

# Novell NetWare® 6

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TRADITIONAL FILE SERVICES  
ADMINISTRATION GUIDE



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# Preface

NetWare<sup>®</sup> provides the traditional NetWare file system components and utilities, such as NetWare partitions, NetWare volumes, and file management utilities.

This documentation includes the following information:

- ◆ [Chapter 1, “Overview of Traditional File System,” on page 9](#)
- ◆ [Chapter 2, “Planning,” on page 19](#)
- ◆ [Chapter 3, “Setting Up the File System,” on page 25](#)
- ◆ [Chapter 4, “Optimizing File System Performance,” on page 35](#)
- ◆ [Chapter 5, “Managing,” on page 39](#)
- ◆ [Chapter 6, “Troubleshooting,” on page 43](#)

**NOTE:** Novell<sup>®</sup> Storage Services<sup>™</sup> (NSS) is the primary file system. You can create and use NSS partitions and volumes along with traditional partitions and volumes. This documentation focuses on traditional file system information.

Functionality pertaining to the NetWare file system continues to evolve. Consequently, there are sometimes a variety of ways in which a particular procedure can be performed. There are also various ways in which the file system itself can be viewed. Novell clients, for example, provide access to file system features and functionality that were once accessible only through NetWare utilities. Wherever possible, links have been provided in file system documentation to let you explore the variety of ways in which you can complete a task.

Because NSS is the primary file system, many of the links in this document will access it. For more information about NSS, see [Introducing Novell Storage Services](#) in the *Novell Storage Services Administration Guide*.

## Documentation Conventions

In this documentation, a greater-than symbol (>) is used to separate actions within a step and items in a cross-reference path.

Also, a trademark symbol (®, ™, etc.) denotes a Novell trademark. An asterisk (\*) denotes a third-party trademark.



# 1

## Overview of Traditional File System

This chapter of the file system documentation explains key aspects of the traditional NetWare<sup>®</sup> file system and contains the following topics:

- ♦ [Volume \(page 9\)](#)
- ♦ [Directories \(page 12\)](#)
- ♦ [Optimizing Performance \(page 14\)](#)
- ♦ [Drive mapping \(page 16\)](#)
- ♦ [How NetWare Protects Network Data \(page 17\)](#)
- ♦ [“Security” on page 18](#)

Information on volumes, directories, files, and other characteristics of the file system is presented to give you background needed for the set-up, managerial, and other procedures described elsewhere in file system documentation. For instructions on setting up partitions and volumes, see [Setting Up and Configuring Novell Storage Services](#) in the *Novel Storage Services Administrator Guide*.

### Volume

There are two types of volumes: traditional and logical. Traditional volumes consist of a fixed amount of physical space on one or more hard disks. Logical volumes can grow dynamically according the available physical space. This document focuses on traditional volumes. For information about logical volumes, see [Create Logical Volumes](#) in the *Novel Storage Services Administrator Guide*.

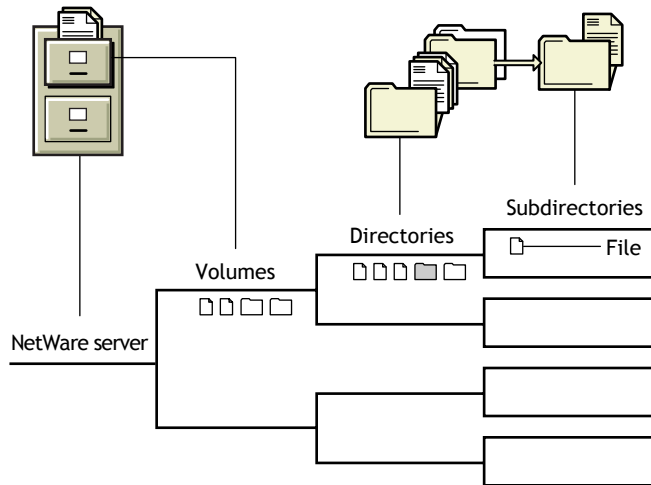
A CD-ROM can also be mounted as a volume. See [CD-ROMs As Logical Volumes](#) in the *Novel Storage Services Administrator Guide*.

A NetWare server is divided into one or more volumes. The first network volume is named SYS: and is created during NetWare installation. Using ConsoleOne, you can create a new volume on any hard disk that has a NetWare partition. A NetWare server supports up to 64 volumes.

NetWare volumes are subdivided in two ways:

- ♦ **Physically.** You divide volumes into volume segments; different segments of a volume can be stored on one or more hard disks. For information about volume segments, see “[Understanding Volume Segments](#)” on page 11.
- ♦ **Logically.** You divide volumes into directories containing files or subdirectories by network supervisors and users who have the appropriate rights.

The file system is similar to an office filing system. This graphic illustrates the file system architecture:



## Understanding Mounting a Volume

When you boot the NetWare server, each volume is mounted, meaning that

- ♦ The volume becomes visible to the operating system
- ♦ The volume's FAT is loaded into memory

Each file block of data takes up one entry in the FAT.

Because of this, volumes with a smaller block size require more server memory to mount and manage.

However, if most of your files are small, a large block size wastes disk space.

- ◆ The volume's DET is loaded into memory

If a volume fails to mount, it might be because you have run out of RAM. This is because the FAT takes up cache buffers.

**NOTE:** The new file system, Novell Storage Services (NSS), mounts volumes more quickly and can mount any size volume with 1 MB of memory. NSS volumes can be used along with traditional NetWare volumes. For information about NSS and its advantages, see [Overview](#) in the *Novel Storage Services Administrator Guide*.

