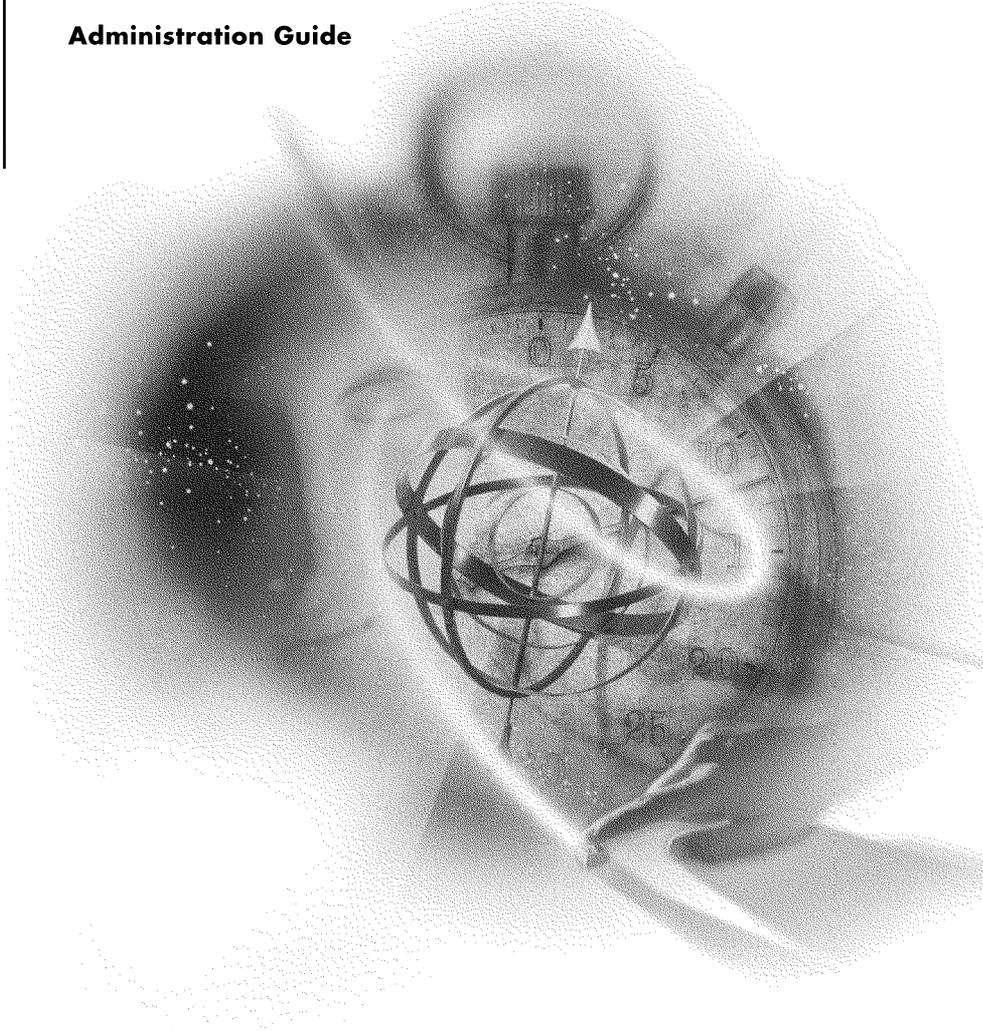**NetWare Server Operating System**

Administration Guide

NetWare 5.1

NETWORKING SOFTWARE

Novell®

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Server Operating System

Although it is frequently more convenient to refer to the computer where NetWare® resides as the server, the NetWare 5 server is the network operating system that is installed on a server class computer. NetWare 5 turns the computer into a high performance network platform that provides connectivity between workstations, printers, mass storage devices, and other networks such as the Internet. NetWare 5 also provides network users with a server platform for hosting Java applications.

The NetWare server manages the transmission of data among the network devices, stores and retrieves data from hard disks, manages one or more file systems, ensures data integrity, manages printers and printing, and allocates and manages memory.The NetWare server is designed to operate on either a uniprocessing or multiprocessing computer. For further information on the server, its console, and its performance, click any of the links below or click Understanding for more options.

