.

Power problems	

Symptom	Part/action

The engine does not turn on.	1. Verify that:
	  • The power cables are properly connected to the engine.
	  • The electrical outlet functions properly.
	  • The type of memory installed is correct.
	  • If you just installed an option, remove it, and restart the engine. If the engine now turns on, you might have installed more options than the power supply supports.
	2. If LEDs for CPUs or VRMs are on, verify that:
	  a. A VRM is populated for each microprocessor.
	  b. Override front panel pushbutton by turning on switch 7 of SW1; if power comes on:
	    1) Service processor error.
	    2) Power reset card.
	3. See "Undetermined problems" on page 137.

The engine does not turn off.	1. Verify whether you are using an ACPI or non-ACPI operating system. If you are using a non-ACPI operating system:
	  a. Press Ctrl+Alt+Delete.
	  b. Turn off the system by holding the power-control button for 4 seconds.
	  c. If engine fails during BIOS POST and power-control button does not work, remove the AC power cord.
	2. If the problem remains or if you are using an ACPI-aware operating system, suspect the system board.

Serial port problems	

Symptom	Part/action

Table 24. Error symptoms (continued)

The number of serial ports identified by the operating system is less than the number of serial ports installed.	1. Verify that:
	   • Each port is assigned a unique address by the Configuration/Setup Utility program and none of the serial ports is disabled.
	   • The serial-port adapter, if you installed one, is seated properly.
	2. Failing serial port adapter.

A serial device does not work.	No corrective action required. No serial device is needed to operate correctly.

Software problem	
Symptom	**Part/action**

Suspected software problem.	1. To determine if problems are caused by the software, verify that:
	   • Your engine has the minimum memory needed to use the software. For memory requirements, see the information that comes with the software.
	   Note: If you have just installed an adapter or memory, you might have a memory address conflict.
	   • The software is designed to operate on your engine.
	   • Other software works on your engine.
	   • The software that you are using works on another system.
	
	   If you received any error messages when using the software program, see the information that comes with the software for a description of the messages and suggested solutions to the problem.
	2. If you have verified these items and the problem remains, contact your IBM representative.

Universal Serial Bus (USB) port problems	
Symptom	**Part/action**
A USB device does not work.	No corrective action is required. No USB device is required for correct operation.

POST error codes

Table 25 describes POST error codes, the suspected parts to be replaced, and recommended actions. *X* can be any number or letter.

Table 25. POST error codes

Error code/symptom	Meaning	Part/action
062	Three consecutive startup failures using the default configuration.	1. Run the Configuration/Setup Utility program. 2. Battery. 3. System board. 4. Microprocessor.
101, 102	System and processor error.	System board
106	System and processor error.	System board
111	Channel check error.	1. Memory DIMM 2. System board
114	Adapter read-only memory error.	1. Failing adapter. 2. Run Base System Diagnostics.
129	Internal cache error.	1. Microprocessor 2. Optional microprocessor (if installed)

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
151	Real time clock error.	1. Run Base System Diagnostics. 2. Battery. 3. System board.
161	Real time clock battery error.	1. Run the Configuration/Setup Utility program. 2. Battery. 3. System board.
162	Device configuration error. **Note:** Be sure to load the default settings and any additional desired settings; then, *save the configuration.*	1. Run the Configuration/Setup Utility program. 2. Battery. 3. Failing device. 4. System board.
163	Real-time clock error.	1. Run the Configuration/Setup Utility program. 2. Battery. 3. System board.
164	Memory configuration changed.	1. Run the Configuration/Setup Utility program. 2. DIMM. 3. System board.
175	Hardware error.	System board
176	Computer cover or cable cover was removed without a key being used.	1. Run the Configuration/Setup Utility program. 2. System board.
177, 178	Security hardware error.	1. Run the Configuration/Setup Utility program. 2. System board.
184	Power-on password damaged.	1. Run the Configuration/Setup Utility program. 2. System board.
185	Drive startup sequence information corrupted.	1. Run the Configuration/Setup Utility program. 2. System board.
186	Security hardware control logic failed.	1. Run the Configuration/Setup Utility program. 2. System board.
187	VPD serial number not set.	1. Set serial number in the Configuration/Setup Utility program. 2. System board.
188	Bad EEPROM CRC #2.	1. Run the Configuration/Setup Utility program. 2. System board.
189	An attempt was made to access the engine with invalid passwords.	1. Run the Configuration/Setup Utility program, and type the administrator password.
201	Memory test error. If the engine does not have the latest level of BIOS installed, update the BIOS to the latest level and run the diagnostic program again.	1. DIMM 2. System board

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
229	Cache error.	1. Microprocessor 2. Optional microprocessor (if installed)
262	DRAM parity configuration error.	1. Run the Configuration/Setup Utility program. 2. Battery. 3. System board.
289	DIMM disabled by POST or user.	1. Run the Configuration/Setup Utility program, if the DIMM was disabled by the user. 2. Disabled DIMM, if not disabled by user.
301	Keyboard or keyboard controller error.	1. Keyboard 2. System board
303	Keyboard controller error.	System board
602	Invalid diskette boot record.	1. Diskette 2. Diskette drive 3. Cable 4. System board
604	Diskette drive error.	1. Run the Configuration/Setup Utility program and Base System Diagnostics. 2. Diskette drive. 3. Drive cable. 4. System board.
605	Unlock failure.	1. Diskette drive 2. Drive cable 3. System board
662	Diskette drive configuration error.	1. Run the Configuration/Setup Utility program and Base System Diagnostics. 2. Diskette drive. 3. Drive cable. 4. System board.
762	Coprocessor configuration error.	1. Run the Configuration/Setup Utility program. 2. Battery. 3. Microprocessor.
962	Parallel port error.	No corrective actions is required. No parallel port is required for correct functioning.
11XX	System board serial port 1 or 2 error.	1. Disconnect the external cable on the serial port. 2. Run the Configuration/Setup Utility program. 3. System board.
1301	I^2C cable to front panel not found.	1. Cable 2. Front panel 3. Power switch assembly 4. System board

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
1302	I^{2}C cable from system board to power on and reset switches not found.	1. Cable 2. Power switch assembly 3. System board
1303	I^{2}C cable from system board to power backplane not found.	1. Cable 2. Power cage assembly, if installed 3. System board
1304	I^{2}C cable to diagnostic LED board not found.	1. Power switch assembly 2. System board
1600	The system management processor is not functioning. Do the following before replacing a part: 1. Ensure that a jumper is not installed on J34. 2. Remove the ac power to the engine, wait 20 seconds; then, reconnect the ac power. Wait 30 seconds; then, turn on the engine.	System board
1601	The system is able to communicate to the system management processor, but the system management processor failed to respond at the start of POST. Do the following before replacing a part: 1. Remove the ac power to the engine, wait 20 seconds; then, reconnect the ac power. Wait 30 seconds; then, turn on the engine. 2. Flash update the Remote Supervisor Adapter. See the *Remote Supervisor Adapter User's Guide* provided on the Documentation CD-ROM for more information.	1. Remote Supervisor Adapter, if installed 2. System board
1602	Cable for optional service processor adapter not installed.	Disconnect all engine and option power cords from engine, wait 30 seconds, reconnect, and retry.
1762	Hard disk configuration error.	1. Hard disk drive. 2. Hard disk cables. 3. Run the Configuration/Setup Utility program. 4. Hard disk adapter. 5. SCSI backplane. 6. System board.