## Volume Objects in NDS

In NDS<sup>®</sup>, each volume is also a Volume object. Volume objects are leaf objects that represent a physical volume on the network.

In the Volume object's properties, you can store information about which NetWare server the physical volume is located on and the volume name recorded when the volume was initialized at the server (for example, SYS:).

You can also store information such as the volume's owner, space use restrictions for users, or a description of its use.

You can also view statistical information on disk space availability, block size, directory entries, name space support, etc.

## Understanding Volume Segments

A volume segment is a physical division of a volume. Different segments of a volume can be stored on one or more hard disks, allowing you to create large volumes.

A single NetWare partition can only contain eight traditional NetWare volumes. You can create up to four NetWare partitions per drive (three if the device also has a DOS partition). Each of these NetWare partitions can only contain eight volume segments.

By placing segments of the same volume on multiple hard disks, different parts of the same volume can be read from or written to simultaneously, speeding up disk input and output.

However, when you spread segments of a volume over several disks, you should protect the volumes against disk failure by mirroring; otherwise, if a single disk fails, one or more entire volumes shut down.

You can add segments to a volume, but removing a segment from a volume destroys the entire volume.

You can increase the size of a traditional volume by adding another hard disk to the NetWare server, by setting up a NetWare partition on the disk, or by adding a new NetWare partition to the existing volume as one or more new volume segments.

## Directories

A directory is a place within a volume where you can store files or other directories. A Directory within a directory is called a subdirectory. Directories can contain any number of files and subdirectories.

This section contains the following topics:

- ◆ “Directory Path” on page 12
- ◆ “Fake Root” on page 13
- ◆ “Directory Map Objects” on page 13

## Directory Path

A directory or file is located by its *path*, which states where the directory or file is on a volume. A path includes the volume, directory, and any subdirectories leading to the file. The following figure shows how to specify a path. (Listing the server is optional.)

**Figure 1** Directory Path Conventions

NetWare server \ Volume : Directory \ (Sub)directory \ Filename

Separate volume and directory with a colon (:).  
Separate all others with a slash (\).

If your network uses more than one client operating system, keep in mind the conventions of the different systems. For example, NetWare allows 255

characters in a directory path (counting the drive letter and delimiters), but DOS permits only 127 characters.

Also, some applications restrict the number of characters in the directory path. For more information, check the application's documentation.

## Fake Root

A fake root is a subdirectory that functions as a root directory.

**NOTE:** Fake roots work with the NetWare DOS Requester, with NetWare shells, and clients including Windows\* 3.x, Windows 95, and Windows NT\*. Fake roots do *not* work for OS/2\* clients. (Under OS/2, all mapped drives are roots, and search drives don't exist.)

Some applications require their executable files to be located in a root directory. However, for security, you should not assign users rights at the root or volume directory level.

NetWare allows you to map a drive to a fake root. This allows you to place applications in a subdirectory and assign rights to them there.

Thus, to use an application that must be installed at the root, load the files in a subdirectory and designate it as a fake root directory in the login script using MAP ROOT.

For example, you might have an application in a FORM directory that must reside in the root directory of drive P:, but you don't want to put the application in the root directory for security reasons. You can map a fake root to the directory and map a search drive to it at the same time by adding the following line to the login script:

```
MAP ROOT S16:=P:= SYS:APPL\FORM
```

You cannot use the DOS CD (change directory) command at the fake root to return to the original root. To change the fake root back to the original root, remap the drive.

## Directory Map Objects

A Directory Map object represents a particular directory in a file system. Directory Map objects can point to directories that contain frequently-used files such as applications.

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.

If the application's location in the directory structure changes, you can update the object instead of having to change all users' drive mappings.

## Optimizing Performance

This section contains the following topics for optimizing file system performance:

- ◆ [“File Compression” on page 14](#)
- ◆ [“Salvageable Files” on page 15](#)
- ◆ [“File Purging” on page 15](#)

## File Compression

One way to conserve disk space is to compress files. Use the following information as background for using file compression to optimize system performance:

- ◆ NetWare maintains the original version of a file during compression. When compression completes, NetWare replaces the original with the compressed version of the file, provided no errors occurred. If errors do occur during compression, NetWare leaves the original version intact.
- ◆ If you have a CD-ROM volume mounted as a volume, treat it as a read-only volume. Do not use file compression on it.
- ◆ 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 may deteriorate.
- ◆ You do not need to separate application files from data files to be compressed. You can use the SET command to preclude compression of frequently used applications. For instructions on how to use SET, see [SET](#) in the [Utilities Reference](#).
- ◆ Monitor compression activity via the SET command's compress screen parameter.
- ◆ Backup applications that use Novell Storage Management Services™ (SMS™) back up and restore compressed files. Other applications may decompress them.

## Salvageable Files

Salvageable files are files saved by NetWare, after being deleted by users, that can be salvaged (recovered).

Salvageable files are usually stored in the directory they were deleted from. If a user deletes that directory, the salvageable files are saved in a DELETED.SAV directory located in the volume's root directory.

The user can view a list of deleted files in a directory and recover files by using ConsoleOne™. For more information on salvaging files, see [Salvaging and Purging Deleted Files on NetWare Volumes](#) in the *ConsoleOne 1.3 User Guide*. Recovered files contain information about who deleted the files and when they were deleted.

Deleted files are saved until the user deliberately purges them or until the NetWare server runs out of disk allocation blocks on the volume.

## File Purging

When the NetWare server runs out of blocks, it purges deleted files beginning with the files that were the first deleted. Purged files cannot be salvaged.

