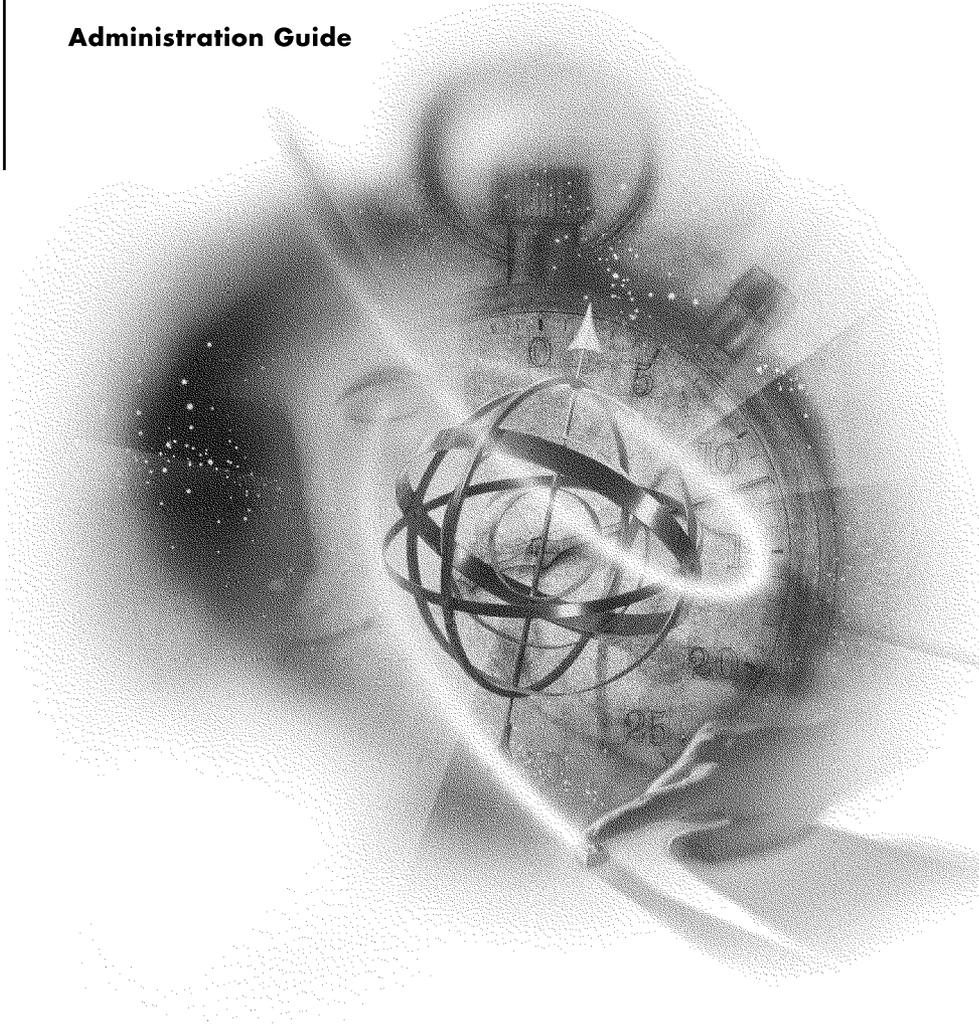

NetWare Server Disks and Storage Devices

Administration Guide



NetWare[®] 5.1
NETWORKING SOFTWARE

Novell[®]

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Server Disks and Storage Devices

NetWare has been enhanced to allow you to create up to four NetWare (or other) partitions on one hard disk and to let you install the advanced Novell Storage Services (NSS) file system. In addition, a new device numbering scheme has been created that lets you easily identify all storage devices as they appear in various NetWare utilities and command displays. For general information about NetWare partitions and device numbering, see [“Understanding” on page 9](#). For information about the NSS file system, see the *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation..

The MONITOR utility provides important disk use statistics. Use MONITOR to assess disk space and to activate or deactivate storage devices.

The NWCONFIG utility contains much of the functionality previously found in INSTALL. Use NWCONFIG to create volumes and partitions and to establish partition mirroring. See [“Managing” on page 29](#) for information about using MONITOR and NWCONFIG.

To optimize the use of your server’s storage devices, follow the general recommendations found in [“Optimizing” on page 19](#).

1

Understanding

Server hard disks and other storage devices (such as tape drives and CD-ROM drives) are all managed by the NetWare[®] operating system.

Hard disks are divided into partitions, including one DOS partition and at least one NetWare partition per server. A hard disk can also contain other partitions, such as a UNIX partition. For general information about disk partitions, see [“Partitioning Disks” on page 9](#) and [“Logical Partitions” on page 11](#).

All storage devices and individual disk partitions are identified by numbers assigned by the NetWare operating system’s Media Manager. The same number represents the same device in all NetWare utilities or console commands. For an explanation of the device numbering system, see [“Device and Partition Numbering” on page 12](#).

All storage devices require drivers. The NetWare Peripheral Storage Architecture™ (NWSA) divides device drivers into two kinds: a custom device module (CDM) that drives the device itself and a host adapter module (HAM) that drives the adapter to which the device is attached. For more information, see [“Drivers for Host Adapters and Storage Devices” on page 15](#).

To increase data fault tolerance, partitions on one disk can be mirrored to partitions on other disks. For information about mirroring, see [“Mirroring and Duplexing” on page 15](#). NetWare also includes a feature called Hot Fix™ that redirects any information stored on corrupted blocks to uncorrupted disk blocks. See [“Redirecting Bad Blocks” on page 17](#).

Partitioning Disks

You can divide a NetWare server hard disk into units called disk partitions. You can also leave free (unassigned) space on a disk.

NOTE: A NetWare disk partition is not related to an NDS® **partition**.

The Novell traditional file system resides on NetWare partitions. The Novell Storage Services (NSS) file system resides on free space not assigned to NetWare partitions.

One of the server's hard disks must contain a DOS partition. This is the primary boot partition where server.exe is stored. You need only one boot partition per server.

One of the server's hard disks must also contain a NetWare partition. The DOS and NetWare partitions do not have to be on the same disk. If you are using the NSS file system, you must keep one NetWare partition on the server's hard disk to contain volume SYS:.

A hard disk can contain as many as four partitions, including a DOS partition, multiple NetWare partitions, or non-NetWare partitions (such as Windows NT or UNIX). The disk can also contain free space assigned to the NSS file system.

A NetWare partition consists of a data area and can also contain a Hot Fix Redirection Area, used for disk sector sparing (maintaining a spare sector per track in case another sector becomes defective). The logical sector 0 of a NetWare partition is the first sector of the data area available to applications, such as the traditional NetWare file system. This data area is referred to as a logical partition. See **“Logical Partitions”** on page 11.

The following figures illustrate some of the ways hard disks can be partitioned.

Figure 1 NetWare and DOS Partitions on One Disk

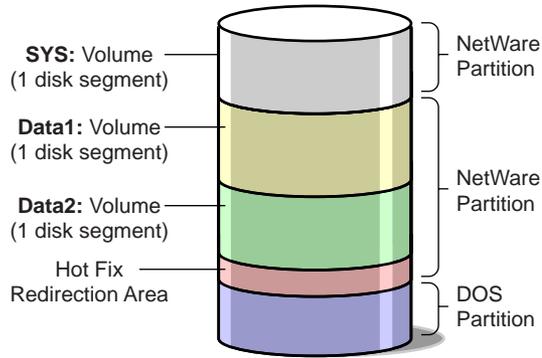


Figure 2 DOS Partition on First Disk, NetWare and Non-NetWare Partitions on Second Disk