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
178X	Fixed disk error.	1. Hard disk cables. 2. Run Base System Diagnostics. 3. Hard disk adapter. 4. Hard disk drive. 5. System board.
1800	No more hardware interrupt available for PCI adapter.	1. Run the Configuration/Setup Utility program. 2. Failing adapter. 3. System board.
1962	Drive does not contain a valid boot sector.	1. Verify that a startable operating system is installed. 2. Run Base System Diagnostics. 3. Hard disk drive. 4. SCSI backplane. 5. Cable. 6. System board.
2400	Video controller test failure.	System board
2462	Video memory configuration error.	System board
5962	IDE CD-ROM drive configuration error.	1. Run the Configuration/Setup Utility program and load the default values. 2. CD-ROM drive. 3. CD-ROM power cable. 4. IDE cable. 5. System board. 6. Battery.
8603	Pointing-device error.	1. Pointing device 2. System board
0001200	Machine check architecture error.	1. Microprocessor 1 2. Optional microprocessor 2
00012000	Microprocessor machine check.	1. Microprocessor 2. System board
00019501	Microprocessor 1 is not functioning - check VRM and microprocessor LEDs.	1. VRM 1 2. Microprocessor 1 3. System board
00019502	Microprocessor 2 is not functioning - check VRM and microprocessor LEDs.	1. VRM 2 2. Microprocessor 2
00019701	Microprocessor 1 failed.	1. Microprocessor 1 2. System board
00019702	Microprocessor 2 failed.	1. Microprocessor 2 2. System board

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
00180100	A PCI adapter has requested memory resources that are not available.	1. Ensure that the PCI adapter and all other adapters are set correctly in the Configuration/Setup Utility program Utility program. If the memory resource settings are not correct, change the settings. 2. If all memory resources are being used, you might need to remove an adapter to make memory available to the PCI adapter. Disabling the adapter BIOS on the adapter might correct the error. (See the documentation provided with the adapter.)
00180200	No more I/O space available for PCI adapter.	1. Run the Configuration/Setup Utility program. 2. Failing adapter. 3. System board.
00180300	No more memory (above 1MB for PCI adapter).	1. Run the Configuration/Setup Utility program. 2. Failing adapter. 3. System board.
00180400	No more memory (below 1MB for PCI adapter).	1. Run the Configuration/Setup Utility program. 2. Failing adapter. 3. System board.
00180500	PCI option ROM checksum error.	1. Remove failing PCI card. 2. System board.
00180600	PCI to PCI bridge error.	1. Run the Configuration/Setup Utility program. 2. Failing adapter. 3. System board.
00180700, 00180800	General PCI error.	1. System board 2. PCI card
00181000	PCI error.	1. Adapter 2. System board
01295085	ECC checking hardware test error.	1. System board 2. Microprocessor
01298001	System BIOS installed on this engine does not support level of processor.	Microprocessor 1.
01298002	System BIOS installed on this engine does not support level of processor.	Microprocessor 2.
01298101	System BIOS installed on this engine does not support level of processor.	Microprocessor 1.
01298102	System BIOS installed on this engine does not support level of processor.	Microprocessor 2.

Table 25. POST error codes (continued)

Error code/symptom	Meaning	Part/action
I9990301	Hard disk sector error.	1. Hard disk drive 2. SCSI backplane 3. Cable 4. System board
I9990305	Hard disk sector error, no operating system installed.	Install operating system to hard disk using the Recovery CD-ROM.
I9990650	AC power has been restored.	1. Check cable. 2. Check for interruption of power. 3. Power cable.

Fan error messages

Table 26 describes fan error messages, the suspected parts to be replaced, and recommended actions.

Note: You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely.

Table 26. Fan errors and actions

Message	Action
Fan *x* failure (level-critical; fan *x* had a failure)	1. Check connections to fan **x.** 2. Replace fan *x.*
Fan *x* fault (level-critical; fan *x* beyond recommended RPM range)	1. Check connections to fan **x.** 2. Replace fan *x.*
Fan *x* outside recommended speed action	Replace fan **x.**

Power error messages

Table 27 describes power error messages, the suspected parts to be replaced, and recommended actions.

Note: You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely.

Table 27. Power errors and actions

Message	Action
Power supply *x* current share fault (level-critical; excessive current demand on power supply *x*)	Replace power supply **x.**

Table 27. Power errors and actions (continued)

Message	Action
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 power supply *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* 12 V fault (level-critical; overcurrent condition detected)	See "Power checkout" on page 92.
Power supply *x* 3.3 V fault (level-critical; 3.3 V power supply *x* had an error)	See "Power checkout" on page 92.
Power supply *x* 5 V fault (level-critical; 5 V power supply *x* had an error)	See "Power checkout" on page 92.
System running non-redundant power (level-noncritical; system does not have redundant power)	Replace power supply. **Note:** System can continue to operate without redundancy protection.
System under recommended voltage for *x* (level-warning; indicated voltage supply under nominal value; value for *x* can be +12, -12, or +5)	1. Check connections to the power subsystem. 2. Power supply. 3. Power cage assembly.

Power-supply LED errors

Use the information in the Table 28 to troubleshoot power-supply problems.

Minimum configuration requirements: The minimum configuration required to enable the DC Power LED is:
- Power supply
- Power backplane
- Processor/PCI board (with pins 2 and 3 on J23 extension cable connected together to bypass the power switch).
- Processor/PCI board (verify that the Processor/PCI board and the system board are connected correctly).

Table 28. Power-supply LED errors

AC good LED	DC good LED	Description	Part/action
Off	Off	No power to system or ac problem.	1. Check ac power to the system. 2. Power supply.

Table 28. Power-supply LED errors (continued)

AC good LED	DC good LED	Description	Part/action

On	Off	Standby mode or dc problem.	1. Check system board cable connectors J4 and J10. Move switch 7 of SW 1 to bypass power control. If the dc good LED is lit, press Ctrl+Alt+Delete. Watch the screen for any POST errors. Check the System Error Log for any listed problems. If the system starts with no errors:
			  a. Power switch assembly
			  b. System board
			2. Remove the adapters and disconnect the cables and power connectors to all internal and external devices. Turn on the system. If the dc power LED is lit, replace the adapters and devices one at a time until you isolate the problem.
			3. Power supply.
			4. Power cage assembly.
			5. System board.

On	On	Power is working correctly.	N/A

SCSI error codes

Table 29 describes SCSI error codes, the suspected parts to be replaced, and recommended actions.