If you are ready to begin installing the server, see NetWare 5.1 Installation Guide. If you are planning to use a multiprocessing computer as your server, see "New NetWare 5 Kernel" on page 14 for information on the higher level of support for multiprocessing.

NetWare 5 uses pure IP as its default communication protocol, but also supports IPX. If you choose IP, you can also choose to have passive IPX in Compatibility Mode. To decide which protocol to use, see NetWare Server Communications.

The NDS® database and the NDS tree are the foundation for convenient network administration. For more information, see Understanding and Planning NDS eDirectory in the *NDS eDirectory Administration Guide* in the NetWare 5.1 online documentation.

NetWare offers a choice of file systems—Novell Storage Services (NSS) advanced file system and NetWare's traditional file system. For more information, see Novell Storage Services Administration Guide and Traditional File Services Administration Guide.

For information about security services for your network, see Auditing the Network.

For information about NetWare's use of memory, see NetWare Server Memory.

For information about NetWare's use of disks and other storage devices, see NetWare Server Disks and Storage Devices.

1 Understanding

Server.exe, the principal executable for NetWare®, includes *bound-in* modules, such as those for Media Manager, NetWare Peripheral Architecture™ (NWPA), and the Link Support Layer™ (LSL). When server.exe is executed, the NetWare server is loaded into memory, takes control of the hardware resources, and begins to load its component modules.

NOTE: NetWare uses DOS as a cold boot loader. It does not run on top of DOS.

Because the system is modular, individual modules can be updated without replacing server.exe. A new module simply replaces the previous version.

NOTE: The directory in which server.exe is stored is called the startup directory or the boot directory. By default, server.exe is stored in the c:\nwserver directory. Updated modules may be copied to the startup directory where they will overwrite previous versions. Server.nlm, however, requires patches.

NetWare 5 is based on an integrated kernel. The new multiprocessing kernel (MPK) is completely multithreaded, supports pre-emption, and—as an integrated kernel—runs on both multiprocessor and uniprocessor systems. NetWare 5 has also been architected with an eye to the future—it supports as many as 32 processors.

Although NetWare 5.1 has minimum hardware requirements (see System Requirements in the *NetWare 5.1 Installation Guide* in the NetWare 5.1 online documentation), we recommend that you provide a high-performance hardware platform so you can get the full benefit of the power and scalability that NetWare 5.1 offers.

To ensure that no component of your system hampers the performance of any other, see also "Matching Performance Capabilities" on page 40.

For information about	See
NetWare 5 integrated kernel	
Server console security and interfaces	
Connections to server, licensing and authentication	
How the NetWare 5 server optimizes its own performance	
Java-based components of NetWare 5	

New NetWare 5 Kernel

The core of the NetWare 5® operating system is the new integrated kernel. MPK (multiprocessing kernel) manages threads, schedules processor resources, handles interrupts and exceptions, and manages access to memory and the I/O subsystems.

For explanations and descriptions, click:

The Run Queue

A *thread* is a stream of control that can execute its instructions independently. A simpler definition is that a thread is a unit of execution. It is not the code itself.

HINT: For more information on threads, see Bil Lewis and Daniel J. Berg's *Threads Primer: A Guide to Multithreaded Programming* © Sun Microsystems, Inc. Their definition of "thread" is quoted.

The kernel maintains a data structure called the run queue which contains threads that are in a state of readiness. In a uniprocessor system, there is only one run queue from which the processor can pick up threads for execution.

In a multiprocessing system where more than one processor is available, there is more than one possible solution. The distribution of threads to multiple processors could be handled by a global run queue (all processors sharing a single run queue) or by per-processor run queues (known also as local run queues or distributed run queues). Or by some combination of both.

To compare the two approaches:

- **Global run queue.** This approach to distributing threads has the advantage of automatic load balancing. The reason is that no processor remains idle as long as the run queue has threads ready. However, the global solution has the drawback of becoming a bottleneck as the number of processors increases in a system, although under certain scheduling policies (such as a real time scheduling policy), a global queue may be necessary.

- **Per-processor run queue.** This approach has the advantage of being able to exploit cache affinity—where threads are preferentially scheduled on the processor on which they last ran. In addition, this approach does not have the bottleneck problem associated with the global run queue approach.