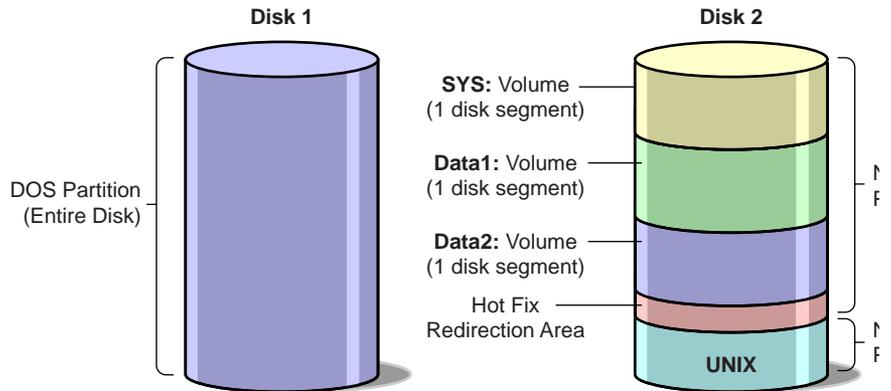
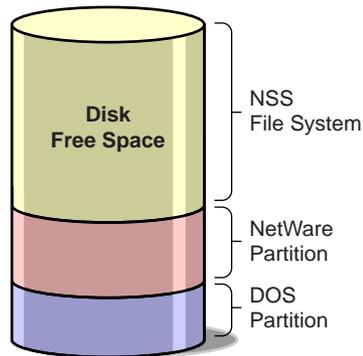


Figure 3 Disk with One NetWare Partition and Free Space Assigned to NSS



Logical Partitions

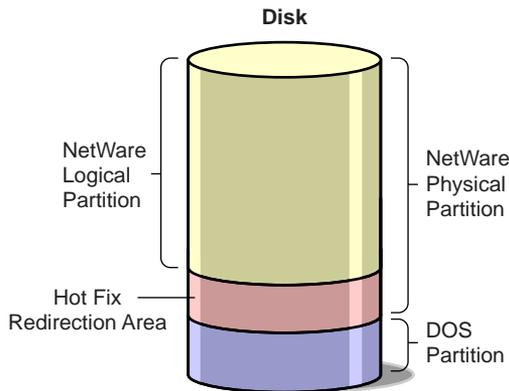
Server hard disks can contain up to four NetWare partitions. Each NetWare partition contains a data area, where the file system resides, and can contain another area, called the Hot Fix/mirror object, which is used to manage mirroring and Hot Fix redirection.

The entire NetWare partition, including both the data area and the Hot Fix/mirror object, is called the *physical partition*.

The data area of the partition is called the *logical partition*.

If Hot Fix and mirroring are not used, then the disk will not contain a Hot Fix/mirror object. In this case, the entire physical partition *is* the logical partition.

Figure 4 Logical and Physical Partitions on a Server Disk



The logical NetWare partition contains four redundant copies of the volume definition table (VDT). Each table contains a list of all volume segments in that NetWare partition. Four copies are maintained for fault tolerance. If a disk error occurs and one table is corrupted, the error can be detected and corrected.

The rest of the logical partition can contain one to eight NetWare volume segments. Each segment should belong to a different NetWare volume.

Device and Partition Numbering

All storage devices, disk partitions, and logical partitions are identified by object numbers assigned by the NetWare operating system's **Media Manager**.

In addition, physical devices and adapters are assigned a device name.

These object numbers and device names are consistent across all NetWare utilities and console commands so that you can easily identify the objects and devices.

Object Numbers

Object numbers are hexadecimal numbers assigned to devices, adapters, media, physical partitions, NSS partitions, and divisions of a partition (such as the Hot Fix redirection area).

If NetWare partitions are mirrored, each logical partition in the mirrored set has the same object number as the other partitions in the set.

Object numbers are not necessarily sequential, nor are they persistent. New numbers can be assigned when the server is restarted. But the same object number represents the same entity in any NetWare utility. For example, if you type `LIST DEVICES` at the server console prompt, you would see a list of storage devices, such as the following. The first number in each line is the object number:

```
0x0001: [V312-A0-d4:0] iomega jaz 1GB rev:H.72
0x0003: [V025-A1-D1:0] WDC AC22100H
0x0002: [V025-A2-D2:0] NEC CD-ROM DRIVE:282 rev:3.07
```

Likewise, in `MONITOR`, in the Available Options menu, if you select Storage Devices, you would see a list of storage devices, partitions, and adapters similar to the following:

```
0x0001: [V312-A0-d4:0] iomega jaz 1GB rev:H.72
0x0000: [V025-A1] Novell IDE Host Adapter Module
0x0003: [V025-A1-D1:0] WDC AC22100H
0x0002: [V025-A2-D2:0] NEC CD-ROM DRIVE:282 rev:3.07
0x0006: DOS Partitioned Media
0x0008: NetWare Partition
0x000A: Non-Mirrored Partition
```

The first number in each line is the hexadecimal object number. In the MONITOR example, object number 0x0001 represents an Iomega Jaz drive, just as it did in the LIST DEVICES display.

Note that a physical NetWare partition is identified as NetWare Partition and a logical partition is identified either as Non-Mirrored Partition or Mirrored Partition.

Mirroring messages use the logical partition object number to report that hard disks are being remirrored or unmirrored.

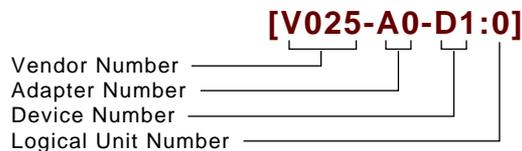
Device Names

Devices such as hard disks and adapters are identified not only by a nonpersistent object number (see “Object Numbers” on page 12), but also by a permanent device name. When a hard disk fails, the failure message includes the device name so you can identify the disk or adapter.

To see a list of storage devices and their names, execute the LIST STORAGE ADAPTERS command at the server console prompt. The screen lists each device adapter, followed by a list of devices driven by that adapter. In the following example, the first line identifies an IDE disk adapter. The second line identifies a hard disk operated by that adapter:

```
[V025-A0] NOVELL IDE HOST ADAPTER MODULE
[V025-A0-D1:0] QUANTUM FIREBALL_TM3840A
```

The bracketed letters and numbers at the beginning of each line are the device name. The device name identifies the adapter or device, as follows:



- ◆ **Vendor number.** A unique number specific to the device vendor.
- ◆ **Adapter number.** The instance of the adapter in the server. In the example, A0 identifies the first instance of an adapter installed in the server. Adapter numbers are unique. The second adapter installed in the server will have adapter number A1, even if the adapter is of the same type as adapter A0.

- ♦ **Device number.** The number of the disk or other device. For a SCSI disk, this is the target ID, usually set by a jumper on the hard disk. For an IDE disk, this number represents the bus from the IDE controller. IDE numbers range from D0 through D3, representing the primary, secondary, tertiary, or quaternary bus.
- ♦ **Logical unit number (LUN).** The LUN identifies individual devices when more than one device is attached to one bus. For example, one IDE bus might be attached to two disks, a master and a slave. LUN 0 represents the master and LUN 1 represents the slave. However, because disk manufacturers rarely use the logical unit number to identify hard disks, the LUN almost always appears as 0.

The same device name represents the device in all Novell utilities and console commands, including MONITOR, NWCONFIG, LIST DEVICES, etc.

Hot Fix messages use the device name to report that data on a hard disk has been redirected.

Drivers for Host Adapters and Storage Devices

All storage devices require drivers. The NetWare Peripheral Storage Architecture (NWPAS) divides device drivers into two kinds: a custom device module (CDM) that drives the device itself and a host adapter module (HAM) that drives the adapter to which the device is attached.

- ♦ Custom Device Module (CDM)

CDMs drive storage devices, including autochangers, that are attached to the host adapter bus.

CDMs are device-specific. For example, if there are three different types of storage devices attached to the host adapter (such as a CD-ROM drive, a SCSI hard drive, and an autochanger) then a specific CDM for each type of device must be installed.

- ♦ Host Adapter Module (HAM)

A HAM is the driver component associated with the host adapter hardware. HAMS provide the functionality to route requests to the bus where a specified device is attached.

HAMS are adapter-specific. For example, if a third-party adapter is installed in the server, a HAM developed specifically for that adapter must be installed.

Loading HAMs and CDMs is much like loading other device drivers, but instead of loading one .dsk file for both the adapter and device, you load one .ham file for the adapter and one .cdm file for each type of device attached to the adapter.