Files and directories can also be purged as they are deleted. You can do this one of two ways:

- ◆ Use the SET command at the NetWare server to disable the salvageable file feature. For instructions on how to use SET, see [SET](#) in the *Utilities Reference*. You do this by setting the parameter named Immediate Purge of Deleted Files to ON. This increases performance, but at the cost of losing the salvageable file feature. The default for this parameter is OFF (this means that by default, files are salvaged when they are deleted instead of being purged immediately).
- ◆ Set the Purge attribute for individual files and directories. When a file is flagged with the Purge attribute, the file is purged when it is deleted.

When a directory is flagged with the Purge attribute, all files in that directory are purged when the directory is deleted. Such files and directories can't be recovered.

- ◆ Use ConsoleOne to manually purge individual files and directories. For instructions, see [Salvaging and Purging Deleted Files on NetWare Volumes](#) in the *ConsoleOne 1.3 User Guide*.

# Drive mapping

A drive mapping is a pointer to a location in the file system, represented as a letter assigned to a directory path on a volume.

A *path* includes the volume, directory, and any subdirectories leading to the file.

A drive mapping assigns a letter to a path so that the letter can be used instead of the complete path name.

Drive mappings can be temporary or permanent:

- ♦ *Permanent mappings*. To make drive mappings permanent so you can use them every time you log in, place MAP commands in your login script, or use the mapping functionality of your client software to make them permanent, so they will be reconnected every time you log in.
- ♦ *Temporary mappings*. To map a drive so you can use it during your current session, use the NetWare MAP utility from a DOS prompt, or use the mapping functionality of your client software. If you use MAP from a DOS prompt, the mapping is only valid until you log out.

For instructions on creating mappings, [Creating eDirectory Objects to Facilitate File Management](#) in the *ConsoleOne 1.3 User Guide*.

NetWare recognizes these types of drive mappings:

- ♦ “Local Drive Mappings” on page 16
- ♦ “Network Drive Mappings” on page 17
- ♦ “Network Search Drive Mappings” on page 17
- ♦ “Fake Root” on page 13
- ♦ “Directory Map Objects” on page 13

## Local Drive Mappings

Local drive mappings are paths to local media such as hard disk drives and floppy disk drives.

To change this default (for example, if you are using the NetWare DOS Requester, you need all of your drives mapped as DOS drives), use the DOS LASTDRIVE command in your workstation CONFIG.SYS file.



## Network Drive Mappings

Network drive mappings point to volumes and directories on the network. Normally, drives F: through Z: are used for network mappings. Each user can map drive letters to different directories.

To create a network drive mapping, use the MAP command.

## Network Search Drive Mappings

Network search drive mappings point to directories containing files such as applications or files.

Search drive mappings enable the system to locate a program even if it isn't located in the directory you're working in.

Search drive mappings are numbered, although they also have drive letters. For example, search drive 1 (or S1) may also be known as network drive Z:.

You can map up to 16 network search drives (letters K: through Z:, starting with Z:). You can't map a search drive and a regular network drive to the same letter.

When you request a file and the system can't find it in your current directory, the system looks in every directory a search drive is mapped to.

The system searches, following the numerical order of the search drives, until either the program file is found or can't be located.

**NOTE:** Search drive mappings aren't supported on OS/2 workstations. The search functionality is provided with the OS/2 PATH, LIBPATH, and DPATH commands.

## How NetWare Protects Network Data

NetWare protects data primarily by

- ◆ Maintaining duplicate file directories.
- ◆ Redirecting data from bad blocks to reliable blocks on the NetWare server's hard disk. See **Redirecting Bad Blocks** in the *NetWare Server Disks and Storage Devices Administration Guide*.
- ◆ Allowing you to mirror and duplex disks. See **Creating a Partition** in the *NetWare Server Disks and Storage Devices Administration Guide*.

# Security

Security is one of the most important aspects of file system organization. NDS rights and the file system's directory and file attributes allow you to determine who may access what, and whether that access amounts to being able to merely read a file or modify it.

To use the capabilities described in the NDS area of this documentation, you might want to organize your approach to designing an appropriately secure system by doing the following:

1. Clustering directories and files according to who needs access to them. In other words, use the directory structure to reflect access requirements.

For example, you can structure the hierarchy of directories in such a way as to take advantage of the inheritance aspect of rights.

Rights can be associated with volumes, directories, and files as a safeguard against deletion or modification by users. Directory and file attributes can also be used to control what users can do.

2. Subdividing the user community into groups on the basis of related access requirements.

Users grouped by role (relative to file access) can be assigned ownership of directories and files, and users whose roles vary can be assigned rights on the basis of equivalence.

Users needing a particular kind of access to certain directories and files can be grouped so that appropriate access belongs to the group (and, consequently, to each member).

# 2 Planning

This chapter presents a simple example of a network directory structure to help you plan your file system. Based on the example and the accompanying information, you can begin to design a directory hierarchy suitable to your own needs.

**NOTE:** You use the Novell® Storage Services™ (NSS) file system to meet your file system needs. NSS lets you create and maintain NSS logical volumes along with traditional NetWare® volumes. For information on Novell Storage Services file system and its advantages, see the [Overview](#) in the *Novell Storage Services Administration User Guide*.

## Planning Directory Structures

This section gives some basic information and suggestions about organizing directories and files to facilitate network administration:

- ♦ “[Directories Created during NetWare Installation](#)” on page 19
- ♦ “[Application Directories](#)” on page 20
- ♦ “[Data Directories](#)” on page 22
- ♦ “[Home or Username Directories](#)” on page 23

## Directories Created during NetWare Installation

During installation, the following directories pertaining to the file system are automatically created.