  With local queues, however, it becomes necessary to ensure that the load on the processors—the number of threads in the queue—does not become severely imbalanced. A load balancing mechanism is required to handle load imbalances so that threads do not pile up at one processor while another processor remains idle.

The NetWare 5 kernel uses the per-processor run queue. As implemented, a processor can pick up threads for execution only from its local run queue. This makes the NetWare 5 scheduler highly scalable compared to an implementation using a global run queue. To address load imbalance, NetWare 5 uses a sophisticated load balancing algorithm.

Load Balancing

Two important requirements of any load balancing scheme are

- Stability. This means *not* overreacting to small load imbalances.

- Ability to distribute the processing load quickly.

The NetWare 5.1 scheduler handles the stability requirement by using a threshold. The threshold determines how much load imbalance is permitted in the system before the load balancing mechanism kicks in.

Because a low threshold value would have less tolerance for load imbalances than a higher value, the *lower value* could lead to excessive thread movement due to frequent load balancing. A *higher value* would have more tolerance for load imbalances, with the result that the load balancing mechanism would be triggered less often. However, an *optimum value* of the threshold would prevent excessive thread migration while addressing load imbalance only as needed.

The NetWare 5 scheduler periodically calculates the system-wide load and the mean load and uses the latter to compare loads and to determine whether an individual processor is overloaded or underloaded.

The load balancing threshold and the calculated mean load are then used to determine the high and low trigger loads.

- A processor is overloaded when its load exceeds the *high trigger load*.

- A processor is underloaded when it is below the *low trigger load*.

In this situation, the scheduler then moves threads from the overloaded processor to the underloaded processor with the result that the loads are balanced. See the following figure for an illustration of the relationship between the mean load, the load balancing threshold, and the high and low trigger loads.

Figure 1   Mean Load, Threshold, and High and Low Trigger Loads
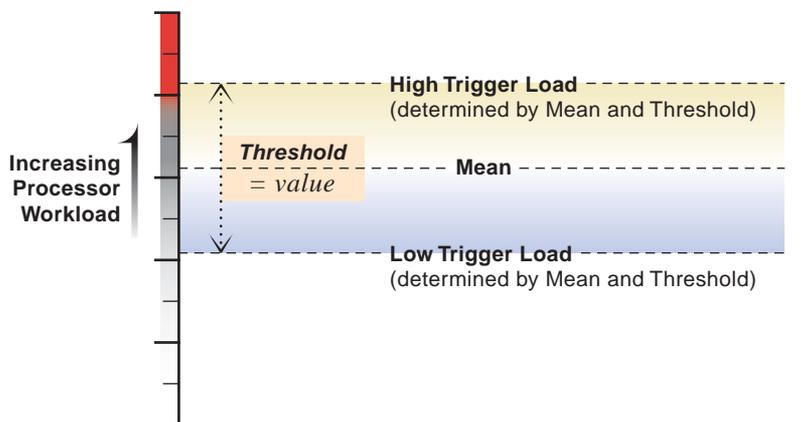
Without the margin provided by the threshold, threads would constantly move from one processor to another, thereby compromising the productivity of the system.

WARNING: Although the threshold is configurable, we strongly recommend that you retain the preset optimum value. If after careful consideration, you decide to modify the threshold, test in an isolated system before modifying the value for a production environment. If you modify the threshold, remember that you can always reset it at the optimum value.

To modify the threshold, access MONITOR's Available Options > Server Parameters > Multiprocessor > System Threshold. For the procedure, see .

Concurrency and Parallelism

NetWare® has always had threads (typically referred to as `processes') but has not exploited the potential for parallelism in multithreaded code. Multithreading enables multiple paths of parallel execution through the code path. A software developer identifies tasks that can be performed concurrently, that are not dependent on being performed in a fixed sequence, and provides the mechanisms for assigning tasks to multiple threads and for appropriate synchronization to protect data shared by the threads.

In a uniprocessor environment, multithreaded code allows threads to run concurrently. This means that one or more threads are active on the same processor. The threads appear to run at the same time—although they do not actually do so. One thread, for example, can be blocking while another thread is executing code. They are perceived as executing simultaneously because processors are very fast and time quanta are very small.