Table 29. SCSI error codes

Error code	Part/action
All SCSI Errors One or more of the following might be causing the problem: • A failing SCSI device (adapter, drive, controller) • An incorrect SCSI configuration or SCSI termination jumper setting • Duplicate SCSI IDs in the same SCSI chain • A missing or incorrectly installed SCSI terminator • A defective SCSI terminator • An incorrectly installed cable • A defective cable	1. External SCSI devices must be turned on before you turn on the engine. 2. Make sure that the cables for all external SCSI devices are connected correctly. 3. If you have attached an external SCSI device to the engine, make sure that the external SCSI termination is set to automatic. 4. Make sure that the last device in each SCSI chain is terminated correctly. 5. Make sure that the SCSI devices are configured correctly.

ServeRAID

Table 30 describes the symptoms and fault messages from the RAID controller, the suspected parts to be replaced, and recommended actions.

Table 30. RAID fault messages

Error code	Description	Parts and recommended actions
1*XXX*	Microcode checksum error	Replace the ServeRAID controller.

Table 30. RAID fault messages (continued)

Error code	Description	Parts and recommended actions
2*XXX* - 5*XXX*	Code DRAM error	1. Install download jumpers. Flash latest level BIOS and firmware for controller. Remove jumpers. 2. Replace the ServeRAID controller.
6*XXX*	Cache DRAM error) (ServeRAID-4H only	1. Reseat daughter card. 2. Install download jumpers. Flash latest level BIOS and firmware for controller. Remove jumpers. 3. ServeRAID controller.
7*XXX* thru 8*XXX*	Host/local PCI bus interface error	1. Install download jumpers. Flash latest level BIOS and firmware for controller. Remove jumpers. 2. Replace the ServeRAID controller.
9*ZXX* - B*ZXX*	SCSI bus error caused by cables, termination, defective drives, and so on). *Z* identifies the specific channel or channels that cause the error.	1. Follow indications in the POST error procedures in "ServeRAID controller" on page 89. Follow the instructions in "ServeRAID controller" on page 89 before continuing with the next steps listed in this index. 2. Replace the SCSI cable. 3. Replace the SCSI backplane. 4. Replace the hard disk drive. 5. Replace the ServeRAID controller.
EFFE	Firmware code corrupt or download jumpers are in place	1. Flash latest level BIOS and firmware for controller. Remove jumpers. 2. Replace the ServeRAID controller.
FFFF or other code not listed.		1. Follow indications in the POST (ISPR) error procedures in "POST (ISPR) error procedures" on page 90. 2. Replace the SCSI cable. 3. Replace the SCSI backplane. 4. Replace the hard disk drive. 5. Replace the ServeRAID controller.

Appliance shutdown

Refer to Table 31 and Table 32 on page 135 when experiencing system shutdown related to voltage or temperature problems.

Voltage-related system shutdown

Table 31 describes voltage-related system-shutdowns messages, the suspected parts to be replaced, and recommended actions.

Table 31. Voltage-related system-shutdown messages

Message	Action
System shutoff due to *x* current over max value (level-critical; system drawing too much current on voltage *x* bus)	See "Power checkout" on page 92.
System shutoff due to *x* V over voltage (level-critical; system shutoff due to *x* supply over voltage)	1. Check the power-supply connectors 2. Power supply. 3. Power cage assembly.

Table 31. Voltage-related system-shutdown messages (continued)

Message	Action
System shutoff due to *x* V under voltage (level-critical system shutoff due to *x* supply under voltage)	1. Check the power-supply connectors. 2. Power supply. 3. Power cage assembly.
System shutoff due to VRM x over voltage	Replace VRM **x**.
System shutoff due to excessive (< 240 VA) loading	1. See "Power checkout" on page 92. 2. Cycle ac on/off.

Temperature-related system shutdown

Table 32 describes temperature-related-shutdown messages, the suspected parts to be replaced, and recommended actions.

Table 32. Temperature-related-shutdown messages

Message	Action
System shutoff due to board over temperature (level-critical; board is over temperature)	1. Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide. 2. Replace board.
System shutoff due to CPU *x* over temperature (level-critical; CPU *x* is over temperature)	1. Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide. 2. Replace CPU *x*.
System shutoff due to CPU *x* under temperature (level-critical; CPU *x* is under temperature)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.
System shutoff due to DASD temperature (sensor *x*) (level-critical; DASD area reported temperature outside recommended operating range)	Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide.
System shutoff due to high ambient temperature (level-critical; high ambient temperature)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.
System shutoff due to system board under temperature (level-critical; system board is under temperature)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.

Bus fault messages

Table 33 describes bus fault messages, the suspected parts to be replaced, and recommended actions.

Table 33. Bus fault messages

Message	Action
Failure reading I²C device. Check devices on bus 0.	1. If installed, reseat the I²C cable between Remote Supervisor Adapter (in PCI slot 1/J32) and system board (J45). 2. Memory DIMMs. 3. System board.

Table 33. Bus fault messages (continued)

Message	Action
Failure reading I²C device. Check devices on bus 1.	1. Reseat the I²C cable between the operator information panel and system board (J24). 2. Operator information panel. 3. System board.
Failure reading I²C device. Check devices on bus 2.	1. Reseat the cable between system board and the power supply (power cage assembly) (J10). 2. Power cage assembly. 3. Power supply. 4. System board.
Failure reading I²C device. Check devices on bus 3.	1. Reseat the cable between the DASD backplane and connector (J10) of system board. 2. DASD backplane. 3. System board.
Failure reading I²C device. Check device on bus 4.	System board

DASD checkout

Table 34 describes a DASD checkout message, the suspected parts to be replaced, and recommended actions.

Table 34. DASD checkout message

Note: If the replacement procedure is not provided in the *IBM TotalStorage NAS 200 Hardware Installation Guide*, then it is a service procedure only.	
Message	**Action**
Hard drive *x* removal detected (level-critical; hard drive *x* has been removed)	Information only, take action as appropriate.

Host built-in self-test

Table 35 describes the built-in self-test (BIST) message, the suspected parts to be replaced, and recommended actions.

Table 35. Host BIST message

Note: If the replacement procedure is not provided in the *IBM TotalStorage NAS 200 Hardware Installation Guide*, then it is a service procedure only.	
Message	**Action**
Host fail (level-informational; built-in self-test for the host failed)	1. Reseat the microprocessor. 2. Reseat the VRM. 3. Replace the microprocessor CPU.

Temperature error messages

Table 36 describes temperature error messages, the suspected parts to be replaced, and recommended actions.

Note: You must connect a keyboard, mouse, and monitor to your appliance in order to see error messages. If the engine does not recognize the monitor, keyboard, and mouse, reboot the engine while they are connected. If a Remote Supervisor Adapter is used for system management, the logs can be accessed remotely.