- ♦ **SYS:DELETED.SAV** contains files that have been deleted from deleted directories. Salvageable files are usually stored in the directory they were deleted from. If a directory is deleted, the salvageable files from the

deleted directory are moved to the DELETED.SAV directory. Deleted files can be salvaged if they have not yet been purged.

- ♦ **SYS:ETC** contains sample files to help you configure the server.
- ♦ **SYS:LOGIN** contains the programs necessary for users to log in to the network, such as LOGIN.EXE. An NLS subdirectory contains subdirectories for login message files for each supported language.
- ♦ **SYS:MAIL** might or might not contain subdirectories or files. If you upgrade your server from a previous version of the NetWare operating system, existing users might still have directories here for their login scripts, but their login scripts will become properties of the new User objects. If you create new users after upgrading, the new users will not have directories in SYS:MAIL.
- ♦ **SYS:SYSTEM** contains NetWare operating system files as well as NetWare utilities and programs for the network administrator. SYS:SYSTEM also has an NLS subdirectory, containing subdirectories for each supported language for message files.
- ♦ **SYS:PUBLIC** allows general access to the network and contains NetWare utilities and programs for network users. SYS:PUBLIC has subdirectories for Windows 95 and Windows NT/2000, as well as a subdirectory called NLS, containing the message files for utilities.

## Application Directories

For ease of management, you should keep application files in a directory apart from the data files. Since the application programs do not normally change, you can keep one set of application files on backup media and skip the application directories when you do network backups.

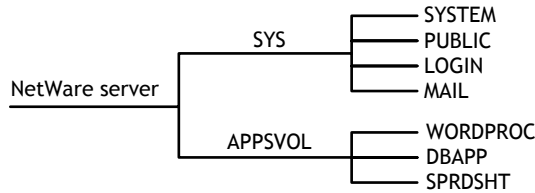
When creating application directories, you should also consider issues related to ease of distribution, installation, and operational control for network applications. For more information on creating application directories, see the *ZENworks for Desktops 3.2* (<http://www.novell.com/documentation/lg/zdfs/index.html>).

Although you can access applications from local drives, installing them on the network provides convenient access. Several structures are possible for application directories:

- ♦ Create a separate volume for applications with a separate directory for each application off the root. Make trustee assignments for each application. Then go into the system or profile login script and map a search drive to each application.

The following figure shows this type of directory structure:

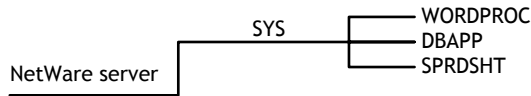
**Figure 2 Application Volume**



- ◆ Create a separate directory off volume SYS: for each application. Make trustee assignments for each application. Then go into the system or profile login script and map a search drive to each application.

The following figure shows this type of directory structure.

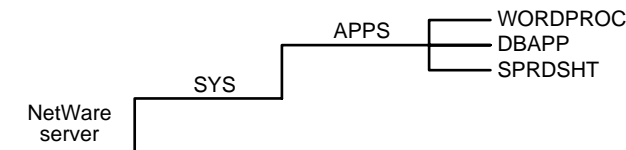
**Figure 3 Application Directory off Volume SYS:**



- ◆ Create a parent directory for applications with subdirectories for each application. Make trustee assignments for each application. Then go into the system or profile login script and map a search drive to each application.

The following figure shows this type of directory structure.

**Figure 4 Parent Directory for Applications**

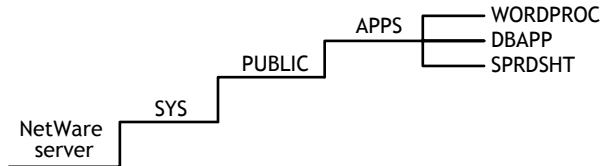


- ◆ Create a parent directory for applications in SYS:PUBLIC. Because users generally have Read and File Scan rights in SYS:PUBLIC, you do not need to make trustee assignments or map a search drive.

However, users can see and use all applications. Use this directory structure only if you want all users to have access to all applications.

The following figure shows this type of directory structure.

**Figure 5 Application Directory in SYS:PUBLIC**



Installing applications in SYS:PUBLIC is not recommended (unless you create a subdirectory for each application).

Mixing NetWare utilities with application program files complicates the file structure when you upgrade a network.

An application file might have the same filename as a NetWare utility file or another application's program file. If so, one file overwrites the other because two files with the same filename cannot coexist in a directory.

**NOTE:** Some applications write files to the root. For security reasons you do not want users working at the root level. Therefore, use MAP ROOT to map a drive to a fake root—a directory or subdirectory in which the user can be assigned rights. For more information about fake roots, see [“Fake Root” on page 13](#).

## Data Directories

These are work directories for groups and users to keep work files in. You can also create a directory to transfer files between directories on the network.

Although data can be created and stored in a home or user directory, when data is stored in a user's directory, no other user (except network administrators or managers assigned file rights) can access it.

Data directories also allow users to share data, create work directories, and make trustee assignments for groups or users who need access to these directories.

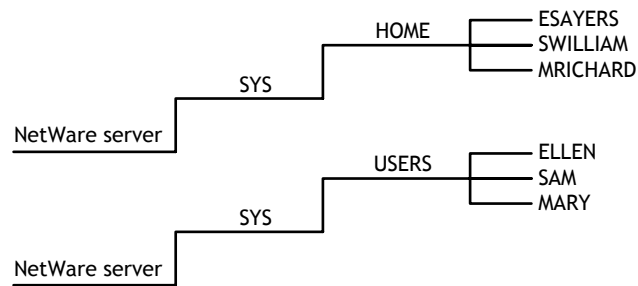
## Home or Username Directories

To provide personal workspace for users, create home or username directories.