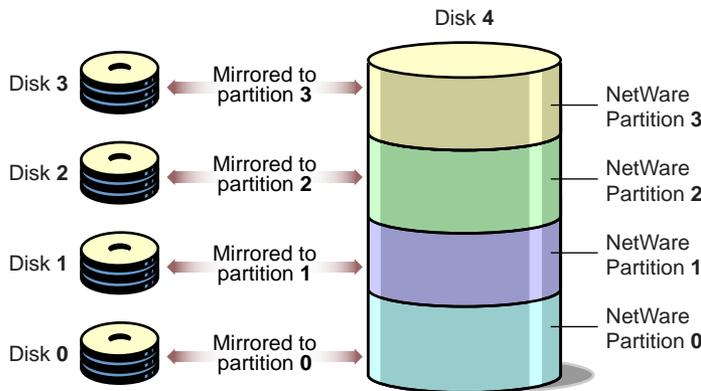
When you want to connect a new hardware device to the host bus adapter, you need to load only the appropriate CDM for that hardware device (in addition to the HAMs and CDMs already loaded, and assuming a compatible adapter is installed).

Mirroring and Duplexing

You can protect your data on disk by mirroring or duplexing disk partitions.

Mirroring stores the same data on separate disks on the same controller channel; duplexing stores the same data on separate disks on separate controller channels. Duplexing can also include using two different drivers. Duplexing is the preferred method since two channels rarely fail simultaneously.

In the following illustration, several smaller disks are mirrored to partitions on one larger disk.



Partitions to be mirrored must have Hot Fix enabled. For information about Hot Fix, see [“Redirecting Bad Blocks” on page 17](#).

When Hot Fix is enabled, a portion of the partition is set aside as the Hot Fix/Mirror object, which holds data tables for both Hot Fix and mirroring. The tables store information about what data blocks are bad, what blocks have

been redirected, what partitions are mirrored, and whether the partitions are synchronized or not.

If you do not enable Hot Fix, then no Hot Fix/Mirror object is created and neither mirroring nor Hot Fix redirection can take place. Remember that it is much easier to set up Hot Fix when you create the partition. To add Hot Fix later, you must delete the volumes from the partition, add Hot Fix, then restore the volumes from a backup.

Following are some considerations to keep in mind when mirroring partitions:

- ◆ Hot Fix must be enabled on all the partitions to be mirrored. You cannot mirror partitions that do not have a Hot Fix Redirection Area.
- ◆ Mirroring requires the NetWare Hot Fix redirection areas on each partition to be the same size. If they are not the same size, NWCONFIG adjusts the larger one to the size of the smaller one when you set up mirroring.
- ◆ Although you can mirror one partition to as many as eight other partitions, mirroring two partitions is usually sufficient fault tolerance for most systems.
- ◆ If a mirrored disk fails and cannot be accessed by the server, you can unmirror the hard disks and salvage the volume from the functional disk. See [“Recovering Data from an Out of Sync Disk” on page 46](#).
- ◆ If you want to remove a hot-plug mirrored disk without bringing down the server, you must unmirror the disk first. See [“Unmirroring Partitions” on page 44](#).

For information about how to set up mirroring and duplexing, see [“Mirroring and Duplexing Partitions” on page 42](#).

Redirecting Bad Blocks

Due to the constant reading and writing of data to disk, some disk storage blocks lose their capacity to store data. NetWare prevents data from being written to unreliable blocks by employing a feature called Hot Fix.

The Hot Fix feature redirects the original block of data (still in memory) to the Hot Fix Redirection Area of the NetWare partition, where the data can be stored correctly. Once the operating system records the address of the defective block in a section of the partition area reserved for that purpose, the server won't attempt to store data in the defective block.

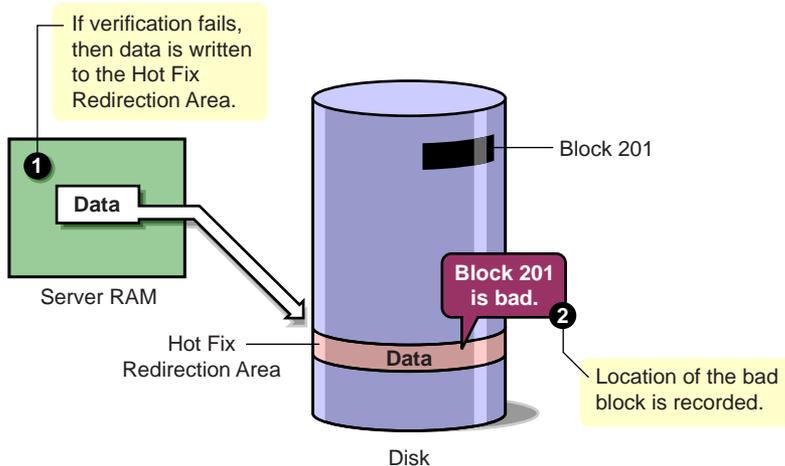
Hot Fix redirection can occur during a write request, a read request, or a read-after-write verification.

- ◆ Write redirection occurs when the disk reports an error during a write request. The system marks the block as bad and redirects the data to a different block.
- ◆ Read redirection occurs when a disk error happens during a read request. If the disk is mirrored, the system retrieves the data from the mirrored disk and redirects the data on the primary disk. If the disk isn't mirrored, the data is lost, but the block is marked as bad.
- ◆ Read-after-write-verify redirection occurs after data is written to disk. The data on disk is then read and compared to that in memory. If the two don't match, the system marks the block as bad and redirects the data to a different block.

By default, 2% of a disk's space is set aside as the Hot Fix Redirection Area. You can increase or decrease the amount.

If Hot Fix is enabled, then it is always active unless the disk fails or the redirection area is full. You can view Hot Fix activity in MONITOR by selecting Storage Devices and then a Hot Fix partition.

Figure 5 Hot Fix



If desired, you can specify no Hot Fix Redirection Area when you create disk partitions. Having no Hot Fix Redirection Area saves partition space.

Eliminating the Hot Fix Redirection Area might be recommended for large RAID systems that provide their own means of fault tolerance.

However, if Hot Fix is not enabled, then the partition will not have the fault tolerance provided by NetWare. Data on corrupted sectors of the disk won't be redirected to the Hot Fix Redirection Area. In addition, you cannot mirror partitions that do not have Hot Fix. It is easiest to enable Hot Fix when you create the partition. To add Hot Fix later, you must delete all the volumes on the partition.

Refer to [“Creating NetWare Partitions” on page 38](#) for instructions on how to specify no Hot Fix Redirection Area.

2

Optimizing

For a list of general guidelines for conserving disk space and improving disk performance, see [“Recommendations” on page 19](#).

To improve disk reads and writes, see [“Improving Disk Reads” on page 22](#) and [“Improving Disk Writes” on page 24](#). You can also increase the speed of disk reads and writes by interleaving volume segments across one or more disks. See *Traditional File Services* > [Enhancing Disk Response Time With Spanning](#) in the NetWare 5.1 online documentation.

To save disk space, try the following:

- ◆ Compressing files. See *Traditional File Services* > [Saving Disk Space with File Compression](#) in the NetWare 5.1 online documentation.
- ◆ Permanently deleting files. See *Traditional File Services* > [Saving Disk Space With File Purging](#) in the NetWare 5.1 online documentation.

Recommendations

- ◆ Enable block suballocation if you are using the traditional NetWare file system. Block suballocation is enabled by default, but can be disabled when the volume is created. If block suballocation has been disabled, enable it using NWCONFIG (NWCONFIG, select Standard Disk Options > NetWare Volume Options > select the volume and change the Block Suballocation field to On). After block suballocation is enabled, it cannot be disabled without recreating the volume.
- ◆ Set your file block size to 64 KB if you are using block suballocation (available only in the traditional NetWare file system). The larger block size causes the system to transfer more data at one time and therefore improves performance. Block suballocation prevents unused portions of large blocks from being wasted.

- ◆ Keep at least 1000 free blocks on each NetWare volume that has suballocation enabled. Free blocks are disk blocks that have no files stored in them. If the number of free blocks is low, then suballocation goes into an aggressive mode that can cause server utilization to increase.

To find the number of free blocks, in MONITOR select Available Options > Volumes, then highlight the name of the volume you want. Press Tab to expand the information window and note the value of the Free Blocks statistic. To free disk blocks, purge deleted files. For more information, see *Utilities Reference* > Utilities > **PURGE** in the NetWare 5.1 online documentation.