Table 36. Temperature error messages

Message	Action
DASD Over Temperature (level-critical; direct access storage device bay *x* was over temperature)	Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide.
DASD Over recommended Temperature (sensor *x*) (level-warning; DASD bay *x* had over temperature condition)	Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide.
DASD under recommended temperature (sensor *x*) (level-warning; direct access storage device bay *x* had under temperature condition)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.
DASD Over Temperature (level-critical; sensor for DASD1 reported temperature over recommended range)	Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide.
Power supply *x* Temperature Fault (level-critical; power supply *x* had over temperature condition)	1. Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide. 2. Replace power supply *x*
System board is over recommended temperature (level-warning; system board is over recommended temperature)	1. Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide. 2. Replace the system board.
System board is under recommended temperature (level-warning; system board is under recommended temperature)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.
System over temperature for CPU *x* (level-warning; CPU x reporting over temperature condition)	Ensure that the system is being correctly cooled; refer to "Specifications" in Chapter 1 of the hardware installation guide.
System under recommended CPU *x* temperature (level-warning; system reporting under temperature condition for CPU x)	Ambient temperature must be within normal operating specifications; refer to "Specifications" in Chapter 1 of the hardware installation guide.

Undetermined problems

Use the information in this section if the diagnostic tests did not identify the failure, the devices list is incorrect, or the system is inoperative. Make sure that the default settings are loaded in the Configuration/Setup Utility.

Notes:

1. Damaged data in CMOS can cause undetermined problems.
2. Damaged data in BIOS code can cause undetermined problems.

Check the LEDs on all the power supplies. If the LEDs indicate the power supplies are working correctly, complete the following steps:

1. Shut down (see "Powering on and shutting down the appliance" on page 65) the engine.
2. Be sure that the engine is cabled correctly.
3. Remove or disconnect the following devices (one at a time) until you find the failure (turn on the engine and reconfigure each time):
   Any external devices
   Surge suppressor device (on the engine)
   Mouse, or non-IBM devices
   Each adapter
   Drives
   Memory modules [minimum requirement = 512 MB (2 banks of 256 MB DIMMs)]

   Note: Minimum operating requirements are:
   a. One power supply
   b. Power cage assembly
   c. System board
   d. One microprocessor and VRM
   e. Memory module (with a minimum of two 256 MB DIMMs)

4. Turn on the engine. If the problem remains, suspect the following parts in the order listed:
   Power supply
   Power cage assembly
   System board

Notes:

1. If the problem goes away when you remove an adapter from the system and replacing that adapter does not correct the problem, suspect the system board.
2. If you suspect a networking problem and all the system tests pass, suspect a network cabling problem external to the system.

Problem determination tips

Due to the variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination. If possible, have this information available when requesting assistance from Service Support and Engineering functions.

- Machine type 5194 and Model 25T
- Microprocessor or hard disk upgrades
- Failure symptom
  - Do Base System Diagnostics fail?
  - What, when, where, single, or multiple systems?
  - Is the failure repeatable?
  - Has this configuration ever worked?
  - If it has been working, what changes were made prior to it failing?
  - Is this the original reported failure?
- Base System Diagnostics version
  - Type and version level
- Hardware configuration
  - Print (print screen) configuration currently in use

- BIOS level
- Operating system software
  - Type and version level

Note: To eliminate confusion, identical systems are considered identical only if they:
1. Are the exact machine type and models.
2. Have the same BIOS level.
3. Have the same adapters/attachments in the same locations.
4. Have the same address jumpers/terminators/cabling.
5. Have the same software versions and levels.
6. Have the same diagnostics code (version).
7. Have the same configuration options set in the system.
8. Have the same setup for the operation system control files.

Comparing the configuration and software setup between "working" and "non-working" systems will often lead to problem resolution.

Appendix D. Communication adapters

This appendix describes the PCI adapters and their correct placement. For more detailed information on the adapters, refer to the hardware installation guide.

The NAS 200 has an integrated 10/100/1000 Ethernet controller as a standard feature. You can also install the following optional adapters:
- Alacritech 100x4 Quad-Port Server Accelerated Adapter
- IBM Gigabit Ethernet SX Server Adapter
- PRO/1000 XT Server Adapter by Intel
- Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter
- Qlogic 2340 1-port Fibre Channel adapter
- IBM PCI Ultra160 SCSI adapter (LVD/SE)
- Remote Supervisor Adapter
- IBM ServeRAID-4Mx Ultra160 SCSI Controller
- IBM ServeRAID-4H Ultra160 SCSI Controller
- IBM ServeRAID-5i Ultra320 SCSI Controller

Adapter placement

Note: You can install a maximum of two IBM Gigabit Ethernet SX Server Adapters, two PRO/1000 XT Server Adapter by Intels, or one of each. You cannot install two IBM Gigabit Ethernet SX Server Adapters *and* two PRO/1000 XT Server Adapter by Intels.

Figure 12 through Figure 21 on page 142 illustrate the connector ends of the adapters. Use these illustrations for identification as necessary.
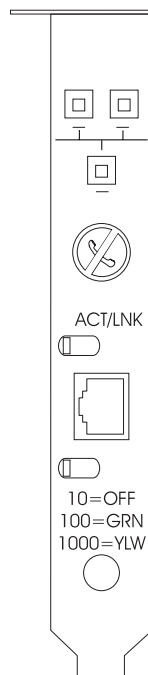
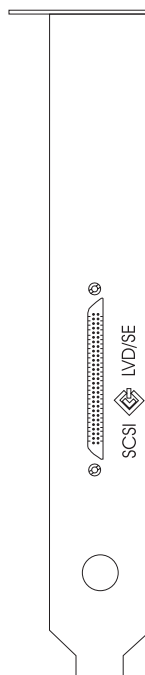*Figure 12. PRO/1000 XT Server Adapter by Intel*
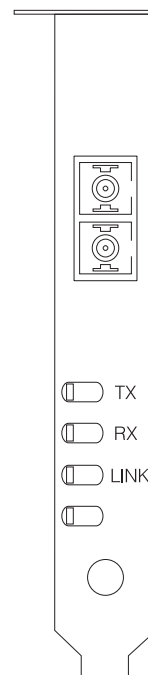
Figure 13. IBM PCI Ultra160 SCSI adapter (LVD/SE)

Figure 14. IBM Gigabit Ethernet SX Server Adapter
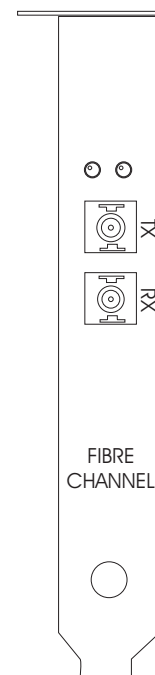
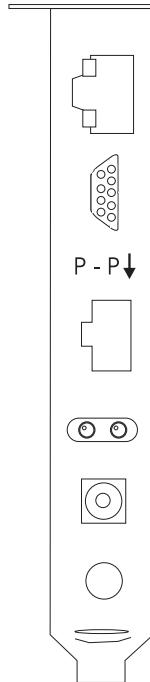*Figure 15. Qlogic 2340 1-port Fibre Channel adapter*