You can create a parent directory in volume SYS: called HOME or USERS. Or, you can create a separate HOME or USERS volume. Then you can create a subdirectory for each user.

The name of each subdirectory should be the username. Usernames can be up to 47 characters, but DOS displays only 8 characters in a one-level directory name. The following figure shows this type of directory structure.

**Figure 6** Home or Username Directories







# 3

## Setting Up the File System

The procedures in this section of the documentation focus on specific tasks pertaining to system administration. Procedures involve various utilities and applications that are provided in the *Novell Storage Services Administration Guide*.

The most productive use of file system documentation is to identify the task you want to complete and find an appropriate procedure. Then use links associated with the procedure to increase your understanding of other ways in which applications and utilities can be used.

This chapter focuses primarily on setting up directories, files, drives, and security. For instructions on creating both NSS and traditional partitions and volumes, see [Setting Up and Configuring Novell Storage Services](#) in the *Novell Storage Services Administration Guide*. System administrators are concerned with all of these aspects of the file system. Users will be concerned with drive mapping and some of the file and directory procedures.

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

By default, traditional NetWare volumes support DOS naming conventions. To store non-DOS files, such as for Macintosh\* or UNIX\* on a NetWare® volume, you must load the appropriate name space NetWare Loadable Module™ (NLM™) program and add the name space support to that volume.

**NOTE:** 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 logical volume. Logical volumes accommodate all name spaces and require less memory to mount than traditional volumes. For instructions on converting traditional volumes to logical volumes, see [Volume Conversion](#) in the *Novell Storage Services Administration Guide*.

The following name space NLM programs are available with NetWare:

- ♦ MAC.NAM (Macintosh)
- ♦ LONG.NAM (OS/2, Windows 95/NT/2000)
- ♦ NFS.NAM (NFS).

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

## Calculating Memory Required for Name Space Support

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

$$0.032 \times \text{volume\_size (in MB)} / \text{block\_size (in MB)}$$

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:

$$0.032 \times 100 \text{ MB} / 4 = 0.8 \text{ MB}$$

## Adding a Name Space

### Prerequisites

- A mounted traditional volume
- Sufficient memory

- 1** Enter the following server console command to load the appropriate name space:

```
LOAD [path]name_space
```

