# Novell
# Open Enterprise Server

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NETWARE® TRADITIONAL FILE SYSTEM ADMINISTRATION GUIDE

Novell®

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# Contents

# About This Guide

This guide discusses how to configure and manage the NetWare® Traditional File System for Novell® Open Enterprise Server 2 NetWare and NetWare 6.5 SP7. The guide is divided into the following sections:



### Audience

This guide is intended for system administrators of a NetWare server that uses NetWare Traditional file systems.

### Feedback

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### Documentation Updates

For the most recent version of the *NetWare Traditional File System Administration Guide for OES*, see the OES Documentation Web Site (http://www.novell.com/documentation/oes2/index.html).

### Additional Documentation

For more information, see the following:

- *OES 2: NetWare Server Disks and Storage Devices*
- *OES 2: File Systems Management Guide*
- *OES 2: NSS File System Administration Guide*
- *OES 2: Novell Remote Manager for NetWare Administration Guide*

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When a single pathname can be written with a backslash for some platforms or a forward slash for other platforms, the pathname is presented with a backslash. Users of platforms that require a forward slash, such as Linux* or UNIX*, should use forward slashes as required by your software.

# Overview of the NetWare Traditional File System

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The NetWare® Traditional File System provides legacy storage and file system management for Novell® Open Enterprise Server NetWare.

The Novell Storage Services™ File System (NSS) provides the primary system for storage and file management for NetWare. The NetWare operating system and its extensions are installed on an NSS pool and volume, named `sys`. For information, see "Comparison of NSS on NetWare and the NetWare Traditional File System" in the *OES 2: NSS File System Administration Guide*.

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**IMPORTANT:** You can optionally use the Traditional volumes on the same server with your NSS volumes. However, if you are planning to implement Apple* File Protocol (AFP), Network File System (NFS), or Common Internet File System (CIFS) for this server, you must use the NSS file system, not the Traditional file system for your system volume and for any data volumes that use these protocols. For information, see *OES 2: Native File Access Protocols Guide*.

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To upgrade your Traditional volumes to NSS volumes, see "Upgrading Legacy NSS and NetWare Traditional Volumes" in the *OES 2: NSS File System Administration Guide*.

This section discusses the following key concepts:



## 1.1 NetWare Traditional Volumes

Traditional volumes consist of a fixed amount of physical space on one or more server disks. A NetWare server supports up to 255 volumes of any combination of Traditional and NSS volumes, plus the system volume.

During installation of OES NetWare, your system volume is automatically created as an NSS volume. After installation, you can use Novell Remote Manager for NetWare to create a new Traditional volume on any disk that has a NetWare partition. For information, see the *OES 2: Novell Remote Manager for NetWare Administration Guide*.

You subdivide Traditional volumes in two ways:

- **Physically:** Traditional volumes consist of physical partitions called volume segments. If a Traditional volume contains multiple volume segments, its member segments can reside on multiple server disks. For information about volume segments, see Section 1.2, "Traditional Volume Segments," on page 12.
- **Logically:** You divide volumes into directories. In turn, the directories contain files and subdirectories created by network supervisors and users who have the appropriate rights. For information about directories and subdirectories, see "Understanding NetWare Directory Structures" the *OES 2: File Systems Management Guide*.

### 1.1.1 What Happens When You Mount a Traditional Volume

When you boot a NetWare server, each Traditional volume is mounted, meaning the following:

- The volume becomes visible to the operating system.
- The volume's File Allocation Table (FAT) is loaded into memory.

  A single block of data in the file takes up one entry in the FAT. Because of this, volumes with a smaller block size require more server memory to mount and manage, and it takes longer to mount the volume. However, if most of your files are small, a large block size wastes disk space.
- The volume's directory entry table (DET) is loaded into the server memory.

As the Traditional volume is mounted, the FAT and DET fill cache buffers in the server memory. The more files and directories in the volume, the longer it takes to mount. If a Traditional volume fails to mount, it might be because you have run out of server memory.

### 1.1.2 Traditional Volume Objects in eDirectory

In Novell eDirectory™, each Traditional volume is represented by a Volume object. Volume objects are leaf objects that represent a physical volume or logical volume on the network.

The Volume object's properties contains the following information:

- The NetWare server the physical volume resides on
- The volume name recorded when the volume was initialized on the server (for example, `sys:`)
- The volume's owner
- Space use restrictions for users
- A description of the volume's use
- Statistical information on disk space availability, block size, directory entries, name space support, and so on.

## 1.2 Traditional Volume Segments

A Traditional volume can use space from up to 32 logical or physical devices. The volume can grow up to 1 TB in total size for all segments combined. Each segment of space is taken from a NetWare partition. The segments of space are automatically carved by the management tools when you create the volume.

The advantage of distributing a volume's segments across multiple server disks is that different parts of the same volume can be read from or written to concurrently, which speeds up disk I/O.

Because of hardware restrictions, a hard drive can contain up to four NetWare partitions, or three NetWare partitions and one DOS partition. (The hard drive that contains the `sys:` volume also contains a DOS partition.)

Each NetWare partition can contain up to eight Traditional volume segments. Thus, a single server disk can contain up to 32 volume segments (4 NetWare partitions with 8 segments each). A single NetWare partition can contain up to eight Traditional NetWare volumes, each with a single volume segment.

A single disk can contain volume segments from multiple volumes. If a single disk fails, each volume segment on it fails, causing all of the volumes that have volume segments on that server disk to fail. To achieve fault tolerance, you should protect the volumes against disk failure by setting up a software RAID 1 (mirroring) device for the partitions. See "Using Software RAID1 Devices for Data Fault Tolerance" on page 35.

You can add volume segments to a Traditional volume if free space is available, but you cannot remove them. Removing a segment from a volume destroys the entire volume.

You can increase the size of a Traditional volume by adding another server disk to the NetWare server, setting up a NetWare partition on the disk, then adding one or more segments in the partition to the existing volume.

## 1.3 What's Next

Use the table below to determine where next to go in this document.

| Task | Reference |
|---|---|
| Configure and manage Traditional NetWare partitions and volumes | Chapter 3, "Configuring and Managing NetWare Traditional Volumes," on page 17 |
| Optimize storage performance | Chapter 4, "Configuring Advanced Features for Traditional Volumes," on page 29 |
| Create a software RAID device | Chapter 5, "Using Software RAID1 Devices for Data Fault Tolerance," on page 35 |
| | Chapter 6, "Using Software RAID0 Devices to Enhance Disk I/O Performance," on page 41 |
| Troubleshoot problems | Chapter 8, "Troubleshooting," on page 51 |
| Plan your directory structure | "Planning Directory Structures for NetWare" in the *OES 2: File Systems Management Guide*. |
| Create and manage directories and files, including purging and salvaging (undeleting) deleted files | "Configuring Directories for NetWare and NSS on Linux" in the *OES 2: File Systems Management Guide*. |
| Configure file system trustees, trustee rights, inherited rights filters, and attributes for directories and files | "Configuring File System Trustees, Trustee Rights, Inherited Rights Filters, and Attributes" in the *OES 2: File Systems Management Guide*. |

# Using NetWare Traditional Volumes in a Virtual Guest Server Environment

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NetWare® Traditional volumes can be used on NetWare guest servers in a virtualized environment just as they are on physical NetWare servers. Novell® Storage Services™ (NSS) is responsible for managing virtual devices for the virtual machine, which parallels the NSS role for storage management on physical servers. For information, see "Using NSS in a Virtual Guest Server Environment" in the *OES 2: NSS File System Administration Guide*.

For information about using Xen* virtual environments on an OES 2 Linux virtual host server, see "Introduction to Xen Virtualization" in the *Virtualization: Getting Started* guide.

For information on setting up a NetWare virtualized guest server on the host server, see "Setting Up Virtual Machines" in the *Virtualization: Getting Started* guide and "NetWare Virtual Machines" in the *Virtualization: Guest Operating System Guide*.

# Configuring and Managing NetWare Traditional Volumes

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You manage the NetWare® Traditional File System volumes with Novell® Remote Manager for NetWare. For information about this management tool, see *OES 2: Novell Remote Manager for NetWare Administration Guide*.