- ◆ You can save a significant amount of partition space and increase performance by eliminating the Hot Fix redirection area on the partition. However, once Hot Fix is eliminated from a partition, you cannot add it again without first deleting the volumes on the partition. Once Hot Fix is gone, the partition will no longer be fault tolerant, unless the hard disk itself provides a means of fault tolerance. Data on corrupted sectors of the disk won't be redirected to the Hot Fix redirection area. In addition, you will not be able to mirror the partition. Refer to **Step 6 on page 39** of *Creating NetWare Disk Partitions* for instructions on how to create a partition without the Hot Fix redirection area.

- ◆ Turn off Read-After-Write-Verify in MONITOR.

Read-After-Write-Verify is almost always provided by the hard disk itself. Use the Read-After-Write-Verify feature in MONITOR only if your hardware does not provide this feature but does support software-controlled Read-After-Write-Verify.

See **“Turning Off Read-After-Write Verification” on page 26**.

- ◆ If you have a 16-bit disk adapter, make sure you increase the number of reserved buffers below 16 MB. Use the SET command or MONITOR to set the parameter Reserved Buffers Below 16 MB to its upper limit, 300. You can also change the parameter using MONITOR, in the Available Options menu, select Server Parameters > Memory. Remember that too many reserved buffers can prevent large volumes from mounting. As soon as possible, upgrade the system to a newer board that can access higher memory.
- ◆ Use a driver that supports **scatter gather** functionality.
- ◆ Provide at least one device large enough to hold a core dump of the server's memory. A core dump cannot span devices.

- ◆ If a NetWare volume is comprised of two or more segments, each segment should be on a different disk. If the volume is made of more than one segment on one disk, the volume spans between the two segments, slowing performance.
- ◆ Make sure that file compression, if enabled, happens only when there is little activity on the server. (File compression is available only on the traditional NetWare file system, not the NSS file system.)

For example, make sure that the Deleted Files Compression Option parameter is *not* set to 2, which would cause compression whenever a file is deleted but not purged. Make sure that users have not flagged their directories IC, which enables immediate compression. Use SET commands to make sure that compression is scheduled to start and stop at the appropriate times. For more information, see **SET > File System Parameters** in *Utilities Reference* in the NetWare 5.1 online documentation.

- ◆ For protection, mirror or duplex the volume SYS:, because it contains the core NetWare files. See **“Mirroring and Duplexing Partitions” on page 42**.
- ◆ Keep 10% free space in any NetWare volume, except SYS:, for which you should maintain 20% free space.

If the volume SYS: fills up or runs out of disk space, the Transaction Tracking System, which protects NDS[®], shuts down. This compromises the NDS replicas on the server.

To keep enough free space on volumes, try the following:

- ◆ Use MONITOR to check each volume’s disk space regularly.
- ◆ Use the Volume Low Warning Threshold parameter to specify when you will be warned that a volume is running out of disk space. Set the parameter using MONITOR, in the Available Options menu, select Server Parameters > **File System Parameters**.
- ◆ Move any user files or print queues to another volume.
- ◆ Don’t store replicas on servers with low disk space.
- ◆ CD-ROM drives can create large index files. Don’t use or mount the CD-ROM unless you have enough space.
- ◆ Limit the size of auditing files.

Improving Disk Reads

For a read-intensive server, the following procedures can improve the speed of disk reads.

- ♦ “Changing Concurrent Disk and Directory Writes for Faster Reads” on page 22.
- ♦ “Changing the Turbo FAT Wait Time for Faster Reads” on page 23.

For information on using MONITOR, see *NetWare Server Operating System* > Monitoring the NetWare Server > **Accessing MONITOR** in the NetWare 5.1 online documentation.

Changing Concurrent Disk and Directory Writes for Faster Reads

Use this procedure if your server is slow to respond to read requests.

NOTE: This procedure requires you to decrease the values of the Maximum Concurrent Disk Cache Writes parameter and the Maximum Concurrent Directory Cache Writes parameter. Although decreasing these values increases the speed of read requests, it might decrease the speed and efficiency of write requests.

- 1** From MONITOR, in the Available Options menu, select Server Parameters > File Caching.

NOTE: You can also set file caching parameters with the SET command. For more information, see *Utilities Reference* > Utilities > **SET** in the NetWare 5.1 online documentation.

- 2** Decrease the value of Maximum Concurrent Disk Cache Writes.

If the parameter is currently set to the default value of 50, try setting the value to 10.

- 3** Press Esc to return to the list of categories and then select Directory Caching.

A list of Directory Caching parameters appears in the upper window.

- 4** Decrease the value of Maximum Concurrent Directory Cache Writes.

If the parameter is currently set to the default value of 10, try setting the value to 5.

- 5** Increase the value of Directory Cache Buffer NonReferenced Delay.

This parameter specifies how long a directory entry must be cached before it can be overwritten. Increasing this value causes the system to allocate more directory cache buffers and thus speeds up directory access.

If the parameter is currently set to the default value of 5.5 seconds, try setting the value to 60 seconds.

- 6 Press Esc until you return to Available Options.

Changing the Turbo FAT Wait Time for Faster Reads

When a program randomly accesses a file that contains more than 64 file allocation table (FAT) entries, the system builds a turbo FAT index for the file so that the information in the file can be accessed quickly.

The Turbo FAT Re-Use Wait Time parameter specifies how long a turbo FAT index remains in memory after the indexed file is closed. When the turbo FAT index is in memory, files can be opened and information accessed faster.

If network users frequently access files larger than 64 blocks, use this procedure to increase the time the index is kept in memory.

- 1 From MONITOR, in the Available Options menu, select Server Parameters > File System.

A list of File System Parameters displays in the upper window.

NOTE: You can also set file system parameters with the SET command. For more information, see *Utilities Reference* > Utilities > SET in the NetWare 5.1 online documentation.

- 2 Scroll down the File System Parameters list to Turbo FAT Re-Use Wait Time.

The scroll thumb to the right indicates that you can use the arrow keys to scroll the list.

- 3 Increase the value of FAT Re-Use Wait Time.

You must specify the value in seconds.

If the parameter is currently set to the default value of 329.5 seconds (5 minutes 29.6 seconds), try setting the value to 600 seconds (10 minutes). The changed value is now persistent.

- 4 Press Esc until you return to Available Options.

Improving Disk Writes

For a write-intensive server, the following procedures can improve the speed of disk writes.

- ◆ “Increasing the Number of Concurrent Writes” on page 24.
- ◆ “Changing Disk and Directory Caching for Faster Writes” on page 25.
- ◆ “Turning Off Read-After-Write Verification” on page 26.

To use MONITOR, see *NetWare Server Operating System* > [Managing > Monitoring the NetWare Server](#) > [Accessing MONITOR](#) in the NetWare 5.1 online documentation.

Increasing the Number of Concurrent Writes

You can increase the speed and efficiency of disk cache writes by increasing the number of write requests that can be executed at one time.

To determine whether you need to increase the number of concurrent writes, first compare the number of dirty cache buffers to the total number of cache buffers. These statistics are found on the General Information screen in MONITOR.

Dirty cache buffers contain data that has not yet been written to disk. The ratio of dirty cache buffers to total cache buffers is an indicator of the efficiency of disk cache writes. If the number of dirty cache buffers is greater than 70 % of total cache buffers, increase the number of concurrent write requests.

For an explanation of file caching, see *NetWare Server Memory* > [Understanding > Introduction to NetWare Memory](#) in the NetWare 5.1 online documentation.

NOTE: Increasing the number of concurrent disk cache writes slows disk cache reads. You will want to balance the speed of disk writes and reads to meet your users' needs. If your server's processing load is write-intensive, you can favor disk writes. If it is read-intensive, favor disk reads.

- 1 From MONITOR, in the Available Options menu, select Server Parameters > File Caching.

NOTE: You can also set file caching parameters with the SET command. For more information, see *Utilities Reference* > Utilities > SET > [File Caching Parameters](#).

- 2 Increase the value of Maximum Concurrent Disk Cache Writes.

If the parameter is currently at the default value of 50, try increasing it to 100. The changed value is now persistent.

- 3 Press Esc until you return to Available Options.

Changing Disk and Directory Caching for Faster Writes

Use this procedure if network users frequently make many small write requests and the server is slow to respond to the requests.

- 1 From MONITOR, in the Available Options menu, select Server Parameters > File Caching.

NOTE: You can also set file caching parameters with the SET command. For more information, see *Utilities Reference* > Utilities > SET in the NetWare 5.1 online documentation.

- 2 Increase the value of Dirty Disk Cache Delay Time.