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

```
LOAD MAC.NAM
```

- 2** Enter the following command to add name space support to the volume:

```
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 will store the non-DOS files.

**NOTE:** You need to add name spaces only once, not each time you start the server.

**3** To verify that the name space loaded, enter the following command:

**VOLUMES**

This shows a list of all name spaces.

## Removing Name Spaces

You can remove the name space by deleting the volume and re-creating it, or by using VREPAIR. For instructions on using VREPAIR, see [Repairing a Traditional Volume](#) in the *Novell Storage Services Administration Guide*.

## Creating a Directory

You create directories in ConsoleOne™. To create a directory, you must have the Create right for the directory which the new directory will be added to.

Creating a root directory requires that you select the volume object instead of selecting a parent directory.

For some ideas for directory structures, see [“Planning Directory Structures” on page 19](#).

For instructions on creating directories, see [Creating a File or Folder](#) in the *ConsoleOne 1.3 Guide*.

## Creating a Directory Map Object

A Directory Map object represents a particular directory in a file system. Directory Map objects can point to directories that contain frequently used files such as applications.

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.

For instructions on creating a Directory Map Object, see [Creating a Directory Map Object](#) in the *Console One 1.3 User Guide*. For an example of how you could use Directory Map objects to reduce maintenance of login scripts, see [“Using Directory Map Objects” on page 41](#).

# Mapping Drives

## Mapping Drives in Windows 95/98, NT/2000

See Common Networking Tasks in the *Novell Client for Windows* documentation.

## Mapping Drives in DOS

Use the command to map drives and search drives to network directories. For a general description of the MAP command, see **MAP** in *Utilities Reference*.

## Distributing Applications on the Network

You can install various types of network applications, such as word processing or spreadsheet programs, to make them available to users. When installing applications, keep the following in mind:

- ◆ You need the Create right in the directory where you will be installing the application.
- ◆ Follow the instructions in the application's documentation for installing the application onto a network.
- ◆ Make sure the application is designed for network (multiuser) use, and that you observe any licensing restrictions on the number of users who can access the application.
- ◆ To allow users to access network-based applications, map search drives to the directories that contain these applications. To make these search drives permanent, place them in login scripts, which are executed when users log in.
- ◆ If the application requires that it be installed at the root of a volume, but you would rather install it in a subdirectory for security reasons, you can map the directory to a fake root. For more information about distributing applications on the network, see *ZENworks for Desktops 3.2* (<http://www.novell.com/documentation/lg/zdfs/index.html>).

- ◆ You can create a Directory Map object that points to an application directory.

Directory Map objects are useful in login scripts. Instead of mapping a drive to a specific directory path, you map a drive to a Directory Map object that points to a directory. For information about Directory Map objects, see “[Directory Map Objects](#)” on page 13.

Then, if you change the directory path, you need to change only the Directory Map object’s definition.

- ◆ Keeping program files separate from data files can simplify application management. Because program files seldom change, for example, you can keep a backup of program files separate from a data file backup so that network backup procedures need focus only on data directories.

Data directories for shared data files also provide for single-point backup and management of shared files.

## Security: Rights to Files and Directories

File system security includes assigning trustee rights. To set up rights, see the following:

- ◆ “[Description of Directory and File Rights](#)” on page 30
- ◆ “[Adding a Trustee to a Directory or File](#)” on page 30
- ◆ “[Viewing/Modifying the Inherited Rights Filter for Directories and Files](#)” on page 30

For information on how to use Windows 95 to set rights, see Common Networking Tasks in *Novell Client for Windows 95* (<http://www.novell.com/documentation/>).

For Windows NT, see NetWare File Security in *Novell Client for Windows NT* (<http://www.novell.com/documentation/>).

## Description of Directory and File Rights

Trustee rights determine the access users have to directories and files. These rights can be given to NDS object such as User objects, Group objects, Organizational Role objects, or container objects.

The following table contains a list and description of rights.

**Table 1** Trustee Rights

Right	Allows you to
Access Control	Add and remove trustees and change rights to directories and files.
Create	Create subdirectories and files.
Erase	Delete directories and files.
File Scan	View directory and file names in the file system structure.
Modify	Rename directories and files, and change file attributes.
Read	Open and read files, and open, read, and execute applications.
Supervisor	Grant and exercise all rights listed in this table.
Write	Open, write to, and modify a file.

## Adding a Trustee to a Directory or File

### Prerequisites

- The Access Control right to the directory or file you want to add the trustee to.

You can add, modify, or delete a trustee in a directory or file using ConsoleOne. For instructions on adding, modifying, and deleting trustees, see [Administering Rights](#) the *Console One 1.3 User Guide*.

## Viewing/Modifying the Inherited Rights Filter for Directories and Files

You can view and modify the Inherited Rights Filter (IRF) for a directory or file using ConsoleOne. For instructions on viewing or modifying the Inherited Rights Filter, see [Administering Rights](#) the *Console One 1.3 User Guide*.

# Setting Directory or File Attributes

To set up attributes and change owners for a directory or file, see the following:

- ♦ “Description of Directory and File Attributes” on page 31
- ♦ “Changing Attributes of a Directory or File” on page 33
- ♦ “Changing Attributes of a Directory or File” on page 33

For information on how to use Windows 95 to set directory or file attributes, see Common Networking Tasks in *Novell Client for Windows 95* (<http://www.novell.com/documentation/>).

## Description of Directory and File Attributes

Directory and file attributes assign properties to individual directories or files. Some attributes are meaningful only when applied at the file level, but some apply to both the directory and the file levels.

Be careful when assigning directory and file attributes. The attribute applies to all users.

For example, if you assign the Delete Inhibit attribute to a file, no one, including the owner of the file or the network administrator, can delete the file. But any trustee with the Modify right can change the attribute to allow deletion.

**Table 2** Directory and File Attributes

Attribute code	Description	Applies to
A	Archive Needed identifies files that have been modified since the last backup. This attribute is assigned automatically.	Files only
Ci	Copy Inhibit prevents Macintosh users from copying a file. This attribute overrides Read and File Scan trustee rights.	Files only
Dc	Do not Compress keeps data from being compressed. This attribute overrides settings for automatic compression of files not accessed within a specified number of days.	Directories and files
Di	Delete Inhibit means that the directory or file cannot be deleted. This attribute overrides the Erase trustee right.	Directories and files

<b>Attribute code</b>	<b>Description</b>	<b>Applies to</b>
Dm	Do not Migrate prevents directories and files from being migrated from the server's hard disk to another storage medium.	Directories and files
Ds	Do not Suballocate prevents data from being suballocated.	Files only
H	The Hidden attribute hides directories and files so they cannot be listed using the DIR command.	Directories and files