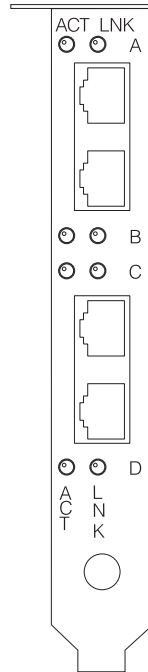*Figure 16. Remote Supervisor Adapter*

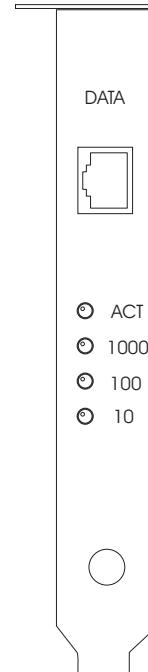*Figure 17. Alacritech 100x4 Quad-Port Server Accelerated Adapter*

Figure 18. Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter
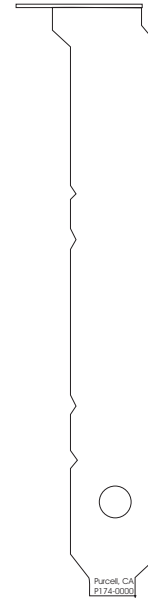

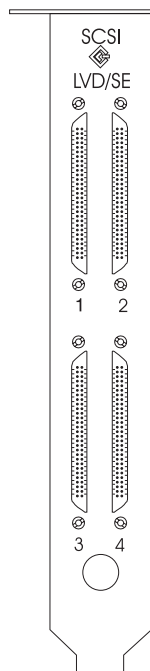*Figure 19. IBM ServeRAID-5i Ultra320 SCSI Controller (no visible channels)*

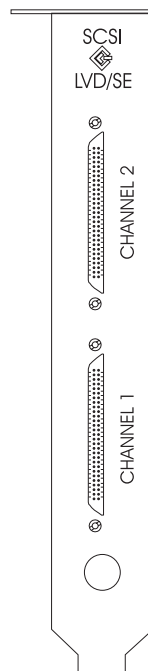*Figure 20. IBM ServeRAID-4H Ultra160 SCSI Controller*

Figure 21. IBM ServeRAID-4Mx Ultra160 SCSI Controller

Adapter placement rules

Adapter placement rules guide which adapter to install in a PCI slot. These rules consist of *priority* and *slot location*. Priority is the sequence in which you install the adapters. Determining the slot location requires eliminating already filled slots and placing the adapter into the first available slot according to its possible Slot locations. The priority and slot locations are shown in Table 37. To determine the location of the slots:

1. Arrange the adapters in order, one having the highest priority, using the Priority column in Table 37.
2. Place the highest priority adapter into the first available slot location listed in the slot location column of Table 37.
3. Repeat step 2 until all adapters are installed.

Example 1: If you are installing a single IBM Gigabit Ethernet SX Server Adapter in the NAS 200, that adapter should be installed in slot 2.

Example 2: If you are installing five adapters—one IBM ServeRAID-4Mx Ultra160 SCSI Controller, two IBM Gigabit Ethernet SX Server Adapters, one IBM PCI Ultra160 SCSI adapter (LVD/SE), and one Alacritech 100x4 Quad-Port Server Accelerated Adapter— they should be installed in the following slots:

*   Slot 1 — Empty
*   Slot 2 — IBM Gigabit Ethernet SX Server Adapter
*   Slot 3 — IBM Gigabit Ethernet SX Server Adapter
*   Slot 4 — IBM ServeRAID-4Mx Ultra160 SCSI Controller
*   Slot 5 — IBM PCI Ultra160 SCSI adapter (LVD/SE)
*   Slot 6 — Alacritech 100x4 Quad-Port Server Accelerated Adapter

Table 37. Adapter installation rules for the Model 25T

Priority	Adapter	Slot location	Maximum quantity
1	IBM ServeRAID-5i Ultra320 SCSI Controller	4	1
2	IBM ServeRAID-4H Ultra160 SCSI Controller	4	1
3	IBM ServeRAID-4Mx Ultra160 SCSI Controller	4, 3	2
4	Remote Supervisor Adapter	1	1
5	Qlogic 2340 1-port Fibre Channel adapter	5	1
6	IBM PCI Ultra160 SCSI adapter (LVD/SE)	5	1
7	Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter	2, 3, 6, 5	2
8	IBM Gigabit Ethernet SX Server Adapter	2, 3, 6, 5	2

Table 37. Adapter installation rules for the Model 25T (continued)

Priority	Adapter	Slot location	Maximum quantity
9	PRO/1000 XT Server Adapter by Intel	2, 3, 6, 5	2
10	Alacritech 100x4 Quad-Port Server Accelerated Adapter	2, 3, 6, 5	2

There is also a complete list of adapter combinations and placement locations in the following charts.

Adapter placement charts

These sections explain where to install the PCI adapters according to your configuration.

The following abbreviations for adapter names are used in the tables:

Tape   Either an IBM PCI Ultra160 SCSI adapter (LVD/SE) or Qlogic 2340 1-port Fibre Channel adapter used for tape backup.

RSA   Remote Supervisor Adapter

EN4   Alacritech 100x4 Quad-Port Server Accelerated Adapter

S5i   IBM ServeRAID-5i Ultra320 SCSI Controller

S4H   IBM ServeRAID-4H Ultra160 SCSI Controller

S4M   IBM ServeRAID-4Mx Ultra160 SCSI Controller

SR1   Either a 4H, a 4Mx or a 5i. SR2 denotes either a 4Mx or a 5i, but not a 4H adapter. See 2.

SR2   Either a 4Mx or a 5i, but not a 4H adapter. See 2.

GB   IBM Gigabit Ethernet SX Server Adapter

CEN   PRO/1000 XT Server Adapter by Intel

CENA   Alacritech 1000x1 Single-Port Server and Storage Accelerated adapter

Notes:

1. The IBM ServeRAID-5i Ultra320 SCSI Controller is only available when it is ordered and installed in the engine from the factory.

2. An engine can be ordered with a single ServeRAID adapter (5i, 4Mx, or 4H) or two ServeRAID adapters (in which case, one must be a 4Mx and the other either a second 4Mx or a 5i). If a IBM ServeRAID-4H Ultra160 SCSI Controller adapter is installed, it must be the only ServeRAID adapter installed. In the placement charts, SR2 denotes either a 4Mx or a 5i, but not a 4H adapter. Similarly, SR1 denotes either a 4H, a 4Mx or a 5i.

3. The Remote Supervisor Adapter is the only adapter that is supported in slot 1. For this reason, the Remote Supervisor Adapter can be added to any of the combinations in the placement charts that do not already list a Remote Supervisor Adapter .

4. An engine can be ordered with a maximum of one adapter for tape backup (either a Qlogic 2340 1-port Fibre Channel adapter or a IBM PCI Ultra160 SCSI adapter (LVD/SE)). In the placement charts, *Tape* refers to the tape backup adapter. If there is a tape backup adapter, it is always installed in slot 5.