On the other hand, it is the availability of hardware systems with multiple processors that makes it possible to have multiple threads actually running at exactly the same time on different processors. When threads execute simultaneously on multiple processors, they are running in parallel. Multithreaded code allows more efficient processor utilization by exploiting parallelism.

NetWare has supported concurrency but not parallelism—until now. With NetWare 5, applications can be written to exploit the parallelism available in multiprocessor (MP) hardware and the support for parallelism in the server operating system, and your system will benefit from the performance gains and scaling that server applications such as Oracle* Database Server and GroupWise® provide.

NOTE: A single binary supports both uniprocessor and multiprocessor systems precisely because the NetWare 5 kernel is multithreaded.

Pre-emption

NetWare 5 allows for pre-emption of threads, within constraints. New NetWare modules may be written to be pre-emptible.

NOTE: Earlier versions of NetWare implemented a nonpre-emptible round-robin (FIFO) scheduling policy where threads were scheduled to run in the order that they entered the run queue. On a uniprocessor system, NetWare is fast and very efficient.

For an application to exploit pre-emption, the code must be explicitly written to be pre-emptible. Critical sections boundaries may be marked by calling scheduler API functions that signal a critical code section. Critical sectioning is used to keep program data in a consistent state and to prevent code that doesn't lend itself to concurrent execution from executing concurrently. A thread cannot be pre-empted when it is in a critical section.

By default, if an application thread is running, it will not be pre-empted until the following conditions are met.

- The code where the thread is running must be pre-emptible. This is indicated by a flag set in the module's NLM file format. When the code is loaded into memory, the memory pages are flagged as pre-emptible.

- The thread cannot be in a critical section of the code.

- The thread has run long enough to qualify for pre-emption. The scheduler checks the elapsed time with every tick.

Support for pre-emption provides

- An execution environment that allows simplified application development. Developers can rely on the scheduler to handle pre-emption.

- A mechanism that prevents ill-behaved modules from monopolizing the processor.

The kernel itself is not pre-emptible.

Platform Support Module

Besides NetWare 5, all that is necessary to enable multiprocessing on a multiprocessor computer is the Platform Support Module (PSM) for your specific hardware platform and NetWare 5. No other modules are required.

NOTE: Use the PSMs that come in the NetWare 5 red box and that load during installation. The PSMs for NetWare 4.11 smp.nlm do not work for NetWare 5.

The PSM is an interrupt abstraction for multiple processors. As a device driver for the processors, it shields NetWare from hardware-dependent or platform-specific details. It enables secondary processors to be brought online and taken offline.

During installation, NetWare 5 detects multiple processors by reading the MP configuration table in BIOS and then determines which of the available NetWare 5 Platform Support Modules (PSMs) matches the MP hardware platform.

The network administrator then has the option to load the PSM or to run NetWare on Processor 0 only. The installation program will modify the startup.ncf file to load the PSM whenever the server is started.

In the NetWare 5 red box, Novell® provides mps14.psm which supports any hardware platform that complies with the Intel* Multiprocessor Specification 1.1 and 1.4. Compaq* also provides a PSM for its system requirements. Contact Tricord* for information on their PSM for NetWare 5.

In addition to scalability, NetWare 5 multiprocessing offers these benefits:

- Backward compatibility for applications written for NetWare 4.11 smp.nlm. In fact, NetWare 5 supports everything written to CLIB in previous releases. Older application code is simply funneled to processor 0.

- An integrated multiprocessing kernel (MPK) that also supports uniprocessing. One binary runs on both uniprocessor and multiprocessor hardware platforms.

- Kernel support for pre-emption. (Applications must be explicitly enabled by their developers to take advantage of the kernel's pre-emption support.).

- Platform support for MPK in a single platform support module.

The Server Console

The server console includes the monitor and keyboard where you view and control NetWare® server activity. From the server console you can

- Shut down and restart the server

- Load and unload NLM programs

- Monitor server performance

- View network traffic

- Set configuration parameters

- Edit configuration and other batch files

- Send messages

You can use the Novell® remote console utility, rconsole.exe, to set up a workstation as a server console. Or you can use the Java-based utility, RConsoleJ. See both Using DOS-Based Remote Console and Using Java-Based Remote Console (RConsoleJ) in *Remote Server Management* in the NetWare 5.1 online documentation.