I	Index allows large files to be accessed quickly by indexing files with more than 64 File Allocation Table (FAT) entries. This attribute is set automatically.	Files only
Ic	Immediate Compress sets data to be compressed as soon as a file is closed. If applied to a directory, every file in the directory is compressed as each file is closed.	Directories and files
N	Normal indicates the Read/Write attribute is assigned and the Shareable attribute is not. This is the default attribute assignment for all new files.	Directories and files
P	Purge flags a directory or file to be erased from the system as soon as it is deleted. Purged directories and files cannot be recovered.	Directories and files
Ri	Rename Inhibit prevents the directory or file name from being modified.	Directories and files
Ro	Read Only prevents a file from being modified. This attribute automatically sets Delete Inhibit and Rename Inhibit.	Files only
Rw	Read/Write allows you to write to a file. All files are created with this attribute.	Files only
Sh	Shareable allows more than one user to access the file at the same time. This attribute is usually used with Read Only.	Files only
Sy	The System attribute hides the directory or file so it cannot be seen by using the DIR command. System is normally used with operating system files, such as DOS system files.	Directories and files
T	Transactional allows a file to be tracked and protected by the Transaction Tracking System (TTS).	Files only



---

Attribute code	Description	Applies to
X	The Execute Only attribute prevents the file from being copied, modified, or backed up. It does allow renaming. The only way to remove this attribute is to delete the file. Use the attribute for program files such as .EXE or .COM. Make a copy of a file before you flag it as Execute Only, so you can replace the file if it becomes corrupted.	Files only

---

## Changing Attributes of a Directory or File

You can change the attributes of a directory or file with ConsoleOne. For instructions on changing attributes of a directory or file, see [Managing Files and Folders on NetWare Volumes](#) the *Console One 1.3 User Guide*.

For a list of attributes, see “[Description of Directory and File Attributes](#)” on [page 31](#).



# 4

## Optimizing File System Performance

This chapter on file system optimization focuses exclusively on tasks for the network administrator. Procedures in this section pertain primarily to disk space utilization, and affect performance only as space utilization affects network performance.

### Saving Disk Space with File Compression

- ♦ “Enabling File Compression” on page 35
- ♦ “Disabling File Compression” on page 36
- ♦ “Setting File Compression Attributes” on page 36
- ♦ “Suspending File Compression” on page 37

### Enabling File Compression

You can conserve disk space by compressing files. You choose to compress files when you create volumes. However, once you enable file compression for a volume, you cannot turn it off. For more information on file compression, see “File Compression” on page 14.

**IMPORTANT:** Do not use file compression on a CD-ROM volume.

You do not need to separate applications from data for file compression. This is unnecessary because the SET parameter named Days Untouched Before Compression can eliminate the compression of applications that are used regularly. 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.

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 will be saved by compression, or if the size difference does not meet the value specified by the SET parameter named Minimum Percentage Compression Gain, the file is not compressed. For a general description of the SET command, see **SET** in *Utilities Reference*.

For a file to be uncompressed, there must be enough free space on the volume to accommodate the uncompressed file size.

For instructions on setting file compression for volumes, directories, and files, see “**Setting File Compression Attributes**” on page 36.

For instructions on enabling or file compression, see **Creating a Traditional Volume** in the *Novell Storage Services Administration Guide*.

## Disabling File Compression

File compression is enabled and disabled at the volume level.

If you do not enable file compression when you create a volume, you can subsequently enable it using the SET utility. Once enabled, however, 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 a general description of the SET command, see **SET** in *Utilities Reference*.

## Setting File Compression Attributes

To set file compression attributes for a volume (including enabling compression), use SET for instructions on using SET for the file compression attributes, see “**Using SET to Set File Compression Attributes for Volumes**” on page 36.

### Using SET to Set File Compression Attributes for Volumes

Use SET to set file compression attributes for an entire volume. File compression SET parameters do not affect the volumes file compression is disabled on.

**IMPORTANT:** Do not use file compression on a CD-ROM volume.

To change SET parameters, execute the SET command at the server console prompt.

The following list identifies SET command parameters that affect file compression. The settings apply to all files and directories in compression-enabled volumes on the server. For the function and range of values associated with each SET parameter, see **SET** in *Utilities Reference*.

- ◆ 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

## Suspending File Compression

Use SET command's Enable File Compression parameter to temporarily suspend file compression for a volume. For instructions on using SET to suspend file compression, see **SET** in *Utilities Reference*.

You can also use the MONITOR command to change file compression parameters. For a general description of MONITOR, see **MONITOR** in the *Utilities Reference*.

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

## Saving Disk Space with File Purging

You can conserve disk space by purging files from volumes. For information and instructions on purging files, see **Deleting NSS Pools or Logical Volumes** in the *Novell Storage Services Administration Guide*.

You can purge files automatically using SET. For a general description of the SET command, see **SET** in *Utilities Reference*.

## 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 **Creating a Traditional Volume** in the *Novell Storage Services Administration Guide*.

## Enhancing Disk Response Time With Disk Striping

For a heavily used volume, you can improve disk response time by distributing volume segments across multiple disks (disk striping). This configuration option is called Redundant Array of Inexpensive Devices (RAID). For background information and instructions, see **Creating a RAID Device** in the *Novell Storage Services Administration Guide*.

If one of the disks fails, the entire volume becomes unavailable. Therefore, you should mirror or duplex drives containing spanned volumes.

If a disk containing a spanned volume fails, the entire volume must be restored from a backup across all segments before you can use it again.

The most effective way to distribute volume segments is to do so equally across the disks. Do not simply fill up a disk, add another, add another, etc.

# 5

## Managing

The procedures in the Managing section of the file system documentation pertain to network administrators and users. Procedures for viewing directory and file information, copying, moving, and other routine functions are of interest to users as well as system administrators. Procedures pertaining to volume management and the protection of network data necessarily belong to network administration.

This chapter includes information about viewing and managing directories and files. It also refers you to the directory and file management procedures in ConsoleOne™. Information about Creating and managing partitions and volumes is provided in the For more information about NSS, see [Introducing Novell Storage Services](#) in the *Novell Storage Services Administration Guide*.

## Managing Volumes

Novell Storage Services™ (NSS) is the primary storage and file system. It supports large volumes and files. Information about the following sections are in the Setting Up and Configuring chapter of the *Novell Storage Services Administration Guide*:

- ♦ [Creating a Logical Volume](#)