This parameter specifies how long the system waits before writing a not-completely-dirty cache buffer to disk.

If the value is low, the system writes to disk more frequently, but writes fewer requests each time. If the value is high, the system waits longer before writing to disk, but executes more write requests with each operation. A higher value provides greater efficiency in writing to disk.

If the parameter is currently at the default value of 3.3 seconds, try increasing the value to 7 seconds.

- 3 Press Esc to return to the list of parameter categories and then select Directory Caching.

A list of Directory Caching Parameters appears in the upper window.

The scroll thumb to the right indicates that you can use the arrow keys to scroll the list.

- 4 Increase the value of Dirty Directory Cache Delay Time.

This parameter specifies how long the system keeps a directory table write request in memory before writing it to disk.

Increasing the parameter provides slightly faster performance, but can increase the chance of directory tables becoming corrupted.

If the parameter is currently at the default value of 0.5 second, try increasing the value to 2 seconds.

- 5 Increase the value of Maximum Concurrent Directory Cache Writes.

This parameter determines how many write requests from directory cache buffers are executed at one time. Increasing this value increases the efficiency of directory cache write requests.

NOTE: Increasing the number of concurrent directory cache writes decreases the speed of directory cache reads. Balance the speed of writes and reads to meet the needs of your users.

If the parameter is currently at the default value of 10, try increasing the value to 25. The changed value is now persistent.

- 6 Press Esc until you return to Available Options.

Turning Off Read-After-Write Verification

Read-After-Write Verify is almost always provided by the hard disk. If your hard disk provides read-after-write verification, you might want to disable the software version of read-after-write verification in order to nearly double the speed of disk writes.

WARNING: Turning off read-after-write verification can increase the risk of data corruption on the server's hard disk. You should use the following procedure only if your disks provide read-after-write verification and are reliable or if your disk subsystem provides data fault tolerance through mirroring or appropriate RAID level.

Prerequisites

- Hard disks that provide their own means of read-after-write verification.

Procedure

- 1 From MONITOR's Available Options, select Storage Devices.

A list of Registered Storage Objects appears. The device information associated with a highlighted storage device appears in the upper window. You can verify the type of storage device in the Device Type field.

- 2 Select the desired hard disk from the list.

The Drive Status window appears. The Read After Write Verification field indicates whether the feature is turned On or Off.

- 3 Press Enter to access the Read After Write Verification options.
- 4 To change Read After Write Status, select Disable Verify.
- 5 Press Esc to return to Available Options.

NOTE: You can also disable read-after-write verification by setting the Enable Disk Read After Write Verify SET parameter to OFF. However, this setting affects only those disks loaded after the parameter value is changed. It does not change the setting for currently loaded disks.

3

Managing

It is important to monitor disk space regularly and keep a log to track disk usage over time. To check available disk space, use the MONITOR utility. See [“Checking Available Disk Space” on page 30](#).

Adding a hard disk to the server requires both installing and partitioning the disk, as well as loading disk drivers.

- ◆ For information about adding conventional hard disks and loading disk drivers, see [“Adding and Replacing Hard Disks” on page 32](#). However, if you have a hot plug bus and your hardware supports devices that can be added or removed without downing the server, see *Hot Plug Hardware Management Guide* in the NetWare 5.1 online documentation.
- ◆ NetWare partitions can be created on any hard drive and can coexist with other partitions such as DOS or UNIX. For information about creating and deleting traditional NetWare partitions, see [“Creating NetWare Partitions” on page 38](#) and [“Deleting NetWare Partitions” on page 40](#).

Disk space not assigned to NetWare partitions can be used for the Novell Storage Services (NSS) file system. For information about creating NSS partitions, storage groups, and volumes, see *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation.

To determine the operating status of your disk subsystem and to activate or deactivate a storage device, see [“Activating and Deactivating a Hard Disk” on page 41](#).

To increase the fault tolerance of your server, you can mirror the data from a NetWare partition on one disk to NetWare partitions on other disks. When you mirror partitions over different disk channels or host bus adapters, this is called *duplexing*. The process for mirroring and duplexing is the same. To mirror and unmirror partitions or to recover data from mirrored partitions, see [“Mirroring and Duplexing Partitions” on page 42](#).

Removable media devices can be mounted and locked or unlocked using MONITOR. See “[Managing Removable Media Devices](#)” on page 47.

View a List of Adapters and Devices

- ◆ To see a list of server hardware devices, type the following at the server console prompt:

```
LIST DEVICES
```

For more information, see *Utilities Reference* > Utilities > [LIST DEVICES](#) in the NetWare 5.1 online documentation.

- ◆ To see a list of storage adapters and the devices they drive, at the server console prompt enter:

```
LIST STORAGE ADAPTERS
```

The screen lists each adapter, followed by a list of devices driven by that adapter. For more information, see *Utilities Reference* > Utilities > [LIST STORAGE ADAPTERS](#) in the NetWare 5.1 online documentation.

- ◆ To see a list of CDMs bound to a particular device, at the server console prompt enter:

```
LIST STORAGE DEVICE BINDINGS object_number
```

Find the object number by executing the LIST DEVICES command; the object number is the first number on each line in the list. Do not enter the 0x000prefix.

For example, this command lists CDMs for device 0x0001:

```
LIST STORAGE DEVICE BINDINGS 1
```

For more information, see *Utilities Reference* > Utilities > [LIST STORAGE DEVICE BINDINGS](#) in the NetWare 5.1 online documentation.

Checking Available Disk Space

You should monitor available disk space regularly and keep a log so you can track disk usage over time. This information helps you make the best use of your disk space management options, such as adding a new hard disk, compressing files, and migrating data to an offline system such as an optical disc library.

HINT: You might want to enter the disk space information on a spreadsheet to create a graph of disk usage over time.

- 1 From MONITOR, in the Available Options menu, select Volumes.

A list of mounted volumes appears. Volume information is displayed for the highlighted volume in the upper screen.

- 2 Press Tab to expand and activate the Volume Information window.

The scroll thumb at the right of the window indicates that the list of Volume parameters is scrollable.

- 3 Scroll to Disk Space and note the available disk space for the volume and record it in a log.

- 4 Press Tab to return to the list of Mounted Volumes. Check additional volumes as necessary.

- 5 Press Esc until you return to Available Options.

- 6 Repeat this procedure weekly for each volume.

Checking for Disk Errors

MONITOR indicates how many data blocks have been redirected by Hot Fix because of bad sectors on the disk. Review Hot Fix statistics regularly to detect disk problems before they cause loss of data.

IMPORTANT: When the number of available Hot Fix redirection blocks is 10 or fewer, NetWare broadcasts warning messages. If you receive these messages, the Hot Fix redirection area is nearly full and the disk is in danger of failing. Take immediate corrective action.

Follow this procedure to review the Hot Fix statistics in MONITOR.

NOTE: Some hard disks perform their own redirection automatically, independent of the NetWare Hot Fix mechanism. The MONITOR statistics reflect only Hot Fix redirection.

- 1 Load MONITOR at the server console prompt.

- 2 Select Storage Devices, then select a Hot Fix partition.

- 3 Press Tab to expand the information window.

The window displays several Hot Fix statistics. The following statistics indicate how much data redirection is taking place:

Total Hot Fix Blocks Available: The total number of blocks within the Hot Fix redirection area, whether used or not.

Used Hot Fix Blocks: The number of blocks holding redirected data.

Number of Available Hot Fix Blocks: Remaining unused blocks in the Hot Fix redirection Area.

System Hot Fix Blocks: The number of blocks in the Hot Fix redirection area set aside for Hot Fix and Mirroring tables. These blocks are used to manage both Hot Fix and mirroring.

The number of available Hot Fix blocks equals the total number of Hot Fix blocks, minus the used and system Hot Fix blocks.

- 4 Note the number of used Hot Fix blocks and compare it to the total number of blocks and the number of available blocks.

If the number of redirected blocks is zero or very low, and if it has not changed since you last reviewed the statistics, you do not need to take corrective action.

If the number of redirected blocks has increased substantially since you last reviewed the statistics, or if the number is over half the total number of redirection area blocks, back up the data on the hard disk and troubleshoot the disk, controller, and host bus adapter.

If the number of redirected blocks has increased slightly since you last reviewed the statistics, monitor the server closely and be prepared to troubleshoot the hardware if necessary.