This section discusses the following file and directory management tasks:



## 3.1 Using Novell Remote Manager for NetWare

To access Novell Remote Manager for NetWare:

1. Open a Web browser, then go to the following URL to open the login page.
   `https://server-ip-address:8009`

   Replace *server-ip-address* with the IP address (such as 192.168.1.1) or DNS name (such as servername.example.com) of the server you want to manage.

2 Type your administrator username (such as *admin*) and password.

3 Click *OK*.

The management interface opens in your Web browser.

The Partition Disks page displays the server disk's layout according to the physical connections in your server. It uses indentation to indicate where a volume physically resides. It lists adapters, devices, partitions, Traditional volumes, and free space at different levels of indentation.

Depending on what tasks can be performed on the listed storage item, Novell Remote Manager for NetWare displays task-based links next to the devices, Traditional volumes, and free space:

- **Create:** Create a new volume on the selected device.
- **Mirror:** Create a mirrored partition on the selected device.
- **Expand:** Expand an existing Traditional volume or software RAID1 device (mirrored partition).
- **Rename:** Change the name of the Traditional NetWare partition or Traditional volume.
- **Delete:** Remove the Traditional NetWare partition or Traditional volume. Deleting a partition or volume destroys all the data in it.
- **Remove Mirror:** Remove a mirrored partition from the mirrored group (a software RAID1 device).

You must assign the free space on the disk to create a Traditional volume. With Traditional volumes, you assign physical volume segments from physical partitions on multiple devices. There are physical limitations in how you combine member segments to create the volume. For information, see Section 1.2, "Traditional Volume Segments," on page 12.

## 3.2 Managing NetWare Partitions for Traditional Volumes

NetWare partitions can be created on any hard drive and can coexist with other partitions such as DOS, Windows*, and 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 on the device. 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.

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**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 eventually tries to use the excess disk space. When it determines there is no corresponding disk location, it deactivates the volume stored on the disk.

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For more information, see Chapter 3, "Configuring and Managing NetWare Traditional Volumes," on page 17.

## 3.3 Creating a NetWare Partition for Traditional Volumes

The first task for setting up the NetWare Traditional file system is to create partitions on your storage devices. The maximum supported partition size for Traditional NetWare partitions is 4 GB.

1. In Novell Remote Manager for NetWare, click *Manage Server* > *Partition Disks*.
2. Locate the device that you want to create the partition on, then click the *Create* link next to it.
3. In the *Partition Type* drop-down list, select the type of partition you want to create. For example, a *Traditional NetWare* partition.
4. Click *Create Partition and Volume*.
5. Specify the size of the partition in bytes (B), kilobytes (KB), megabytes (MB), or gigabytes (GB).

   The physical size of the partition must be at least 100 KB.

   If you plan to make this a mirrored partition, it must be compatible in data area size with other partitions you plan to use. The partition should not be more than 120 MB larger than the data size of the existing partitions in the mirror group.
6. (Conditional) To create a partition that can be mirrored, click *Mirror*, then select one of the following options:
   - **Create New Mirror:** This option means you are making the partition capable of being part of a mirror group. You do not actually create the group until you add another mirrored partition to the partition you are creating.
   - **Existing Mirror Group:** This option lets you add this new partition to one of the mirror groups in the list. From the list of existing mirror groups that are compatible in data area size, select the ID of the mirrored partition.
7. Complete the required fields, click *Create*, then click *OK* to confirm your decision.

   If this is a mirrored partition, NetWare displays the status as "`100% mirrored`" when the mirroring is complete.

## 3.4 Expanding the Size of a NetWare Partition

1. In Novell Remote Manager for NetWare, click *Manage Server* > *Partition Disks*.
2. Locate the partition you want to expand, then click the *Expand* link next to it.
3. Under *Free Disk Space*, select the device with the amount of space available that you want to use.
4. Specify the amount of space (in megabytes) that you want to use.
5. Click *Expand*.

## 3.5 Unmirroring a Mirrored NetWare Partition

If a partition is mirrored, you must unmirror it before you can delete it. For more information about mirroring, see Chapter 5, "Using Software RAID1 Devices for Data Fault Tolerance," on page 35.

1. In Novell Remote Manager for NetWare, click *Manager Servers* > *Partition Disks*.
2. Locate the partition you want to unmirror, then click the *Remove Mirror* link next to it.

This removes the partition from the mirror group. You can now delete the partition, if desired.

## 3.6 Deleting a NetWare Partition

If you delete a partition, you destroy all volumes and data on that partition.

If the partition is mirrored, the other partitions in the mirror group retains the data from the deleted partition. Before you can delete a mirrored partition, unmirror the partition, then delete it.

### Unmirror a Partition

1. In Novell Remote Manager for NetWare, click *Manager Servers* > *Partition Disks*.
2. Locate and the partition you want to unmirror, then click the *Remove Mirror* link next to it.

   This removes the partition from the mirror group. You can now delete the partition.

### Delete a Partition

1. Delete all Traditional volumes contained in the partition you want to delete.
   - 1a Click *Manager Servers* > *Volumes* to view a list of volumes.

     **IMPORTANT:** Volumes must have the Long namespace enabled in order to appear in the list in Novell Remote Manager. To enable the Long namespace, see Section 3.13, "Loading and Installing Name Spaces on a Traditional Volume," on page 22.
   - 1b For each volume you want to delete, locate the volume, then click the *Delete* link next to it.
2. Click *Manage Server* > *Partition Disks*.
3. Locate the partition you want to delete, then click *Delete* link next to its name.
4. Click *OK* to confirm the delete.

## 3.7 Creating and Mounting a Traditional Volume

To create Traditional volumes on your NetWare server, follow these guidelines:

- You cannot put Traditional volumes in an NSS storage pool.
- If you create a Traditional volume in NetWare 6.5 or later, you cannot access that volume from previous releases of NetWare. The file system format is not compatible.

To create a Traditional volume:

1. In Novell Remote Manager for NetWare, Click *Manage Server* > *Partition Disks*.
2. Locate the free space on the device where you want to create the volume, then click the *Create* link next to it.
3. In the *Partition Type* drop down-list, select the type of partition you want to create. For example, a *Traditional NetWare* partition.
4. Provide information for the required fields for the type of partition and volume you want to create, then select the check boxes for the volume attributes that you want to set.

**IMPORTANT:** Some attributes cannot be changed after the volume is created. You must decide before you go forward what attributes you want to assign.

Select any of the following options:

- **Compression:** Enables the file system to compress the files in the volume. You set up file compression when you create volumes. After you enable file compression, you cannot turn it off for the life of the volume. You can back up the data in uncompressed form, create a new uncompressed volume, then restore the uncompressed data to the new volume.
- **Migration:** Enables the operating system to move infrequently accessed data to remote areas on your server. This creates space for new and more commonly accessed data. Selecting this option only enables the attribute. The data migration feature uses a third-party software package that does the migration function.
- **Suballocation:** Enables the file system to divide partially used disk blocks into suballocation blocks of 512 bytes. These blocks can be used by other data files.
- **Mount Volume on Creation:** Instructs the operating system to mount the volume when you create it. Otherwise, you can mount it later.

5 Click *Create*, then click *OK* to confirm.

6 After creating a volume, you must mount it in order to use it. Locate the newly created volume in the list, then click *Mount Volume*.

## 3.8 Mounting a Traditional Volume

1 In Novell Remote Manager for NetWare, Click *Manage Server* > *Volumes*.

2 Locate the volume you want to mount, then click the *Mount* link next to it.

When the page refreshes, the option changes from *Mount* to *Dismount*.

## 3.9 Dismounting a Traditional Volume

To repair a Traditional volume, you must dismount that volume.

1 In Novell Remote Manager for NetWare, Click *Manage Server* > *Volumes*.

2 Locate the volume you want to dismount, then click the *Dismount* link next to it.

When the page refreshes, the option changes from *Dismount* to *Mount*.

## 3.10 Expanding the Size of a Traditional Volume

To increase the size of a Traditional volume, add another segment to that volume.