- ♦ [Creating a Traditional Volume](#)
- ♦ [Renaming a Logical Volume](#)
- ♦ [Renaming a Traditional Volume](#)
- ♦ [Increasing the Size of a Traditional Volume](#)
- ♦ [Dismounting a Traditional Volume](#)
- ♦ [Deleting NSS Pools or Logical Volumes](#)

- ♦ [Deleting a Traditional Volume](#)
- ♦ [Repairing a Traditional Volume](#)
- ♦ [Volume Conversion](#)

## Viewing Directory and File Information

You can see extended information about a directory or file using ConsoleOne. For instructions on viewing directory and File information, see [Viewing or Modifying Information about a File or Folder](#) in the *ConsoleOne 1.3 User Guide*.

You can see file information such as

- ♦ Owner and trustees
- ♦ Attributes, effective rights, and the Inherited Rights Filter (IRF)
- ♦ Name space
- ♦ File size
- ♦ Creation, access, archive, and modify dates

You can see directory information such as

- ♦ Owner and trustees
- ♦ Creation date and time
- ♦ Attributes, effective rights, and the IRF
- ♦ Disk space limitations

## Copying or Moving Directories and Files

You can copy and move files and directories, as you do objects from your desktop application.

The destination can be in another browser containing the same tree or a different tree.

To copy or move files, you must have File Scan rights to the source directory, and you must have the Create right to the destination directory.

To move files, you must also have the Erase right to the source directory, because moving files includes deleting them from the source directory. For



instructions on copying directories and files, see [Viewing or Modifying Information about a File or Folder](#) in the *ConsoleOne 1.3 User Guide*.

## 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 hard 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 User Guide*.

## Protecting Data: Disk Mirroring and Duplexing

NetWare<sup>®</sup> allows you to protect your data with disk mirroring or duplexing.

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 is the preferred method since two channels rarely fail simultaneously.

Do not mirror a partition on a disk to another partition on the same disk. Doing so is not fault tolerant, even though mirroring allows it.

With multiple partitions on a disk, any partition can be mirrored to any other disk. This provides considerable flexibility in protecting partitions.

For information on mirroring and duplexing partitions, see [Creating a Partition](#) in the *Novell Storage Services Administration Guide*.

**IMPORTANT:** Access the ConsoleOne online help for important information about mirroring partitions.

## Using Directory Map Objects

A Directory Map object represents a particular directory in the file system. For more information about Directory Map Objects, see [“Directory Map Objects” on page 13](#).

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 User Guide*.

If you have a directory that contains a word processor, you will probably map a search drive to that directory in any login scripts you create. If you should later upgrade to the word processor and rename the directory, you would have to change the mapping in every login script where that search mapping appears.

By using a Directory Map object, you could avoid having to make 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 *Utilities Reference*.

When users log in, their 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 have to change the MAP command in the login script because the MAP command still indicates the correct Directory Map object.

# 6

## Troubleshooting

This chapter presents various troubleshooting procedures for resolving problems with traditional volume including the following:

- ◆ [Resolving File I/O Errors \(page 43\)](#)
- ◆ [Resolving Volume I/O Errors \(page 44\)](#)
- ◆ [Resolving Problems When the Server Hangs after Mounting Last Volume \(page 44\)](#)
- ◆ [Resolving Problems When No Volumes Mount \(page 45\)](#)
- ◆ [Resolving Problems When Only Some Volumes Mount \(page 45\)](#)
- ◆ [Resolving Disk Error Problems When a Volume Is Mounting \(page 46\)](#)
- ◆ [Resolving Memory Errors When a Volume Is Mounting \(page 46\)](#)
- ◆ [Resolving Volume Mounting Problems Because of Corrupted Directory Entry Tables or File Allocation Tables \(page 47\)](#)
- ◆ [Resolving Volume Mounting Problems Because of Name Space Module \(page 48\)](#)
- ◆ [Other Troubleshooting Information \(page 49\)](#)

### 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 will 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 volume SYS:. 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).
- ◆ Enter **SET IMMEDIATE PURGE OF DELETED FILES = ON** at the console prompt and 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.

## Resolving Volume I/O Errors

To resolve a volume I/O errors 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 VREPAIR.
- ◆ 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.

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

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

- ◆ The server network board is not initializing when the server is started because the board is not installed or seated correctly.
- ◆ The server network board is not configured correctly.

To resolve problems when the server stops processing after mounting the last volume, perform the following actions or ensure that the following conditions exist:

- ◆ 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 and then stops processing if the network is not cabled or terminated properly.
- ◆ Check the network boards in all workstations for correct node address settings.

## Resolving Problems When No Volumes Mount

Volume SYS: contains the NetWare system files and the NLM programs.

If volume SYS: 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 eDirectory tree.

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

- ◆ Volume SYS: is corrupted.
- ◆ The hard disk containing volume SYS: has failed.
- ◆ The cable or power to the external hard 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 hard disks. Replace any faulty components.
- ◆ Replace the hard disk containing volume SYS:..
  - ◆ Create the partitions and volume SYS:.
  - ◆ Restore the data from a backup copy.

## 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 driver for external drives are not be loaded

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

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

## 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, do the following:

- ◆ 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 file allocation table (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 VREPAIR.

## 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.

If you combine directories so that most directories have about 32 files and you then purge the deleted subdirectories and files, you will free up memory.

- ◆ Calculate how much memory you need and add memory to the server.
- ◆ Remove the recently added name space support.

**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.

Have all users log out and 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 VREPAIR and 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. Then exit to the main menu. Run VREPAIR > Repair a Volume on the volume that would not mount.

## Resolving Volume Mounting Problems Because of Corrupted Directory Entry Tables or File Allocation Tables

To diagnose problems when mismatches exist in the duplicate copies of the file allocation table (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 hard 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:

- ◆ Run VREPAIR.
- ◆ Add a UPS system so that the server is shut down automatically when a power failure occurs.
- ◆ Replace faulty disks or controllers.

## Resolving Volume Mounting Problems Because of 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 and 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 VREPAIR and select Set VRepair Options. Then select the Remove Name Space Support from the Volume and Write All Directory and FAT Entries to Disk options. Then exit to the main menu. Run VREPAIR > Repair a Volume on the volume that would not mount.

## Other Troubleshooting Information

For other troubleshooting information on the traditional file system and server operating system, see [Troubleshooting the NetWare Server](#) in the *Server Operating System Administrator Guide*.