Adding and Replacing Hard Disks

The following procedures explain how to add or replace conventional hard disks in the NetWare server and how to load or replace disk drivers.

- ◆ [“Adding a Hard Disk to the NetWare Server” on page 33](#)
- ◆ [“Replacing a Hard Disk” on page 34](#)
- ◆ [“Loading Disk Drivers” on page 36](#)
- ◆ [“Replacing Disk Drivers” on page 37](#)

If you have a hot plug bus and if your hardware supports hot plug devices (such as hard disks that can be added or removed without downing the server), see *Hot Plug Hardware Management Guide* in the NetWare 5.1 online documentation.

Adding a Hard Disk to the NetWare Server

Prerequisites

- All users logged out of the server
- Access to the documentation that came with the hard disk
- Access to the documentation that came with the computer

Procedure

Use the following procedure to install an additional hard disk in a functioning NetWare server.

- 1** Follow the instructions that came with your hard disk to install the disk and associated hardware, such as a disk adapter and cable. If necessary, configure the computer to recognize the new disk

Refer to the documentation that came with the computer for more information about configuration methods and requirements.

- 2** Start the server.

Change to the boot directory (usually `c:\nwserver`) and type the following at the prompt:

```
SERVER
```

- 3** At the server console prompt, enter

```
[LOAD] NWCONFIG
```

- 4** Use NWCONFIG to load a disk driver, if needed.

You must load a driver if you have installed a new disk adapter along with the hard disk.

For more information about loading drivers, see [“Loading Disk Drivers” on page 36](#).

- 5** Use NWCONFIG to partition the disk, creating at least one NetWare partition.

If you need help, see [“Creating NetWare Partitions” on page 38](#).

- 6** Do one of the following:
 - 6a** Mirror or duplex the partitions. For more information, see “[Mirroring and Duplexing Partitions](#)” on page 42.
 - 6b** Create a new NetWare volume. For more information, see *Traditional File Services > Setting Up > Setting Up Volumes > [Creating a Volume](#)* in the NetWare 5.1 online documentation.
 - 6c** Create NSS volumes. For more information, see the *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation.
 - 6d** Add the partition to an existing volume. For more information, see *Traditional File Services > Managing > Managing Volumes > [Changing Volume Size](#)* in the NetWare 5.1 online documentation..

Replacing a Hard Disk

If a hard disk becomes unreliable or unusable, follow this procedure to remove the disk from the network.

If you have been backing up your data consistently and verifying its integrity, you will be able to reload data for the volumes affected by the disk failure.

WARNING: Some buses support hard disks (called hot plug devices) that can be removed while the system is running. For more information, see *Hot Plug Hardware Management Guide* in the NetWare 5.1 online documentation.

If you replace a mirrored hot-plug disk while the system is running, execute SCAN FOR NEW DEVICES as soon as the disk is removed. This command lets the system know that the disk is gone. Failure to execute this command could cause the new disk to mirror over the existing disk, thus erasing all data on the existing disk. For more information, see “[Unmirroring Partitions](#)” on page 44 and *Utilities Reference > Utilities > [SCAN FOR NEW DEVICES](#)* in the NetWare 5.1 online documentation.

Procedure

- 1** If the bad disk was mirrored, check the sys\$log.err file to see which disk in the mirrored set failed.

The error log contains a message stating that a device has been deactivated due to a device error. It includes the device name, which is a series of letters and numbers within brackets. For more information, see “[Device Names](#)” on page 13.

- 2** If possible, make a backup copy of the data on the hard disk.

Make sure the backup copy contains uncorrupted versions of all files and directories on the hard disk.

- 3 If the disk is mirrored, dismount the volumes that reside on the disk.

Enter the following command for each volume on the disk:

```
DISMOUNT [volume_name]
```

- 4 Unmirror the hard disk if it is mirrored.

For more information, see [“Unmirroring Partitions” on page 44](#).

- 5 At the server console, bring down the server by entering

```
DOWN
```

- 6 Turn off the system containing the hard disk to be replaced.

- 7 Remove the hard disk and install the replacement.

Use the instructions that came with the hard disk.

- 8 Turn on power and restart the server.

If the failed disk contained the only copy of the server operating system, refer to your backup software to determine whether you can restore NetWare and the file system from a backup or whether you must reinstall NetWare.

If you use Storage Management Services™ (SMS™) as your backup application, you must reinstall NetWare, then restore files from a backup. For procedures, see [Backup and Restore Services Administration Guide](#) in the NetWare 5.1 online documentation.

If another disk contains the server operating system, so that the server is functional, continue with the remaining steps.

- 9 At the server console prompt, enter

```
[LOAD] NWCONFIG
```

- 10 Use NWCONFIG, select Driver Options > Configure Disk and Storage Device Drivers to load a disk driver, if needed.

You must load a driver if you have installed a new disk adapter along with the hard disk.

For more information about loading drivers, see [“Loading Disk Drivers” on page 36](#).

- 11 If the replacement disk has been used before, use NWCONFIG to delete any existing partitions on the replacement disk.

See “Deleting NetWare Partitions” on page 40.

WARNING: Deleting disk partitions makes *all* data on the partitions inaccessible. Be sure you delete the partitions on the replacement disk, not an existing disk.

12 Use NWCONFIG to create new partitions on the replacement disk.

For procedures, see “Creating NetWare Partitions” on page 38.

13 Complete one of the following steps:

13a If the partitions on the old disk were not mirrored, create the NetWare volumes that previously resided on the hard disk and restore the data from a backup.

For more information, see *Traditional File Services > Setting Up > Setting Up Volumes > Creating a Volume* in the NetWare 5.1 online documentation.

13b If the partitions on the old disk were mirrored or duplexed, remirror or duplex the new partitions.

See “Mirroring and Duplexing Partitions” on page 42.

13c If the NSS file system existed on the old disk, create the NSS storage groups and volumes that previously resided on the hard disk and restore the data from a backup.

For more information, see *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation.

Loading Disk Drivers

After you add or replace a hard disk adapter on your NetWare server, you must load the corresponding disk driver.

Loading a disk driver enables communication between the disk controller and the server’s CPU.

Load the disk driver once for each disk adapter you want to support.

Most NetWare disk drivers have a help file that appears on the screen as you highlight the driver. Refer to these descriptions to determine which driver to load.

1 At the server console prompt, enter

```
[LOAD] NWCONFIG
```

2 Select Driver Options > Configure Disk and Storage Device Drivers.

- 3** If you want NWCONFIG to find the drivers compatible with your disk, select Discover and Load Additional Drivers. Otherwise, go to **Step 4**.

If NWCONFIG finds only one driver compatible with your disk adapter, it loads the driver automatically. Press Alt + F10 to exit NWCONFIG.

If NWCONFIG finds either more than one driver or no driver compatible with your disk adapter, it displays a message listing the hardware it detected. Press Enter to see a list of drivers to choose from and go to **Step 5**.

- 4** To load a driver manually, select Load an Additional Driver.

- 5** Select the disk driver you want to load and press Enter.

You can also press Ins to load a driver from diskette.

IMPORTANT: Some drivers do not have a description file (a configuration file that's appended to the driver). These drivers have to be loaded manually at the system console. To load these drivers, follow the screen prompts or press F1 for help.

- 6** If a parameter window appears, you can select Select/Modify Driver Parameters to modify the defaults. When parameter values are correct, select Save Parameters and Load Driver.

The system displays a message asking if you want to select an additional driver.

- 7** If you want to load an additional driver, select Yes and repeat **Step 5** and **Step 6**; otherwise select No.

You can load the same driver more than once if you have additional disk controller boards of the same type. (Remember to check controller board settings for conflicts.)

- 8** To exit NWCONFIG, press Alt + F10.

For general information about .cdm and .ham modules, see “**Drivers for Host Adapters and Storage Devices**” on page 15.

Replacing Disk Drivers

The conventional way to replace a disk driver is to unload the driver, thus dismounting all the volumes, then load the new driver and remount the volumes. If you are following this process, be sure you replace a driver only when users won't need to access the volumes.

You can replace one instance of a driver that has been loaded multiple times by using the REMOVE STORAGE ADAPTER command. For more information, see *Utilities Reference* > Utilities > **REMOVE STORAGE ADAPTER** in the NetWare 5.1 online documentation.