1 In Novell Remote Manager for NetWare, Click *Manage Server* > *Partition Disks*.

2 Locate the volume you want to expand, then click the *Expand* link next to it.

3 Under *Free Disk Space*, select the device with the amount of space available that you want to use.

4 Specify the amount of space (in megabytes) that you want to use

5 Click *Expand*.

NetWare creates a volume segment of that size, then adds it to the volume.

## 3.11 Setting the Space Quota for a Traditional Volume

1. In Novell Remote Manager for NetWare, click *Manage Servers* > *Volumes*.
2. Locate the volume you want to set quotas for, then click the *Space Quota* link next to it.
3. Click *Volume Space Quota*.
4. Specify the value (in megabytes) of the space size you want to specify, then click *Apply*.
5. To confirm your decision, click *OK*.

## 3.12 Salvaging and Purging Files

Files deleted from the NetWare server remain on the disk until the deleted files are purged. Deleted files can be salvaged any time before they are purged.

Purging frees the space used to store the deleted files on the server's server disk. If a disk runs out of free space, NetWare automatically purges the files that were deleted first. For instructions on salvaging and purging deleted files, see "Salvaging and Purging Deleted Files on NetWare Volumes" in the *ConsoleOne 1.3.x User Guide*.

## 3.13 Loading and Installing Name Spaces on a Traditional Volume

1. In Novell Remote Manager for NetWare, click *Manage Servers* > *Volumes*.
2. Locate the volume you want to view, then click the *Name Spaces* link next to it.
3. Locate the name space you want to load, then click the *Not Loaded* link for the name space in the *Name Space Module Status* column.
4. Locate the name space you want to install, then click the *Not Installed* link for the name space in the *Volume Name Space Status* column.
5. To confirm your decision, click *OK*.

## 3.14 Storing Non-DOS Files on a Traditional Volume

By default, NetWare Traditional volumes support DOS naming conventions. To store non-DOS files on a Traditional volume, you must load the appropriate name-space NetWare Loadable Module™ (NLM™) program and add the name-space support to that volume. The following NLM programs are available with NetWare:

- `mac.nam` (Macintosh*)
- `long.nam` (IBM* OS/2*, Windows)
- `nfs.nam` (NFS)

An FTAM name space module is available from third-party providers.

Each name space you add to a Traditional NetWare volume requires additional server memory. If you add name-space support to a volume and do not have enough memory, that volume cannot be mounted.

If you have insufficient memory to mount a Traditional volume with a long name space, you might want to convert the volume to an NSS volume. For information, see "Upgrading Legacy NSS and NetWare Traditional Volumes" in the *OES 2: NSS File System Administration Guide*.

This section discusses the following:

- Section 3.14.1, "Calculating Memory Required for Name Space Support," on page 23
- Section 3.14.2, "Adding a Name Space," on page 23
- Section 3.14.3, "Removing Name Spaces," on page 24

## 3.14.1 Calculating Memory Required for Name Space Support

Use the following formula to calculate the name space memory requirement for Traditional NetWare non-DOS volumes:

`0.032 x volume_size (in MB) / block_size (in MB)`

Round the size up to the highest number.

For example, adding Macintosh name space to a 100 MB volume with a block size of 4 MB would require 1 MB of additional memory:

`0.032 x 100 MB / 4 = 0.8 MB`

## 3.14.2 Adding a Name Space

You must add name spaces only once, not each time you start the server.

### Prerequisites

- ❑ A mounted Traditional volume
- ❑ Sufficient memory

### Procedure

1. To load the appropriate name space: At the server console prompt, enter:

   `load [path]name_space`

   For example, to load the name space module for Macintosh support, enter:

   `load mac.nam`

2. To add name-space support to the volume: At the server console prompt, enter:

   `add name space name to volume_name`

   In this example, *name* is the name space NLM and *volume_name* is the name of the volume that stores the non-DOS files.

3. To verify that the name space loaded: At the server console prompt, enter:

   `volumes`

   This displays a list of all name spaces for the server.

### 3.14.3 Removing Name Spaces

You can remove the name space by deleting the volume and re-creating it, or by using the Vrepair utility. For instructions, see Section 3.18, “Repairing a Traditional Volume,” on page 24.

## 3.15 Creating an eDirectory Object for a Traditional Volume

If a NetWare volume exists on the server and does not have a corresponding Volume object in Novell eDirectory™, a *Create eDir Object* link appears on the volume line in Novell Remote Manager on the Partition Disks page. This can occur when you create a new server and keep an existing Traditional volume.

1. In Novell Remote Manager for NetWare, click *Manage Servers* > *Volumes*.
2. Locate the volume where you want to create a new eDirectory object, then click the *Create eDir Object* next to it.

## 3.16 Naming or Renaming a Traditional NetWare Partition or Volume

After creating a partition, you can give the partition a name (label). You can rename the partition by modifying the label. You can also delete the label.

#### Naming or Renaming the Partition Label

1. In Novell Remote Manager for NetWare, click *Manage Servers* > *Partition Disks*.
2. Locate the partition you to want to label or rename, then click the *Set Partition Label* link next to it, or click the link for the name of the partition.
3. In the *Enter the New Partition Label* field, specify the name for the partition.
4. Click *Apply*, then click *OK*.

#### Deleting the Partition Label

1. In Novell Remote Manager for NetWare, click *Manage Servers* > *Partition Disks*.
2. Locate the partition you want to delete the label from, then click the *Name* link of the partition.
3. Click *Delete Partition Label*, then click *OK*.

## 3.17 Deleting a Traditional Volume

1. In Novell Remote Manager, click *Manager Servers* > *Volumes* to view a list of volumes.
2. Locate the Traditional volume you want to delete, then click the *Delete* link next to it.
3. Click *OK* to confirm your choice.

## 3.18 Repairing a Traditional Volume

Typically, you cannot mount a Traditional volume if it has even minor damage. Occasionally, a damaged volume mounts and causes errors in the process.

Dismount the volume (see Section 3.9, "Dismounting a Traditional Volume," on page 21), then use the Vrepair utility to correct volume problems or to remove name space entries from File Allocation Tables (FATs) and Directory Entry Tables (DETs).

You can run the Vrepair utility (`vrepair`) on a damaged volume while other volumes are mounted. For details about using the Vrepair utility, see "VREPAIR" in the *OES 2: Utilities Reference*.

Following are typical instances when the Vrepair utility can help:

- A hardware failure either prevented a volume from mounting or caused a disk read error.

  **NOTE:** Although the Vrepair utility cannot fix hardware problems, it can sometimes fix related volume damage.

- A power failure caused a corrupted volume.
- The server console displays a mirroring error when the server boots.

  This mirroring refers to the two copies of FATs and DETs that the operating system keeps (if disks are mirrored, NetWare keeps four copies).

If a volume fails to mount as the server is booting, the Vrepair utility loads automatically and attempts to repair the volume.

When the Vrepair utility autoloads, it uses the default options. If you want to use an alternate option, load the Vrepair utility manually and set the alternate option before running the Vrepair utility.

**NOTE:** If you do not want the Vrepair utility to automatically repair a volume that fails to mount, use the "SET" parameter named *Automatically Repair Bad Volumes* to change the default value of On to Off.

## 3.18.1 Prerequisites

- ❑ The volume you want to repair must be dismounted. For instructions, see Section 3.9, "Dismounting a Traditional Volume," on page 21.
- ❑ If the volume to be repaired has name space support, the corresponding Vrepair name space module (`v_namespace.nlm`) must be located in either the `sys:\system` directory or in a search path directory.

  Example modules include `v_mac.nlm` and `v_long.nlm`.

## 3.18.2 Procedure

1 At the server console prompt, enter

```
vrepair [volume_name] [logfile_name]
```

Replace *volume_name* with the name of the volume to repair. If there is only one volume that is dismounted, you don't need to specify this parameter, because the Vrepair utility attempts to repair that volume.

If you want to save the error log, replace the *logfile_name* with the name of the file you want the Vrepair utility to create. The Vrepair utility creates a log of errors it finds. It displays the errors on screen and writes them to a file if you specify a filename.

When you launch the Vrepair utility, an *Options* menu is displayed.

2 Accept the default options, or select alternate options, as appropriate.

The first time you try to repair a volume, accept the default options. If the default options fail to repair the volume, select alternate options.