5. The maximum number of Ethernet adapters in each engine is four.

6. Each NAS 200 engine must be ordered with at least one of the following ServeRAID controllers:
   - IBM ServeRAID-5i Ultra320 SCSI Controller
   - IBM ServeRAID-4Mx Ultra160 SCSI Controller
   - IBM ServeRAID-4H Ultra160 SCSI Controller

   Each engine can also support two ServeRAID controllers in these combinations:
   - 1 IBM ServeRAID-5i Ultra320 SCSI Controller and 1 IBM ServeRAID-4Mx Ultra160 SCSI Controller
   - 2 IBM ServeRAID-4Mx Ultra160 SCSI Controller

No options

Table 38 shows the placement of a single ServeRAID adapter with no additional options. Table 39 shows the placement of dual ServeRAID adapters with no additional options.

Table 38. Single ServeRAID adapter Options (SR1) — No options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
				S5i		
				S4H		
				S4M		

Table 39. Dual ServeRAID adapter Options (SR2) — No options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
			S4M	S5i		
			S4M	S4M		

RSA only options

Table 40 shows the adapter placement of a SAN connection with only an RSA option.

Table 40. NAS 200 with SAN: RSA only options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
RSA	RSA			SR1		
RSA	RSA		S4M	SR2		

Tape only options

Table 41 shows the adapter placement of a SAN connection with only a tape backup option.

Table 41. NAS 200 with SAN: Tape only options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
LVD	RSA			SR1	LVD	
LVD	RSA		S4M	SR2	LVD	
FC	RSA			SR1	FC	

Table 41. NAS 200 with SAN: Tape only options (continued)

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
FC	RSA		S4M	SR2	FC	

Network only options

These tables show the adapter placement of a SAN connection with only network connection options.

- Table 42 shows placement of single ServeRAID adapters with network options
- shows placement of dual ServeRAID adapters with network options

Table 42. Single ServeRAID adapters with network options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
CENA	RSA	CENA		SR1		
GB	RSA	GB		SR1		
CEN	RSA	CEN		SR1		
EN4	RSA	EN4		SR1		
CENA, CENA	RSA	CENA	CENA	SR1		
CENA, GB	RSA	CENA	GB	SR1		
GB, GB	RSA	GB	GB	SR1		
CEN, CEN	RSA	CEN	CEN	SR1		
CEN, CENA	RSA	CENA	CEN	SR1		
CEN, GB	RSA	GB	CEN	SR1		
EN4, EN4	RSA	EN4	EN4	SR1		
EN4, CEN	RSA	CEN	EN4	SR1		
EN4, CENA	RSA	CENA	EN4	SR1		
EN4, GB	RSA	GB	EN4	SR1		
EN4, EN4, CEN	RSA	CEN	EN4	SR1		EN4
EN4, EN4, CENA	RSA	CENA	EN4	SR1		EN4
EN4, EN4, GB	RSA	GB	EN4	SR1		EN4
EN4, CEN, CEN	RSA	CEN	CEN	SR1		EN4
EN4, CEN, CENA	RSA	CENA	CEN	SR1		EN4
EN4, CEN, GB	RSA	GB	CEN	SR1		EN4
EN4, CENA, CENA	RSA	CENA	CENA	SR1		EN4
EN4, CENA, GB	RSA	CENA	GB	SR1		EN4
EN4, GB, GB	RSA	GB	GB	SR1		EN4
CEN, CEN, CENA	RSA	CENA	CEN	SR1		CEN
CEN, CEN, GB	RSA	GB	CEN	SR1		CEN
CEN, CENA, CENA	RSA	CENA	CENA	SR1		CEN
CEN, CENA, GB	RSA	CENA	GB	SR1		CEN
CEN, GB, GB	RSA	GB	GB	SR1		CEN
CENA, CENA, GB	RSA	CENA	CENA	SR1		GB

Table 42. Single ServeRAID adapters with network options (continued)

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
CENA, GB, GB	RSA	CENA	GB	SR1		GB
EN4, EN4, CEN, CENA	RSA	CENA	CEN	SR1	EN4	EN4
EN4, EN4, CEN, GB	RSA	GB	CEN	SR1	EN4	EN4
EN4, EN4, CEN, CEN	RSA	CEN	CEN	SR1	EN4	EN4
EN4, EN4, CENA, CENA	RSA	CENA	CENA	SR1	EN4	EN4
EN4, EN4, CENA, GB	RSA	CENA	GB	SR1	EN4	EN4
EN4, EN4, GB, GB	RSA	GB	GB	SR1	EN4	EN4
EN4, CEN, CEN, CENA	RSA	CENA	CEN	SR1	EN4	CEN
EN4, CEN, CEN, GB	RSA	GB	CEN	SR1	EN4	CEN
EN4, CEN, CENA, CENA	RSA	CENA	CENA	SR1	EN4	CEN
EN4, CEN, CENA, GB	RSA	CENA	GB	SR1	EN4	CEN
EN4, CEN, GB, GB	RSA	GB	GB	SR1	EN4	CEN
EN4, CENA, CENA, GB	RSA	CENA	CENA	SR1	EN4	GB
EN4, CENA, GB, GB	RSA	CENA	GB	SR1	EN4	GB
CEN, CEN, CENA, CENA	RSA	CENA	CENA	SR1	CEN	CEN
CEN, CEN, CENA, GB	RSA	CENA	GB	SR1	CEN	CEN
CEN, CEN, GB, GB	RSA	GB	GB	SR1	CEN	CEN
CEN, CENA, CENA, GB	RSA	CENA	CENA	SR1	CEN	GB
CEN, CENA, GB, GB	RSA	CENA	GB	SR1	CEN	GB
CENA, CENA, GB, GB	RSA	CENA	CENA	SR1	GB	GB

Table 43. Dual ServeRAID adapters with network options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
CENA	RSA	CENA	S4M	SR2		
GB	RSA	GB	S4M	SR2		
CEN	RSA	CEN	S4M	SR2		
EN4	RSA	EN4	S4M	SR2		
CENA, CENA	RSA	CENA	S4M	SR2		CENA
CENA, GB	RSA	CENA	S4M	SR2		GB
GB, GB	RSA	GB	S4M	SR2		GB
CEN, CEN	RSA	CEN	S4M	SR2		CEN
CEN, CENA	RSA	CENA	S4M	SR2		CEN
CEN, GB	RSA	GB	S4M	SR2		CEN
EN4, EN4	RSA	EN4	S4M	SR2		EN4
EN4, CEN	RSA	CEN	S4M	SR2		EN4
EN4, CENA	RSA	CENA	S4M	SR2		EN4
EN4, GB	RSA	GB	S4M	SR2		EN4
EN4, EN4, CEN	RSA	CEN	S4M	SR2	EN4	EN4
EN4, EN4, CENA	RSA	CENA	S4M	SR2	EN4	EN4

Table 43. Dual ServeRAID adapters with network options (continued)

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
EN4, EN4, GB	RSA	GB	S4M	SR2	EN4	EN4
EN4, CEN, CEN	RSA	CEN	S4M	SR2	EN4	CEN
EN4, CEN, CENA	RSA	CENA	S4M	SR2	EN4	CEN
EN4, CEN, GB	RSA	GB	S4M	SR2	EN4	CEN
EN4, CENA, CENA	RSA	CENA	S4M	SR2	EN4	CENA
EN4, CENA, GB	RSA	CENA	S4M	SR2	EN4	GB
EN4, GB, GB	RSA	GB	S4M	SR2	EN4	GB
CEN, CEN, CENA	RSA	CENA	S4M	SR2	CEN	CEN
CEN, CEN, GB	RSA	GB	S4M	SR2	CEN	CEN
CEN, CENA, CENA	RSA	CENA	S4M	SR2	CEN	CENA
CEN, CENA, GB	RSA	CENA	S4M	SR2	CEN	GB
CEN, GB, GB	RSA	GB	S4M	SR2	CEN	GB
CENA, CENA, GB	RSA	CENA	S4M	SR2	GB	CENA
CENA, GB, GB	RSA	CENA	S4M	SR2	GB	GB

Tape and network options

These tables show the adapter placement of a SAN connection with tape and network connection options.