NetWare also supports hot replace disk drivers that can be replaced without dismounting volumes or otherwise interrupting the server's operation. If you are replacing such a driver, simply load the new driver at the server console prompt. The server loads the new driver immediately and unloads the old driver without dismounting volumes or otherwise interrupting service.

If you aren't sure whether your disk driver is a hot replace driver, try loading the new driver without unloading the existing driver. You will receive an error message if the driver can't be replaced without first unloading the old driver and dismounting volumes.

Creating NetWare Partitions

NetWare partitions can be created on any hard drive and can coexist with other partitions such as DOS, Windows NT, or UNIX. Disk space not assigned to NetWare partitions can be used for the Novell Storage Services file system.

When there is a DOS partition on the drive, it should always be the *first* partition. The NetWare partition should always be the *last* partition on the drive.

You can have as many as four partitions on the same drive, including multiple NetWare partitions.

If you have partitions from previous versions of NetWare that you are no longer using, you can delete them and create a new NetWare partition. (See **"Deleting NetWare Partitions"** on page 40 for more information.)

WARNING: When creating a disk partition, never specify a partition size larger than the actual size of the disk. If you specify a larger size, NetWare will eventually try to use the excess disk space. When it determines there is no corresponding disk location, it deactivates the volume stored on the disk.

- 1 At the server console prompt, enter

```
[LOAD] NWCONFIG
```

- 2 Select Standard Disk Options > Modify Disk Partitions and Hot Fix.

If you have more than one disk, the Available Disk Drives list appears. If this list appears, select the disk you want to partition.

A list of existing partitions appears, along with the Disk Options menu.

3 Select Create NetWare Disk Partition.

You can create more than one NetWare partition per disk. If the disk has more than one free partition area, select an area for the NetWare partition.

A screen containing disk partition and Hot Fix information with their default values appears. The cursor is on the Partition Size field.

4 If you don't want to use all the available space for NetWare, type a smaller value in the Partition Size field.

The difference between the original size and the smaller size becomes new free space on the disk. If you want to use the NSS file system, be sure to leave sufficient free space; a minimum of 10 MB is required. The NSS file system resides only in free space.

5 To change the size of the partition's data area, use the arrow keys to move the cursor to one of the Data Area fields and then type in a new value.

One field contains the size of the data area in blocks, the other in megabytes. When you change the value in one field, the system changes the corresponding value in the other field.

6 To change the size of the Hot Fix redirection area, use the arrow keys to move the cursor to one of the Hot Fix redirection area fields and then type in a new value. To specify no Hot Fix redirection area, enter 0.

One field contains the size of the area in blocks, the other as a percentage of the partition. When you change the value in one field, the system changes the corresponding value in the other field.

WARNING: If you do not specify a Hot Fix redirection area, you cannot add one later without deleting the volumes on the partition, nor will you be able to mirror the partition.

If there is no Hot Fix redirection area, you can save partition space, but your partition will not be software fault tolerant. You must determine whether the increased risk is worth the savings in disk space and performance.

7 Press Esc to display the Create NetWare Partition? window.

8 Select Yes.

9 Press Esc to redisplay the Available Disk Options menu.

10 To create NetWare partitions on additional disks or additional partitions on the same disk, repeat **Step 2** through **Step 9**. When finished, press Alt+F10 to exit.

After you have created one or more partitions, you can do one of the following:

- ◆ Create one or more NSS volumes on free space not assigned to partitions. For more information, see the *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation.
- ◆ Create one or more traditional NetWare volumes. For more information, see *Traditional File Services > Setting Up > Setting Up Volumes > Creating a Volume* in the NetWare 5.1 online documentation.
- ◆ Mirror the partitions. For more information, see “*Mirroring and Duplexing Partitions*” on page 42.
- ◆ Add the partition to an existing volume. For more information, see *Traditional File Services > Managing > Managing Volumes > Changing Volume Size* in the NetWare 5.1 online documentation.

Deleting NetWare Partitions

This section explains how to delete traditional NetWare partitions. For information about deleting NSS partitions, storage groups, and volumes, see *Novell Storage Services Administration Guide* in the NetWare 5.1 online documentation.

NOTE: The partition table displays partitions such as OS/2, UNIX, and XENIX* as Unknown Partition Type #. Don't delete these unknown partition types unless you know what is on them.

Some machine vendors such as COMPAQ create a small partition that setup and configuration utilities can be run from. Don't delete this partition.

Prerequisites

- A backup copy of data on the partition, if needed
- All volumes on the partition dismounted and deleted
- Unmirror the partition if it is mirrored

Procedure

- 1 At the server console prompt, enter
`[LOAD] NWCONFIG`
- 2 Select Standard Disk Options > Modify Disk Partitions and Hot Fix.

If you have more than one disk, the Available Disk Drives list appears. Select the disk you want from the list.

A list of disk partitions on the selected disk appears at the top of the screen. The Disk Options menu appears at the bottom of the screen.

- 3** Select Delete Any Disk Partition from the menu.

A list of the available disk partitions is displayed; mirrored partitions are identified.

- 4** Select the disk partition you want to delete.

If the selected partition is mirrored or if it contains volumes that have not been deleted, the appropriate message is displayed. Follow the prompts. Otherwise, a confirmation box is displayed containing the message Delete Disk Partition?

- 5** Select Yes.

The space occupied by the deleted disk partition now appears as Free Space in the list of disk partitions at the top of the screen. You can create a new disk partition in this free space.

Activating and Deactivating a Hard Disk

Use this procedure to determine the operating status of your disk subsystem components and to activate or deactivate a storage device. (When you deactivate a disk, its volumes are dismounted.)

- 1** From MONITOR, in the Available Options menu, select Storage Devices.

A list of Registered Storage Objects appears. The device information associated with a highlighted storage device appears in the upper window. You can verify the type of storage device in the Device Type field.

NOTE: Storage devices are listed in hierarchical order to reflect each object's dependencies. In descending order, each object is indented to indicate that it is a child to the object above it. In ascending order, parent objects appear immediately above the highlighted object.

- 2** Select the appropriate hard disk from the list.

The Drive Status window appears. The Operating Status field indicates whether the device is activated or deactivated.

- 3** Press Enter to access the Operating Status options.

- 4 To change the operating status of the disk, highlight either Activate or Deactivate and press Enter.

If you attempt to deactivate a disk that has mounted volumes, you receive a confirmation prompt. If you confirm that you want to deactivate the disk, the volumes are dismounted.

- 5 Press Esc until you return to the Available Options menu.

Mirroring and Duplexing Partitions

The process for mirroring and duplexing is the same. The term mirroring is used in all menus to refer to both mirroring and duplexing.

The following procedures explain how to mirror and unmirror NetWare partitions and how to recover data when partitions are no longer mirrored:

- ♦ [“Mirroring Partitions” on page 42](#)
- ♦ [“Unmirroring Partitions” on page 44](#)
- ♦ [“Recovering Data from an Out of Sync Disk” on page 46](#)

Mirroring Partitions

IMPORTANT: If you want to mirror IDE/ATA disks, you should duplex them by mirroring them on separate host adapters or on different ports of a multiport IDE/ATA host adapter, with each port or adapter configured to support a single drive. This is necessary because IDE drives have a design limitation that prevents them from continuing normally after one of the drives fails.

Note that mirroring can take a long time to complete, depending on the size of the partitions and the amount of data to be mirrored. To mirror one or more NetWare partitions to each other, follow these steps.

Prerequisites

- A disk containing one or more partitions with data you want to mirror
- A blank disk to contain the mirrored data from the first disk
- Hot Fix enabled on all partitions

Procedure

- 1 Make sure all partitions are deleted from the disk that will be mirrored to an existing disk.

Make sure you do not delete the partitions from the disk containing data you want to mirror. If you need help deleting partitions, see [“Deleting NetWare Partitions” on page 40](#).

- 2 On the blank disk, create one or more new partitions to match those on the disk containing data. Do not create any volumes.

If you need help, see [“Creating NetWare Partitions” on page 38](#). Be sure to enable Hot Fix on the new partitions.

Make the data area of the new partitions the same size in blocks as the data area of the partitions containing information. When you mirror the partitions, the partitions containing information will be mirrored to the new partitions.