**2a** To accept the default options, continue with Step 3.

**2b** To set alternate options at the *Options* menu, choose *Set Vrepair Options*, then select *Option 2*.

3 To begin the repair process, choose *Repair A Volume* from the *Options* menu.

- If more than one volume is dismounted, select the volume to repair from those listed.
- If only one volume is dismounted, the Vrepair utility assumes it is the volume that needs repairing and begins the repair.

As the volume is being repaired, the server console screen displays a message indicating `vrepair` activity.

4 (Optional) Modify error log settings after the repair has started.

If the Vrepair utility finds many errors during the repair process, you might want to change some of the run-time error settings. To modify these settings after the repair has started, press *F1* to display the *Current Error Settings* menu.

- Select *Option 1* if you do not want the Vrepair utility to pause after each error.
- Select *Option 2* if you want the Vrepair utility to log errors in a text file.
- Select *Option 3* to stop the volume repair.
- Select *Option 4* to continue with a volume repair after you have stopped it.

5 When the repair is complete, answer *Y* (yes) when prompted to write repairs to the disk.

6 If the Vrepair utility has found errors, run `vrepair` again by repeating Step 2 through Step 5. Repeat until the Vrepair utility finds no errors.

If you are unable to mount the volume after running the Vrepair utility several times, you must delete the volume, then re-create the volume using Novell Remote Manager for NetWare.

## 3.19 Protecting Data: Disk Mirroring and Duplexing

NetWare allows you to protect your data with disk mirroring or duplexing. For information, see Chapter 5, “Using Software RAID1 Devices for Data Fault Tolerance,” on page 35.

## 3.20 Using Directory Map Objects

A Directory Map object represents a particular directory in the file system. If you create a Directory Map object to point to an application, users can access the application by mapping a drive to the Directory Map object.

Directory Map objects can be especially useful in login scripts by indicating directories that contain applications or other frequently used files. For instructions on creating Directory Map Objects, see “Creating a Directory Map Object” in the *ConsoleOne 1.3.x User Guide*.

For example, if you have a directory that contains a word processor, you will probably map a network-search drive to that directory in any login scripts you create. If you should later upgrade the

word processor and rename the directory, you need to change the mapping in every login script where that search mapping appears.

By using a Directory Map object, you could avoid making changes to the login scripts.

First, using ConsoleOne®, you could create a Directory Map object called `current_wpr` that points to the word processor directory (`sys:\public\wpr\80`).

Then, with a `map` command in your login scripts, map a search drive to the Directory Map object, rather than to the specific directory:

```
map ins s2:=.current.wpr.sales.novell_us
```

For a general description of the Map command, see "MAP" in the *OES 2: Utilities Reference*.

When users log in, their network-search drive is mapped to the `current_wpr` Directory Map object, which points to the directory containing WPR8.0.

Later, if you upgrade to WPR9.0 and change the directory's name to `sys:\public\wpr\90`, you would change only the Directory Map object to indicate the new path.

You would not change the `map` command in the login scripts because the `map` command still indicates the correct Directory Map object.

## 3.21 Upgrading Media Format from Traditional Volumes to NSS Volumes

For information on upgrading the media format for a Traditional volumes to the media format for NSS volumes, see "Upgrading Legacy NSS and NetWare Traditional Volumes" in the *OES 2: NSS File System Administration Guide*.

# Configuring Advanced Features for Traditional Volumes

# 4

This section discusses how to optimize file system performance for your NetWare® Traditional File System storage and file management systems.



## 4.1 Compressing and Decompressing Files

One way to conserve disk space is to compress files. If you set the File Compression attribute for a Traditional volume, NetWare compresses files that have been inactive for a period of time. Compression typically occurs at non-peak hours.

---

**IMPORTANT:** You cannot use compression for volumes on removable drives, such as CDs, DVDs, or ISO files.

---

NetWare maintains the original version of a file during compression. When compression completes, NetWare replaces the original with the compressed version of the file, if no errors occurred. If errors do occur during compression, NetWare leaves the original version intact.

This section discusses the following topics:



### 4.1.1 Planning for File Compression

To effectively use file compression for your Traditional volumes, you must understand several key concepts:

### Only Inactive Files Are Candidates for Compression

Files automatically pass in and out of their compressed state as they are unused, then used. It is not necessary to separate application files from data files for file compression because NetWare compresses files based on the interval of time that a file remains inactive. Most application files are used regularly.

Use the `set` command to preclude compression of frequently used applications. For instructions, see "SET" in the *OES 2: Utilities Reference*.

### Decompression Activity Depends on Available Space

Compressed files are uncompressed as they are needed, then remain uncompressed until they are inactive for an extended period. For a file to be uncompressed, there must be enough free space on the volume to accommodate the uncompressed file size.

### Immediate Compression Impacts CPU Performance

Compression is usually a low-priority process thread because of compression's impact on performance. If you flag an item for immediate compression during peak system usage, performance might deteriorate.

### Files Remain Compressed during Backup and Restore

Backup applications that use Novell Storage Management Services™ (SMS™) can back up and restore files in their compressed state. Other applications might decompress them.

### Compressed Volumes Remain Compressed

The File Compression attribute can be turned on when you create the Traditional volume or at any time afterwards. However, after you enable file compression for a Traditional volume, you cannot turn it off. Instead, you can suspend the compression activity, as needed.

If you want to turn off file compression, you must back up the volume in its uncompressed state, then restore the data to a new volume on which the File Compression attribute is not set.

### How to Monitor Compression Activity

Monitor compression activity via the `set` command's *Compress Screen* parameter. For instructions on how to use the `set` command, see "SET" in the *OES 2: Utilities Reference*.

## 4.1.2 Setting Server-Level File Compression Attributes

For the NetWare server, the compression parameters apply to all files and directories in compression-enabled volumes on the server. They have no affect on the file compression for volumes where the volume's File Compression attribute is disabled.

The following list identifies `set` command parameters that affect file compression. For details about each parameter and instructions for setting them, see "Configuring Compression for a Server" in the *OES 2: NSS File System Administration Guide*.

- Compression Daily Check Stop Hour
- Compression Daily Check Starting Hour

- Minimum Compression Percentage Gain
- Enable File Compression
- Maximum Concurrent Compressions
- Convert Compressed to Uncompressed Option
- Decompress Percent Disk Space Free To Allow Commit
- Decompress Free Space Warning Interval
- Deleted Files Compression Option
- Days Untouched Before Compression

## 4.1.3 Enabling File Compression for a Traditional Volume

You choose to compress files when you create volumes by setting the File Compression attribute.You can also set the File Compression attribute later. However, after you enable file compression for a volume, you cannot turn it off. For instructions on setting file compression for volumes, directories, and files, see "Setting Server-Level File Compression Attributes" on page 30.

The following `set` command parameters affect how file compression behaves. For information on how to use the `set` command, see "SET" in the *OES 2: Utilities Reference*.

- "Days Untouched Before Compression" on page 31
- "Minimum Percentage Compression Gain" on page 31

### Days Untouched Before Compression

Use the `set` command's parameter named *Days Untouched Before Compression* to set this interval of inactivity. This parameter specifies the number of days that must pass without access to a file before the file can be compressed. The parameter uses the date the file was last accessed to gauge whether a file should be compressed.

### Minimum Percentage Compression Gain

To avoid the overhead of uncompressing files that do not compress well, the system calculates the compressed size of a file before actually compressing it. If no disk space can be saved by compression, or if the size difference does not meet the value specified by the `set` command's parameter named *Minimum Percentage Compression Gain*, the file is not compressed.

## 4.1.4 Disabling File Compression for a Traditional Volume

File compression is enabled and disabled at the volume level. If you do not enable the File Compression attribute when you create a volume, you can subsequently enable it using the `set` command. However, after it is enabled, file compression cannot be disabled on the volume unless you re-create the volume.

You can temporarily suspend file compression using the `set` command's *Enable File Compression* parameter. For more information, see Section 4.1.5, "Suspending File Compression," on page 32.

### 4.1.5 Suspending File Compression

Use the `set` command's *Enable File Compression* parameter to temporarily suspend file compression for a volume. For instructions, see "SET" in the *OES 2: Utilities Reference*.

While file compression is suspended, files that would have been compressed are queued and compressed when compression is re-enabled.