- Table 44 shows placement of single ServeRAID adapters with tape and network options
- Table 45 on page 149 shows placement of dual ServeRAID adapters with tape and network options

Table 44. Single ServeRAID adapters with tape and network options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
Tape, CENA	RSA	CENA		SR1	Tape	
Tape, GB	RSA			SR1	Tape	
Tape, CEN	RSA	CEN		SR1	Tape	
Tape, EN4	RSA	EN4		SR1	Tape	
Tape, CENA, CENA	RSA	CENA	CENA	SR1	Tape	
Tape, CENA, GB	RSA	CENA	GB	SR1	Tape	
Tape, GB, GB	RSA	GB	GB	SR1	Tape	
Tape, CEN, CEN	RSA	CEN	CEN	SR1	Tape	
Tape, CEN, CENA	RSA	CENA	CEN	SR1	Tape	
Tape, CEN, GB	RSA	GB	CEN	SR1	Tape	
Tape, EN4, EN4	RSA	EN4	EN4	SR1	Tape	
Tape, EN4, CEN	RSA	CEN	EN4	SR1	Tape	
Tape, EN4, CENA	RSA	CENA	EN4	SR1	Tape	
Tape, EN4, GB	RSA	GB	EN4	SR1	Tape	
Tape, EN4, EN4, CEN	RSA	CEN	EN4	SR1	Tape	EN4

Table 44. Single ServeRAID adapters with tape and network options (continued)

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
Tape, EN4, EN4, CENA	RSA	CENA	EN4	SR1	Tape	EN4
Tape, EN4, EN4, GB	RSA	GB	EN4	SR1	Tape	EN4
Tape, EN4, CEN, CEN	RSA	CEN	CEN	SR1	Tape	EN4
Tape, EN4, CEN, CENA	RSA	CENA	CEN	SR1	Tape	EN4
Tape, EN4, CEN, GB	RSA	GB	CEN	SR1	Tape	EN4
Tape, EN4, CENA, CENA	RSA	CENA	CENA	SR1	Tape	EN4
Tape, EN4, CENA, GB	RSA	CENA	GB	SR1	Tape	EN4
Tape, EN4, GB, GB	RSA	GB	GB	SR1	Tape	EN4
Tape, CEN, CEN, CENA	RSA	CENA	CEN	SR1	Tape	CEN
Tape, CEN, CEN, GB	RSA	GB	CEN	SR1	Tape	CEN
Tape, CEN, CENA, CENA	RSA	CENA	CENA	SR1	Tape	CEN
Tape, CEN, CENA, GB	RSA	CENA	GB	SR1	Tape	CEN
Tape, CEN, GB, GB	RSA	GB	GB	SR1	Tape	CEN
Tape, CENA, CENA, GB	RSA	CENA	CENA	SR1	Tape	GB
Tape, CENA, GB, GB	RSA	CENA	GB	SR1	Tape	GB

Table 45. Dual ServeRAID adapters with tape and network options

Configuration	PCI Slot-1 (32-bit)	PCI Slot-2 (64-bit)	PCI Slot-3 (64-bit)	PCI Slot-4 (64-bit)	PCI Slot-5 (64-bit)	PCI Slot-6 (64-bit)
Tape, CENA	RSA	CENA	S4M	SR2	Tape	
Tape, GB	RSA	GB	S4M	SR2	Tape	
Tape, CEN	RSA	CEN	S4M	SR2	Tape	
Tape, EN4	RSA	EN4	S4M	SR2	Tape	
Tape, CENA, CENA	RSA	CENA	S4M	SR2	Tape	CENA
Tape, CENA, GB	RSA	CENA	S4M	SR2	Tape	GB
Tape, GB, GB	RSA	GB	S4M	SR2	Tape	GB
Tape, CEN, CEN	RSA	CEN	S4M	SR2	Tape	CEN
Tape, CEN, CENA	RSA	CENA	S4M	SR2	Tape	CEN
Tape, CEN, GB	RSA	GB	S4M	SR2	Tape	CEN
Tape, EN4, EN4	RSA	EN4	S4M	SR2	Tape	EN4
Tape, EN4, CEN	RSA	CEN	S4M	SR2	Tape	EN4
Tape, EN4, CENA	RSA	CENA	S4M	SR2	Tape	EN4
Tape, EN4, GB	RSA	GB	S4M	SR2	Tape	EN4

Glossary of terms and abbreviations

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.

- The *ANSI/EIA Standard - 440A: Fiber Optic Terminology*, copyright 1989 by the Electronics Industries Association (EIA). Copies can be purchased from the Electronics Industries Association, 2001 Pennsylvania Avenue N.W., Washington, D.C. 20006. Definitions are identified by the symbol (E) after the definition.

- 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

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).

100BASE-T.   The IEEE 802.3 Ethernet standard that supports a transmission rate of 100 Mbps using two twisted-pair wires (Category 5 telephone wiring).

A

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.

assigned disk.   A disk that is mapped to a logical drive.

attach.   To make a device a part of a network logically. Contrast with *connect*.

attention (ATTN).   An occurrence external to an operation that could cause an interruption of the operation.

ATTN.   See *attention*.

B

baseband LAN.   A local area network in which data is encoded and transmitted without modulation of a carrier (T).

Basic Input/Output System (BIOS).   The personal computer code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

BIOS.   See *Basic Input/Output System*.

bits per second (bps).   The rate at which bits are transmitted per second. Contrast with *baud*.

bps.   See *bits per second.*

buffer.   See *buffer storage*.

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, a serial and a parallel device, or between devices having different transfer rates. (2) In word processing, a temporary storage in which text is held for processing or communication (T).

bus. See *data bus*.

C

cache. A high-speed buffer storage that contains frequently accessed instructions and data to reduce access time.

carrier sense multiple access with collision detection (CSMA/CD). A class of medium access procedures that allows multiple stations to access the medium at will, without explicit prior coordination, and avoids contention by way of carrier sense and deference. Contention is resolved by way of collision detection and transmission.