- 3 Load NWCONFIG and select Standard Disk Options.
- 4 From the Available Disk Options menu, select Mirror/Unmirror Disk Partitions.

A Disk Partition Mirroring Status window appears. This window lists each device and its mirrored status. For example,

```
Mirrored: Logical Partition 7
Not Mirrored: Logical Partition 3
Out of Sync: Logical Partition 6
The meaning of each status is as follows:
```

Status	Explanation
Mirrored	The partition is mirrored to another partition.
Not Mirrored	The partition is not mirrored to another partition.
Out of Sync	The partition is mirrored to another partition, but is currently out of sync.

- 5 From the Disk Partition Mirroring Status window, select the disk partition containing live data you want to mirror to another partition.

A Mirrored Disk Partitions list appears. This window displays any hard disks that are currently mirrored to the partition you selected.

You must now specify the empty partition to be mirrored to the selected partition.

6 Press Insert.

The system displays the Available Disk Partitions list—a list of all partitions that can be mirrored to the first partition.

IMPORTANT: Do not mirror one NetWare partition to another NetWare partition on the same disk. To do so eliminates fault tolerance.

7 Select the empty partition from the Available Disk Partitions list.

The system mirrors the two partitions to each other so that one partition becomes synchronized with the data from the other partition.

Mirroring can take a long time, depending on the size of the partitions and the amount of data to be mirrored. You can view the status of mirroring, abort the mirroring, and start the mirroring again, by entering the following commands at the server console:

- ◆ MIRROR STATUS

Displays a list of logical partitions and their mirroring status, such as Being Remirrored. If a partition is being mirrored, the percent complete is also displayed. For more information, see *Utilities Reference* > Utilities > **MIRROR STATUS** in the NetWare 5.1 online documentation.

- ◆ ABORT REMIRROR *logical_partition_number*

Stops the mirroring process on a designated partition. For more information, see *Utilities Reference* > Utilities > **ABORT REMIRROR** in the NetWare 5.1 online documentation.

- ◆ REMIRROR PARTITION *logical_partition_number*

Remirrors a designated partition to a previously mirrored set. NetWare automatically remirrors partitions when they become unsynchronized. Use REMIRROR PARTITION only if something has caused the server to stop remirroring. For more information, see *Utilities Reference* > Utilities > **REMIRROR PARTITION** in the NetWare 5.1 online documentation.

NOTE: The status on the Mirrored Disk Partitions list is now Out of Sync for one of the disks. As soon as mirroring is complete, the status of both disks changes to In Sync.

Unmirroring Partitions

You must unmirror mirrored partitions before you can delete a partition or conduct surface tests on a disk.

WARNING: If you plan to replace a mirrored Hot Plug disk while the system is running, you must first unmirror the partitions on the disk.

1 At the server console prompt, enter

```
[LOAD] NWCONFIG
```

2 Select Standard Disk Options > Mirror/Unmirror Disk Partitions.

The system displays the Disk Partition Mirroring Status list.

3 Select a mirrored partition from the list.

After you select a partition, the system displays the list of disk partitions in the mirrored set.

4 Select the partition you want to unmirror from the set and press Delete.

If volumes were not dismounted from the partition, the system displays a message warning that the partition contains volume information.

5 Press Enter to clear the message.

A confirmation prompt is displayed. You have the option to save the information on the partition or delete it.

6 Choose Yes to salvage the information on the partition or No if you do not want to salvage the data.

- ◆ If you choose No, the data is destroyed and the Mirrored Disk Partitions list is redisplayed.
- ◆ If you choose Yes, the system warns that the selected partition contains a volume with a name and segment number matching an existing volume. Continue with [Step 6a](#) and [Step 6b](#).

6a Press Enter to clear the message.

The system prompts you to enter a new name for the volume.

6b Enter the new volume name.

The Mirrored Disk Partitions list is redisplayed.

7 Press Esc from the Mirrored Disk Partitions list.

The Disk Partition Mirroring Status list is displayed. The Out of Sync status appears next to the disk you unmirrored.

You can now

- ◆ Finish salvaging the information on the volume (if you chose to salvage information in [Step 6](#) by pressing F3 and following the prompts.
- ◆ Repair or replace the hard disk.
- ◆ Format the hard disk.
- ◆ Delete the partition on the hard disk.
- ◆ Allocate the unmirrored partition as a new volume segment, if you did not salvage the data on the partition. For instructions on creating the new volume segment, see *Traditional File Services > Managing > Managing Volumes > [Changing Volume Size](#)* in the NetWare 5.1 online documentation.

Recovering Data from an Out of Sync Disk

Once a hard disk is unmirrored, its status is listed as either Not Mirrored or Out of Sync on the Disk Partition Mirroring Status list.

When a hard disk is listed as Out of Sync, the operating system does not recognize any volume information on it. Use this procedure to recover data from an Out of Sync partition.

- 1** At the server console prompt, enter
`[LOAD] NWCONFIG`
- 2** Select Standard Disk Options > Mirror/Unmirror Disk Partitions.
- 3** Select the Out of Sync partition and press F3.

The following warning appears if another volume segment with the same name exists on another disk:

```
Warning! The selected partition contains volume < name>  
segment < number> and that volume is already defined.  
<Press ESCAPE To Continue>
```

- 3a** Press Esc and respond Yes to the Rename the Volume Segment? prompt.
- 3b** Enter a unique name for the new volume segment.
- 4** Respond Yes to the prompt to salvage the volume segment.

Now the segment can be mounted as an independent volume.

Managing Removable Media Devices

Mounting a Removable Media Device

Use this procedure to mount a removable media device, such as a CD-ROM drive.

Before you mount a CD-ROM volume, make sure you have enough space or else consider making it read-only. The associated indexing files create substantial overhead.

- 1 From MONITOR, in the Available Options menu, select Storage Devices.

A list of Registered Storage Objects appears. The device information associated with a highlighted storage device appears in the upper window. Use the Device Type field to verify the type of storage device.

NOTE: Storage devices are listed in hierarchical order to reflect each object's dependencies. In descending order, each object is indented to indicate that it is a child to the object above it. In ascending order, parent objects appear immediately above the highlighted object.

- 2 Select the appropriate CD-ROM or other removable media device from the list.

The Drive Status window appears. The Removable Drive Mount Status field indicates whether the device is mounted or dismounted.

- 3 To change the mount status of the device, select the Removable Drive Mount Status field.

The Change Mount Status window appears.

- 4 Select Mount Drive.
- 5 Press Esc until you return to Available Options.

Dismounting a Removable Media Device

Use this procedure to dismount a removable media device, such as a CD-ROM device.

- 1 From MONITOR, in the Available Options field, select Storage Devices.

A list of Registered Storage Objects appears. The device information associated with a highlighted storage device appears in the upper window. Check the Device Type field to verify the type of storage device.

NOTE: Storage devices are listed in hierarchical order to reflect each object's dependencies. In descending order, each object is indented to indicate that it is a child to the object above it. In ascending order, parent objects appear immediately above the highlighted object.

- 2** Select the appropriate CD-ROM or other removable media device from the list.

The Drive Status window appears. The Removable Drive Mount Status field indicates whether the device is mounted or dismounted.

- 3** To change the mount status of the device, select Removable Drive Mount Status field.

The Change Mount Status window appears.

- 4** Select Dismount Drive.
- 5** Press Esc until you return to Available Options.

Locking and Unlocking a Removable Media Device

Use this procedure to lock or unlock a removable media device, such as a CD-ROM device. (When a removable media device is locked, the media can be ejected only by using a software switch.)

- 1** From MONITOR, in the Available Options field, select Storage Devices.

A list of Registered Storage Objects appears. The device information associated with a highlighted storage device appears in the upper window. Check the Device Type field to verify the type of storage device.

NOTE: Storage devices are listed in hierarchical order to reflect each object's dependencies. In descending order, each object is indented to indicate that it is a child to the object above it. In ascending order, parent objects appear immediately above the highlighted object.

- 2** Select the appropriate CD-ROM or other removable media device from the list.

The Drive Status window appears. The Change Lock Status field indicates whether the device is locked or not locked.

- 3** To change the lock status of the device, select the Removable Drive Lock Status field.

The Change Lock Status window appears.

- 4** Select either Lock Drive or Unlock Drive.
- 5** Press Esc until you return to the Available Options menu.

A

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