You can also use the `monitor` utility to change file compression parameters. For a general description, see "MONITOR" in the *OES 2: Utilities Reference*.

## 4.2 Salvaging and Purging Files

Traditional volumes provide a salvage subsystem where deleted files are retained on the server until a purge delay time elapses, the deleted file is salvaged, or the deleted file is purged manually, whichever first occurs. The default purge delay time is four (4) days. When the purge delay time elapses or if server runs out of disk allocation blocks on the volume, deleted files are deleted in a first-deleted, first-purged order.


- Section 4.2.1, "Configuring Salvage for All NSS Volumes on the Server," on page 32
- Section 4.2.2, "Salvaging Deleted Files," on page 32
- Section 4.2.3, "Purging Deleted Files," on page 33


### 4.2.1 Configuring Salvage for All NSS Volumes on the Server

By default, all volumes on the server can optionally use the salvage feature to save deleted files for some predefined time or until space is needed. If you do not want files to be salvageable after deletion, you can enable the Immediate Purge of Deleted Files parameter. When this parameter is enabled at the server level, whenever a file is deleted, it is purged immediately. This server-level salvage setting overrides the settings for volume-level and file-level salvage parameters. For instructions, see "SET" in the *OES 2: Utilities Reference*.

***Table 4-1*** *Server-Level Salvage Parameter*

| Parameter | Description |
|---|---|
| `/(No)ImmediatePurgeOfDeletedFiles` | **Supported Values:** On or Off (default)<br>If this parameter is set to On, all files on all Traditional volumes or NSS volumes on the server are purged immediately when they are deleted. |

### 4.2.2 Salvaging Deleted Files

Salvageable files are deleted files that are saved by NetWare after being deleted by users

When you delete a file on a Traditional NetWare volume, the deleted file is moved into the `sys:\deleted.sav` directory, which is known as the file salvage area. No record is kept of where the file originated, so salvaging files by their original directory is not possible.

You can view a list of deleted files in a directory and recover files by using Novell Remote Manager for NetWare. For more information on salvaging files, see the *OES 2: Novell Remote Manager for NetWare Administration Guide*. Recovered files contain information about who deleted the files and when they were deleted.

Deleted files are saved until the server's purge delay time elapses, the administrator manually purges them, or the NetWare server runs out of disk allocation blocks on the volume.

### 4.2.3 Purging Deleted Files

Salvageable files are usually stored in the directory they were deleted from. If a directory is deleted, NetWare moves the salvageable files from the deleted directory to the `deleted.sav` directory.

When the NetWare server runs out of blocks, it purges deleted files. It deletes the files in the order that they were deleted (first in, first out) in any of the salvageable areas. Purged files cannot be salvaged.

To purge files and directories as they are deleted, use one of these methods:

- Use the `set` command at the NetWare server console to disable the salvageable file feature.

  By default, the *Immediate Purge of Deleted Files* parameter is set to Off. By default, files are salvaged when they are deleted instead of being purged immediately.

  To purge files as they are deleted, set the parameter named *Immediate Purge of Deleted Files* to On. This increases performance, but at the cost of losing the salvageable file feature. For instructions, see "SET" in the *OES 2: Utilities Reference*.

- Set the *Purge* attribute for individual files and directories.

  If a file is flagged with the Purge attribute, the file is purged when it is deleted.

  If a directory is flagged with the Purge attribute, NetWare purges all files in that directory when the directory is deleted. Purged files and directories cannot be recovered.

- Use Novell Remote Manager for NetWare to manually purge individual files and directories. For instructions, see the *OES 2: Novell Remote Manager for NetWare Administration Guide*.

# Using Software RAID1 Devices for Data Fault Tolerance

# 5

NetWare® Traditional File System volumes can span multiple disks. If a single disk fails, all Traditional volumes that have segments on that disk also fail. To increase the data fault tolerance of a server that has a Traditional file system, you can mirror the data from a Traditional NetWare partition on one disk to Traditional NetWare partitions on other disks.

This section discusses the following:



## 5.1 Planning Your Software RAID1 Device

Mirroring is a software RAID1 technique that writes data in parallel to multiple separate devices. If one device fails, the other member devices remain available.

You can create a software RAID1 device with up to four member partitions, including the original partition and up to three mirrored partitions. Each member partition resides on a separate server disk.

As contrasted to a hardware RAID1 device, the server operating system controls the mirroring activity in a software RAID1 device, which can slightly impact the CPU performance for the server. Adding additional mirrors after the first contributes to availability, but it also incrementally impacts CPU performance.

Typically, you write only to the original partition and send duplicate writes to the mirrored partitions. However, you can read from all member partitions. This improves the read performance of your Traditional volumes that contain volume segments in member partitions of the RAID.

This section discusses the following considerations for achieving fault tolerance:



### 5.1.1 Fault Tolerance for Traditional Volumes

If you mirror one partition, you do not necessarily provide data protection for the entire volume. To create software RAID1 devices for Traditional NetWare partitions, you must keep in mind the relationship between Traditional NetWare partitions, volumes, and volume segments. (For information about these key concepts, see Chapter 1, “Overview of the NetWare Traditional File System,” on page 11.)

NetWare partitions consist of up to 8 volume segments. Each segment can be allocated separately as a member of a different Traditional volume. If you mirror a partition, the volume segments it contains are mirrored on the mirror partition. For a Traditional volume that spans multiple server disks, only its volume segments in that particular partition are mirrored. The volume segments on other partitions on the same or different server disks remain unprotected. To fully protect your Traditional volume, you must create a RAID1 device for each Traditional NetWare partition that contains one of the volume's segments.

## 5.1.2 Key Concepts for Mirroring Traditional NetWare Partitions

The following are important concepts for mirroring Traditional NetWare partitions:

- All member partitions of a software RAID1 device must be of the same type. A Traditional NetWare partition can only be mirrored to other Traditional partitions.
- Each member partition in the software RAID1 device must be compatible in data area size.

  The new partition must be at least the same size or slightly larger than the other partitions in the group. The physical size of the partition must be at least 100 kilobytes (KB), but no more than 120 megabytes (MB) larger than the data size of the existing partitions in the mirror group.
- All member partitions in the software RAID1 device must have the same sharable status. Either all are sharable for clustering, or all are not.
- Partitions you add to the software RAID1 device cannot be members of any other software RAID device. They must be standalone partitions.
- Only partitions marked with the Mirror attribute can be used as a software RAID1 mirrored partition. You must set the Mirror attribute for partitions when you create them; you cannot add the option later.
- Although you can mirror one partition to as many as four other partitions, mirroring two partitions is typically sufficient fault tolerance for most systems.
- If a mirrored disk fails and cannot be accessed by the server, you can unmirror the server's partitions on the functional disk, then salvage the lost volume segments.
- If you want to remove a hot-plug mirrored disk without bringing down the server, you must unmirror the disk first.

## 5.1.3 Improving Fault Tolerance for Software RAID1 Devices with Duplexing

Mirroring stores the same data on separate disks on the same controller channel. If you mirror partitions on separate disks over different controller channels or host bus adapters, this is called *duplexing*. Duplexing can also concurrently use two instances of a driver for the channels. Duplexing is the recommended method for fault tolerance because two channels rarely fail simultaneously.

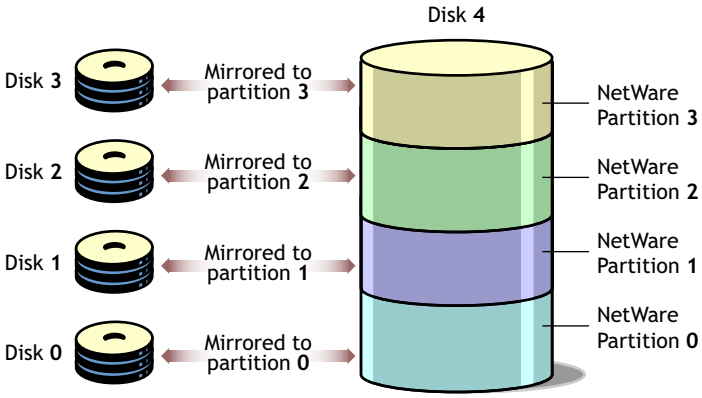
The process for mirroring and duplexing is the same. The term mirroring is used in all menus in Novell Remote Manager for NetWare to refer to both mirroring and duplexing.