CIFS. See *Common Internet File System.*

cluster. (1) A station that consists of a control unit (a *cluster controller*) and the terminals attached to it. (2) A group of APPN nodes that have the same network ID and the same topology database. A cluster is a subset of a network identifier (NETID) subnetwork. See also *high-availability cluster multiprocessing (HACMP)* and *network identifier (NETID)*.

collision avoidance. In carrier sense multiple access with collision avoidance (CSMA/CA), the process of sending a jam signal and waiting for a variable time before transmitting data. The process is designed 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.

connect. In a LAN, to physically join a cable from a station to an access unit or network connection point. Contrast with *attach*.

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* .

D

DASD. See *direct access storage device*.

data bus. A bus used to communicate data internally and externally to and from a processing unit, storage, and peripheral devices (A).

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 subsystem continues to run. The disk-unit subsystem reconstructs the data after the disk unit in the subsystem is repaired or replaced. See also *RAID*.

DHCP. See *Dynamic Host Configuration Protocol*.

DIMM. See *dual inline memory module*.

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 performs the transfer of data between itself and the system's memory directly.

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 in an appliance into which you insert a hard-disk-drive module. The bays are in storage units that can be located in a different 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.

E

EIA. See *Electronic Industries Association*.

EISA. See *Extended Industry Standard Architecture*.

electromagnetic compatibility (EMC). The design and test of products to meet legal and corporate specifications dealing with the emissions and susceptibility to frequencies in the radio spectrum. Electromagnetic compatibility is the ability of various electronic equipment to operate correctly in the intended electromagnetic environment.

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.

electrostatic discharge (ESD). An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

EMC. See *electromagnetic compatibility*.

engine. The unit that contains the processors that respond to requests for data from clients. The operating software for the IBM TotalStorage appliance resides in the engine.

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). Contrast with *failure*.

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 manages 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.

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 Industry Standard Architecture (EISA). The PC bus standard that extends the AT bus (ISA bus) to 32 bits and provides support for bus master. 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

fabric. A complex network using hubs, switches and gateways. For example, Fibre Channel uses a fabric to connect devices. A fabric can be as simple as a single cable connecting two devices.

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 in which the primary database server or application server switches to a backup system due to the failure of the primary server.

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*.

field-replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases, a FRU may contain other FRUs. Contrast with *customer-replaceable unit*.

File Transfer Protocol (FTP). In the Internet suite of protocols, an application layer protocol that uses TCP/IP and Telnet services to transfer bulk-data files between machines or hosts.

flash memory. A type of non-volatile storage device that must be erased in fixed blocks rather than single bytes.

FRU. See *field-replaceable unit*.

FTP. See *File Transfer Protocol*.

G

gateway. A device that acts as a router to transfer packets between networks, but occurs at the transport layer. See also *router*.

H

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.

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 client, a server, or both. (2) In Fibre Channel technology, 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.

I

IETF. See *Internet Engineering Task Force*.

iLUN. See *iSCSI client logical-unit number.*

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.

interrupt request (IRQ).   An input found on a processor that causes it to suspend normal instruction execution temporarily and to start executing an interrupt handler routine.

IP.   See *Internet Protocol*.

IRQ.   See *interrupt request*.

iSCSI client logical-unit number (iLUN).   A unique number that is assigned to each virtual logical unit number (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.

L

LAN.   See *local area network*.

local area network (LAN).   A network in which a set of devices is connected to one another for communication and that can be connected to a larger network.

logical drive.   A unit of virtual storage that is made available to the network through virtual logical unit numbers (VLUNs) and iSCSI client logical-unit number (iLUNs). It consists of one or more physical disks that are combined using RAID 0, 1, 1E, 5, or 5E technology.

logical unit.   A type of network-accessible unit that enables users to gain access to network resources and communicate with each other.

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

loop.   A closed unidirectional signal path connecting input/output devices to a system.

LUN.   See *logical unit number*.

M

management information base (MIB).   Simple Network Management Protocol (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 equals 1 000 000 hertz.

MES.   See *miscellaneous equipment specification*.

MHz.   See *megahertz*.

MIB.   See *management information base*.

miscellaneous equipment specification (MES).   Any equipment that is added after the time of the initial order.

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.   A type of IP address, which identifies a group of interfaces and permits all of the systems that are in that group to receive the same packet of information.

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 - 100 microns that will allow a large number of modes to propagate.

N

N. See *newton*.

NAS. See *network-attached storage*.

network-attached storage (NAS). A task-optimized storage device directly attached to a network that operates independently of the general-purpose file servers.

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 unit of force required to impart an acceleration of one meter per second per second to a mass of one kilogram (1 m/s^2).

NFS. See *Network File System*.

NIS. See *network information services*.

O

optical cable. A fiber, multiple fibers, or a fiber bundle in a structure built to meet optical, mechanical, and environmental specifications (E).

P

path. In a network, a route between two nodes.

path group. A collection of equivalent paths. Storage devices may have one - *n* path groups.

PCI. See *Peripheral Component Interconnect*.

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 industry standard architecture (ISA) or extended industry standard architecture (EISA) bus. ISA and EISA boards 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, TrueImage data views of any or all system and data volumes residing on network-attached storage. All persistent images survive system 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.

port. See *socket*.

protocol. The meaning of, and the sequencing rules for, requests and responses used for managing a network, transferring data, and synchronizing the states of network components.

PSM. See *Persistent Storage Manager*.

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 (DASD)*.

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 also *device parity protection*.

router.   An attaching device that connects two LAN segments at the reference-model network layer. The LAN segments may use similar or different architectures.

S

SAN.   See *storage area network*.

SCSI.   See *small computer system interface*.

server.   In a network, a node that provides facilities to other stations; examples of servers are a file server, a printer server, and a mail server.

shielded twisted pair (STP).   A cable medium consisting of a telephone wire wrapped in a metal sheath to eliminate external interference.

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-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*.

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

SNMP.   See *Simple Network Management Protocol*.

storage area network (SAN).   A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services.

storage client network.   A classic, interconnected, Fibre Channel fabric with a single, Fibre Channel, fabric name.

storage controller.   A device (such as a RAID controller) that creates and manages other storage devices.

storage device.   A logical unit number (LUN) that terminates a collection of ports on the storage network.

storage network.   An arrangement that provides shared access to a set of logical unit numbers (LUNs) across one - *n* storage client networks.

storage port.   An engine's connection point to a storage client network. A storage port is a member of a single fabric. See also *engine*.

storage unit.   Hardware that contains one or more drive bays, power supplies, and a network interface. Some storage units contain RAID controllers; their storage unit is accessed by the appliance.

STP.   See *shielded twisted pair*.

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.

T

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, such as 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*.

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

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 concept permits resegmentation of the LAN without requiring physical rearrangement.

virtual logical unit number (VLUN).   A subset of a logical drive.

VLAN.   See *virtual local area network*.

VLUN.   See *virtual logical unit number*.

volume.   (1) A unit of storage on disk, tape, or other data-recording media. (2) A logical disk visible to an appliance over a storage network. A volume is a member of a single storage network of 1 - *n* fabrics. It can have 1 - *n* path groups of 1 - *n* equivalent paths.

W

Windows Internet Naming Service (WINS).   A Microsoft 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*.

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