### 5.1.4 Example Software RAID1 Solution for Fault Tolerance of Traditional Volumes

As an example, consider a server that has five server disks. Four of the disks (0, 1, 3, and 4) are under 4 gigabytes (GB) and each disk contains a single partition the size of the disk. The fifth disk (5) is 20 GB and contains four partitions of 4 GB each; the remaining 4 GB capacity are unused free space. Each physical NetWare partition is further subdivided into eight volume segments of about 500 MB each. The first four disks contain 32 volume segments that can be allocated to up to 32 separate Traditional volumes. (4 disks x 1 partition per disk x 8 volume segments per partition = 32 volume segments) You choose to create 8 Traditional volumes, each with 4 segments that span the four disks.

For data fault tolerance, you create four software RAID1 mirrored partitions on the fifth server disk, where the other device's partition are mirrored separately. In Figure 5-1, single partitions on several smaller disks are mirrored to similarly sized partitions on one larger disk. In this configuration, if any of the small disks fail, the data on the volume segments can be recovered from the mirrored partition. However, if the large server disk fails, all of the mirrored partitions would also fail. The original data would not be harmed.

***Figure 5-1*** *Mirroring Small Disks to Partitions on One Large Disk*




## 5.2 Managing Traditional Software RAID1 Devices

This section discusses the following management tasks:

- Section 5.2.1, "Mirroring Partitions," on page 37
- Section 5.2.2, "Unmirroring Partitions," on page 38
- Section 5.2.3, "Recovering Data from an Out of Sync Disk," on page 38

### 5.2.1 Mirroring Partitions

You set the Mirror attribute for a partition when you create it.

1. In Novell Remote Manager for NetWare, click *Manage Server* > *Partition Disks*.
2. Locate the device that you want to create the partition on, then click *Create*.
3. In the *Partition Type* drop-down list, select the type of partition you want to create.

For example, a *Traditional NetWare* partition.

4. Click *Create Partition and Volume*.
5. Specify the size of the partition in bytes (B), kilobytes (KB), megabytes (MB), or gigabytes (GB).

   If you plan to make this a mirrored partition, it must be compatible in data area size with other partitions you plan to use. The physical size of the partition must be at least 100 KB, but no more than 120 MB larger than the data size of the existing partitions in the mirror group.
6. (Conditional) To create a partition that can be mirrored, select *Mirror* and select one of the following options:
   - **Create New Mirror:** This option means you are making the partition capable of being part of a mirror group. You do not actually create the group until you add another mirrored partition to the partition you are creating.
   - **Existing Mirror Group:** (If you select this option, also select the *ID* of the mirrored partition.) This shows a list of existing mirror groups that are compatible in data area size. This option lets you add this new partition to one of the mirror groups in the list.
7. Complete the required fields, click *Create*, then click *OK* to confirm your decision.

   If this is a mirrored partition, NetWare displays the status as "`100% mirrored`" when the mirroring is complete.

## 5.2.2 Unmirroring Partitions

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

1. In Novell Remote Manager for NetWare, click *Manager Servers* > *Partition Disks*.
2. Locate the partition you want to unmirror, then click the *Remove Mirror* link next to it.

   This removes the partition from the mirror group. You can now delete the partition, if desired.

## 5.2.3 Recovering Data from an Out of Sync Disk

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

### Checking Mirror Status

1. At the server console command prompt, enter
   `mirror status`

### Resynchronizing the Mirror

When a server 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 command prompt, enter:
   `remirror partition id`

   Substitute the actual partition ID for *id*. For example, if the device is 0X1e, enter
   `remirror partition 1e`

This initiates the resynchronization process for the mirror group that contains the partition you selected.

2 Check the mirror status to confirm the resynchronization.

# Using Software RAID0 Devices to Enhance Disk I/O Performance

6

If your disk response time is slow for heavily used volumes, you can improve disk I/O performance by using a software RAID0 device for the volume. Even though the NetWare® Traditional File System volumes can comprise segments from multiple disks, the disks are not forced to distribute data evenly across the member disks. A RAID0 device evenly stripes data across its disks.

This section discusses the following:



## 6.1 Planning Your Software RAID0 Device

Striping is a software RAID technique that writes data concurrently to multiple separate devices. Consider the following guidelines before creating your RAID 1 device:

- A segment is the amount of storage space used from each disk you plan to use in the software RAID device. A software RAID0 device can accommodate 2 to14 segments.
- A stripe is the amount of data the file system places on one device before moving to the next device. The stripe size ranges from 4 KB to 256 KB, in increments of 2 KB. The default stripe size is 64 KB.
- Each segment in the software RAID0 configuration should come from a different device. You can obtain segments from the same device, but this can severely impede the performance of your file system on the RAID.
- It is best to use segments of the same size when you create your RAID device. The size of each segment must be compatible in data area size with other segments you plan to use. The minimum segment size is 100 KB. The maximum size must not be more than 120 MB larger than the size of other partitions. The size the RAID pulls from each segment is equivalent to the size of its smallest member segment.
- All member segments in the software RAID0 device must have the same sharable status. Either all are sharable for clustering, or all are not. Set the segment’s disk as Sharable or Not Shareable before you build the RAID.
- If one of the member disks fails, all volumes on the RAID device become unavailable. After you replace the disk, you must restore each volume from backup media. Each volume’s data must be restriped across all segments in the RAID before you can use the volume again.
- If one of the member disks fails, the entire volume becomes unavailable. Therefore, you should mirror or duplex volumes built on RAID0 devices. To mirror the software RAID0 devices, the devices in the mirror must have no disks in common. This configuration creates a software RAID 10 Traditional volume.

## 6.2 Managing Traditional Software RAID0 Devices

You must use Novell Storage Services™ Management Utility or the NSS Storage Management plug-in for iManager to create a software RAID0 device. For instructions, see "Managing Software RAID Devices" in the *OES 2: NSS File System Administration Guide*.

After you create the RAID0, use Novell Remote Manager for NetWare to create a Traditional volume on the device. Make sure to use the RAID0 for your segment. For information on creating a Traditional volume, see Section 3.7, "Creating and Mounting a Traditional Volume," on page 20.

To create a RAID 10 Traditional volume, mirror the volume you just created. For information on mirroring Traditional volumes, see Chapter 5, "Using Software RAID1 Devices for Data Fault Tolerance," on page 35.

# Optimizing Disk and Cache Performance for Traditional Volumes

7

NetWare® provides several methods for improving the performance of your NetWare Traditional File System:

- Section 7.1, “Optimizing Storage Disk Capacity for Traditional Volumes,” on page 43
- Section 7.2, “Improving Disk Reads on Traditional Volumes,” on page 45
- Section 7.3, “Improving Disk Writes for Traditional Volumes,” on page 46
- Section 7.4, “Configuring SET Parameters for the NetWare Traditional File System,” on page 48
- Section 7.5, “Configuring Common File System SET Parameters for NetWare,” on page 49

For instructions on using the `set` command, see “SET” in the *OES 2: Utilities Reference*.

For instructions on configuring `set` command parameters in Novell Remote Manager for NetWare, see the *OES 2: Novell Remote Manager for NetWare Administration Guide*.

## 7.1 Optimizing Storage Disk Capacity for Traditional Volumes

There are several options for increasing the capacity of your storage disks:

- Section 7.1.1, “Saving Disk Space with Block Suballocation,” on page 43
- Section 7.1.2, “Disable Read-After-Write-Verify,” on page 44
- Section 7.1.3, “For 16-Bit Disk Adapters, Increase the Number of Reserved Buffers Below 16 MB,” on page 44
- Section 7.1.4, “Use Drivers that Support Scatter/Gather Functionality,” on page 44
- Section 7.1.5, “Provide a Disk Large Enough for a Memory Core Dump,” on page 44
- Section 7.1.6, “Select Segments for Volumes from Different Disks,” on page 44
- Section 7.1.7, “Monitor Free Space in Volumes,” on page 44

### 7.1.1 Saving Disk Space with Block Suballocation

Use block suballocation to enhance use of disk space.

Block suballocation divides any partially used disk block into suballocation blocks of 512 bytes. These suballocation blocks can be used by files to share what would otherwise be unavailable space.

You can set block suballocation only when creating a Traditional volume. For instructions on setting block suballocation on Traditional volumes, see Section 3.7, “Creating and Mounting a Traditional Volume,” on page 20.

Keep at least 1000 free blocks on each Traditional 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, the suballocation increases server utilization. To view the number of free blocks, view the volume's details in iManager.

### 7.1.2 Disable Read-After-Write-Verify

Disable *Read-After-Write-Verify* in the Monitor (`monitor`) utility if your hard disk provides this capability.

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

For information, see Section 7.3.3, "Turn Off Read-After-Write Verification," on page 47.

### 7.1.3 For 16-Bit Disk Adapters, Increase the Number of Reserved Buffers Below 16 MB

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 the Monitor (`monitor`) utility to set the *Reserved Buffers Below 16 MB* parameter to its upper limit, 300. The parameter is found in *Monitor* > *Available Options* > *Server Parameters* > *Memory*. For instructions, see "SET" in the *OES 2: Utilities Reference*.

Remember that too many reserved buffers can prevent large volumes from mounting in a Traditional file system. As soon as possible, upgrade the system to a newer board that can access higher memory.

### 7.1.4 Use Drivers that Support Scatter/Gather Functionality

Scatter/gather is an I/O technique to organize the read and write calls from multiple data buffers that are separated in memory. The purpose is to lower the overhead associated with each call by reducing the number of calls that must be made.

### 7.1.5 Provide a Disk Large Enough for a Memory Core Dump

Provide a device that is large enough to hold a core dump of the server's memory. A core dump cannot span multiple devices.

### 7.1.6 Select Segments for Volumes from Different Disks

If a volume comprises 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.

### 7.1.7 Monitor Free Space in Volumes

Keep at least 10% free space in any NetWare volume, except for the `sys:` volume, where there should be 20% free space.

**WARNING:** Do not fill up your `sys:` volume. This could damage your entire file system. The Transaction Tracking System™, which protects Novell eDirectory™, shuts down, compromising the eDirectory replicas on the server.

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

- Regularly monitor each volume's disk space.
- Use the *Volume Low Warning Threshold* parameter to specify when you are warned that a volume is running out of disk space.
- Move any user files or print queues to another volume.
- Do not store replicas on servers with low disk space.
- Limit the size of auditing files on Traditional NetWare partitions.

# 7.2 Improving Disk Reads on Traditional Volumes

On a server that is read-intensive, the following procedures can improve the speed of disk reads on your NetWare Traditional volumes.


- Section 7.2.1, "Change Concurrent Disk and Directory Writes for Faster Reads for Traditional Volumes," on page 45
- Section 7.2.2, "Change the Turbo FAT Wait Time for Faster Reads of Traditional Volumes," on page 46


## 7.2.1 Change Concurrent Disk and Directory Writes for Faster Reads for Traditional Volumes

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

**NOTE:** This procedure requires that you 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.

Modify the following parameters by using "SET" as described in the *OES 2: Utilities Reference*.

- 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.
- 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.
- Increase the value of *Directory Cache Buffer Non Referenced 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.

### 7.2.2 Change the Turbo FAT Wait Time for Faster Reads of Traditional Volumes

When a program randomly accesses a file that contains more than 64 file allocation table (FAT) entries, the file 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, increase the value of *FAT Re-Use Wait Time*, using "SET" in the *OES 2: Utilities Reference*. You must specify the value in seconds.The new setting is persistent through a server reboot. 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).

## 7.3 Improving Disk Writes for Traditional Volumes

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

- Section 7.3.1, "Increase the Number of Concurrent Writes," on page 46
- Section 7.3.2, "Change Disk and Directory Caching for Faster Writes," on page 47
- Section 7.3.3, "Turn Off Read-After-Write Verification," on page 47

### 7.3.1 Increase 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 must 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 the `monitor` utility. 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.

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

---

Increase the value of *Maximum Concurrent Disk Cache Writes*, using "SET" in the *OES 2: Utilities Reference*. The new setting is persistent through a server reboot. If the parameter is currently at the default value of 50, try increasing it to 100.

## 7.3.2 Change Disk and Directory Caching for Faster Writes

Change the *Disk and Directory Caching* parameter for faster writes if network users frequently make many small write requests and the server is slow to respond to the requests. Use "SET" in the *OES 2: Utilities Reference* to modify the following parameters:

- Increase the value of the *Dirty Disk Cache Delay Time* parameter.

  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.

- Increase the value of the *Dirty Directory Cache Delay Time* parameter.

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

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

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

- Increase the value of the *Maximum Concurrent Directory Cache Writes* parameter.

  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.

  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 or 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.

## 7.3.3 Turn Off Read-After-Write Verification

Read-after-write verification 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.

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**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.

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### Prerequisite

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

### Procedure

Use the "SET" command as described in the *OES 2: Utilities Reference* to disable the *Disk Read After Write Verification* parameter.

## 7.4 Configuring SET Parameters for the NetWare Traditional File System

Table 7-1 indicates the default settings in NetWare 6.5 or later for the Traditional file system SET parameters.

***Table 7-1*** *SET Parameters for a Traditional File System Volume*

| SET Parameters for the Traditional File System | Default Value |
|---|---|
| Volume Log File State | 1 |
| Volume TTS Log File State | 1 |
| Volume Log File Overflow Size | 4194304 |
| Volume TTS Log File Overflow Size | 4194304 |
| Auto TTS Backout Flag | On |
| TTS Abort Dump Flag | Off |
| TTS UnWritten Cache Wait Time | 1 minute 5.9 seconds |
| TTS Backout File Truncation Wait Time | 59 minutes 19.2 seconds |
| Dirty Directory Cache Delay Time | 0.5 seconds |
| Directory Cache Allocation Wait Time | 2.2 seconds |
| Directory Cache Buffer NonReferenced Delay | 5.5 seconds |
| Maximum Directory Cache Buffers | 2000 |
| Minimum Directory Cache Buffers | 500 |
| Maximum Number Of Internal Directory Handles | 100 |
| Maximum Number Of Directory Handles | 20 |
| Maximum Record Locks Per Connection | 500 |
| Maximum File Locks Per Connection | 2500 |
| Maximum Record Locks | 20000 |
| Maximum File Locks | 200000 |
| Read Ahead Enabled | On |
| Read Ahead LRU Sitting Time Threshold | 10 seconds |
| Minimum File Cache Buffers | 20 |
| Maximum Concurrent Disk Cache Writes | 750 |

| SET Parameters for the Traditional File System | Default Value |
|---|---|
| Dirty Disk Cache Delay Time | 3.3 seconds |
| Minimum File Cache Report Threshold | 20 |
| Automatically Repair Bad Volumes | On |
| File Delete Wait Time | 5 minutes 29.6 seconds |
| Allow Deletion Of Active Directories | On |
| Maximum Percent of Volume Space Allowed for Extended Attributes | 10 |
| Maximum Extended Attributes per File or Path | 16 |
| Purge Files On Dismount | Off |
| Fast Volume Mounts | On |
| Maximum Percent Of Volume Used By Directory | 13 |
| Maximum Subdirectory Tree Depth | 25 |
| Volume Low Warn All Users | On |
| Volume Low Warning Reset Threshold | 256 |
| Volume Low Warning Threshold | 256 |
| Turbo FAT Re-Use Wait Time | 5 minutes 29.6 seconds |
| Allow Unowned Files To Be Extended | On |
| Auto Mount Mirrored Volume Containing Inactive Device | Off |

# 7.5 Configuring Common File System SET Parameters for NetWare

The `SET` parameters for Common File System are shared by NSS and Traditional file systems. Table 7-2 indicates the default settings in NetWare 6.5 or later for the Common File System SET parameters.

**IMPORTANT:** When modifying Common File System SET parameters, ensure that your planned settings satisfy the requirements for both your NSS and Traditional volumes.

***Table 7-2*** *Common File System SET Parameters*

| Common File System SET Parameters | Default Value |
|---|---|
| Maximum Transactions | 10000 |
| Maximum Concurrent Directory Cache Writes | 75 |
| Minimum File Delete Wait Time | 1 minute 5.9 seconds |
| Immediate Purge Of Deleted Files | Off |
| Compression Daily Check Stop Hour | 6 |

| Common File System SET Parameters | Default Value |
|---|---|
| Compression Daily Check Starting Hour | 0 |
| Minimum Compression Percentage Gain | 20 |
| Enable File Compression | On |
| Maximum Concurrent Compressions | 2 |
| Convert Compressed To Uncompressed Option | 1 |
| Decompress Percent Disk Space Free To Allow Commit | 10 |
| [XXX] Decompress Free Space Warning Interval | 31 minutes 18.5 seconds |
| Deleted Files Compression Option | 1 |
| Days Untouched Before Compression | 14 |

# Troubleshooting

# 8

This section presents various troubleshooting procedures for resolving problems with Traditional volumes:



## 8.1 Resolving File I/O Errors

To resolve a file I/O error, try one or more of the following:

- Make sure that the volume (especially volume `sys:`) is mounted.
- If the volume is out of disk space, error messages appear on the Logger Console screen indicating that the volume is almost out of disk space. Check this screen for messages.
- Check how much space remains on the `sys:` volume. If it is low, increase the size by adding free space.

To increase the amount of free space, do one or more of the following:

- Delete extraneous files (if you can log in from a workstation).
- At the server console prompt, enter `set immediate purge of files = on`, then retry the action.
- If you have an additional disk, increase the size of the volume by creating an additional segment of the volume on the disk.

## 8.2 Resolving Volume I/O Errors

To resolve a volume I/O error on Traditional volumes, try one or more of the following:

- Make sure that all devices that contain the volume are online. (Volumes can span multiple devices.)
- Repair the volume using the Vrepair utility.
- Make sure that the volume is visible.

If you have tried all of the above without success, contact a Novell® Support Provider or the disk drive manufacturer.

## 8.3 Resolving Problems When the Server Hangs after Mounting the Last Volume

To diagnose problems when the server stops processing after mounting the last volume, identify whether the following conditions exist:

- Make sure the server network board is installed or seated correctly and is initializing when the server is started.
- Make sure that the server network board is configured correctly.
- Check the network board configurations of the boards in the server and the settings shown on the server and make sure that the settings match.
- Make sure that all server and workstation network boards are seated properly and that cabling and connections are attached securely.
- Make sure that the terminators on cables have the right ohm rating and are installed correctly. The IBM PC Cluster sends a broadcast message during initialization, then stops processing if the network is not cabled or terminated properly.
- Check the network boards in all workstations for correct node address settings.

## 8.4 Resolving Problems When No Volumes Mount

The `sys:` volume contains the NetWare system files and the NLM™ programs.

If the `sys:` volume does not mount when the server is booted, then the `autoexec.ncf` file does not execute, LAN drivers do not load, and the volume does not become part of the Novell eDirectory™ tree.

To diagnose problems when no volumes mount, identify whether the following conditions exist:

- The `sys:` volume is corrupted.
- The server disk containing volume `sys:` volume has failed.
- The cable or power to the external server disks has malfunctioned.

To resolve problems when no volumes mount, do the following:

- Repair the volume using the utilities that are appropriate for the volume type.
- Check the cabling and power to the external server disks. Replace any faulty components.
- Replace the server disk containing the `sys:` volume.
  - Create the partitions and the `sys:` volume.
  - Restore the data from a backup copy.

## 8.5 Resolving Problems When Only Some Volumes Mount

To diagnose problems when only some volumes mount, identify whether the following conditions exist:

- The server does not have enough RAM.
- The disk drivers for external drives are not loaded.

To resolve problems when only some volumes mount, do the following:

- Add more RAM.
- Verify which drivers are loaded.

## 8.6 Resolving Disk Error Problems When a Volume is Mounting

To diagnose problems when disk errors occur while a Traditional volume is mounting, identify whether the following conditions exist:

- The server does not have enough memory to mount the volume.
- The operating system is experiencing directory sector mismatching. This mismatching can be caused if the media is defective or if the server is turned off without the `Down` command.

To resolve disk error problems that occur while a volume is mounting:

- Check the status of the available cache buffers. If the available cache buffers are fewer than 20%, add more memory to your server.
- Minor errors usually correct themselves through normal network use. For example, if a FAT entry is wrong, the entry is updated and corrected the next time the table is written to. If errors do not correct themselves, repair the volume using the Vrepair utility.

## 8.7 Resolving Memory Errors When a Volume Is Mounting

To diagnose memory error problems when a Traditional volume mounts, identify whether the following conditions exist:

- Volumes take more memory to mount than they require after being mounted because the mounting process performs consistency checks (for example, the duplicate copies of all the tables are checked).
- Volumes and directory entries grow dynamically. Therefore, if your server is using most of the RAM (file cache buffers are close to 20% of the memory) and you dismount a volume, you might not be able to remount the volume unless additional memory is available.
- Each additional name space support that you add to a volume increases the size of the file allocation tables and directory entry tables. Adding name space support can cause the tables to grow so large that the server does not have enough RAM to mount the volume.

To resolve memory errors when a volume mounts, perform the following actions or ensure that the following conditions exist:

- Check the status of the available cache buffers. If the cache buffers are fewer than 20%, add more RAM to your server.
- Free up memory by unloading resources.
- On volumes using the Traditional file system, streamline the directory structure. Each subdirectory takes at least one directory block (by default, a 4 KB block of memory). Therefore, subdirectories with only one file require as much memory as directories with 32 files. Check the 4 KB size.

  For example, you can free up memory by combining few files in many directories into fewer directories so that most directories have about 32 files, then purging the deleted subdirectories and files.
- Calculate how much memory you need and add memory to the server.
- Remove any recently added name space support.

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  **WARNING:** This is a destructive step that destroys all the extended file information. Before taking this step, try to free up enough memory so that the volume mounts and you can back up the data.

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  Have all users log out, then unload all NLM programs except the volume's disk drivers. Dismount any mounted volumes.

  To remove the name space on a Traditional volume, load the Vrepair utility, select *Set Vrepair Options*, then select the *Remove Name Space Support from the Volume* and *Write All Directory and FAT Entries Out to Disk* options. Exit to the main menu, then run *VRepair > Repair a Volume* on the volume that would not mount.

# 8.8 Resolving Volume Mounting Problems Caused by Corrupted Directory Entry Tables or File Allocation Tables

To diagnose problems when mismatches exist in the duplicate copies of the FAT and directory entry table (DET) on Traditional volumes, identify whether the following conditions exist:

- A power failure has occurred and the server has not been shut down with the `down` command.
- A server disk has failed.
- A disk channel error has occurred. A volume does not dismount when you enter the `dismount` command.
- Directory information in cache is not completely written to disk.

To resolve problems when mismatches exist in the duplicate copies of the FAT and DET, do the following:

- Use the Vrepair utility to repair the disk.
- Add a UPS system so that the server is shut down automatically when a power failure occurs.
- Replace faulty disks or controllers.

# 8.9 Resolving Volume Mounting Problems Caused by the Name Space Module

After a volume has been configured to support more than the DOS naming convention, the name space NLM program must be loaded before the volume can be mounted.

To diagnose problems when a Traditional volume cannot mount because the name space NLM program is not loaded, identify whether the following conditions exist:

- The command to load the name space NLM is not in the `startup.ncf` file.
- The NLM to load the name space has not been copied to the boot directory of the server.

To resolve problems when a Traditional volume cannot mount because the name space NLM program is not loaded, do the following:

- Load the name space NLM program, then mount the volume. Copy the name space NLM to the server boot directory and add the load command to the `startup.ncf` file. The NLM then loads automatically whenever the server is booted.
- Delete the name space configuration from the volume.

  **WARNING:** This is a destructive step that destroys all of the extended file information.

- Back up all non-DOS files.
- Load the Vrepair utility, select *Set VRepair Options*, then select the *Remove Name Space Support from the Volume* and *Write All Directory and FAT Entries to Disk* options. Exit to the main menu, then run *Vrepair > Repair a Volume* on the volume that would not mount.