The server console also supports more than one interface:

- **Command line.** Commands can be entered at the server console prompt, with or without options and parameters. The prompt is indicated by a colon (:). LOAD is an example of a server console command.

- **Character-based menuing.** Utilities use menus, lists, and portals. The key utility for monitoring the server—MONITOR—is an example of this interface.

- **Java-based GUI**. The new Servertop application ConsoleOne uses a graphical user interface.

When NetWare 5 is installed, the server console defaults to the ConsoleOne screen. However, you can toggle between screens when you need access to the command line or if you choose to keep MONITOR loaded. For the procedure for toggling between console screens, see "Accessing MONITOR" on page 65.

HINT: For information on bypassing the server splash screen or replacing it with a screen of your own choice, see SERVER in *Utilities Reference* in the NetWare 5.1 online documentation.

Be aware of the following console security issues:

- **Unauthorized access of the server console.** Control keyboard access by requiring the use of a password. (See *NetWare Server Security* in the NetWare 5.1 online documentation.)

  Use the SECURE CONSOLE command to secure your console against breaches of security. (See SECURE CONSOLE in *Utilities Reference* in the NetWare 5.1 online documentation.)

You can also use the screen saver and console-locking features in SCRSAVER. (See SCRSAVER in *Utilities Reference* in the NetWare 5.1 online documentation.)

 ◆ **Software tampering.** An expert could use the built-in debugger to disable or bypass the security system. To prevent this, use SECURE CONSOLE.

 ◆ **Hardware tampering.** Keep your server in a secure location. An intruder could disable the power-on password or remove hard disks to access data.

Network Connections

NetWare® licenses client connections in large multiples, such as 100, 250, or 1000 licenses per server.

A network login passes through three connection phases until a license is consumed:

 ◆ **Not Logged-In**. Unlicensed—the connection does not count against connection licenses—and is not authenticated to NDS®. This can be the initial attachment of the client before authentication or licensing occurs or it could also indicate users who have logged out, leaving a Not Logged-In connection to the server on which a default drive was located.

  Unlicensed connections are indicated by an asterisk (*) in MONITOR's Active Connection list.

 ◆ **Authenticated**. Unlicensed and authenticated only to NDS. This connection cannot—in its current state—access other resources on the server. This type of connection occurs most often when users are browsing the NDS tree to view objects located in an NDS replica held on another server. This type of connection can also be from other NetWare servers carrying out NDS synchronization or time synchronization activities.

  As unlicensed connections, they do not consume licenses, and as such, they are indicated by an asterisk (*) in MONITOR's Active Connection list.

 ◆ **Authenticated/Licensed**. Both authenticated and licensed. Also called a *Normal* connection. The authenticated state comes about when the user enters a valid username and password. From this information, NDS establishes the user's identity and authenticates the user via the security methods found in its encryption algorithms. However, a user's connection

doesn't actually become authenticated and licensed until the user requests access to the server's file and print services. Typically, such requests are initially performed through the container, profile, or user login script.

Once the user is authenticated during the initial login process, background authentication establishes connections to any other servers that are specified in the login scripts. An authenticated/licensed connection consumes one of the connection licenses. Most connections are of this type.

All connections described as licensed or unlicensed, authenticated or Not Logged-In, are considered active connections and are tracked by the server. See .

NetWare 5 connection licenses are managed through Novell Licensing Services. You can increase your NetWare 5 connections by purchasing additional licenses and installing them using NLS Manager or Netware Administrator. For more information, contact your Novell Authorized Reseller.

NetWare Is Self-Tuning

In many ways, NetWare® is a self-tuning system. It allocates resources according to need and availability.

Typically, new resources are not immediately allocated when a request is received. The operating system waits a specified amount of time to see if existing resources become available to service the demand. If resources become available, no new resources are allocated. If they do not become available within the time limit, then new resources are allocated.

The time limit ensures that sudden, infrequent peaks of server activity do not result in permanently allocating unneeded resources.

For example, when the server is started, all free memory is assigned to file caching. However, as demand increases for other resources (such as directory cache buffers), the number of available file cache buffers decreases.

The following parameters are dynamically configured by the operating system:

- Directory cache buffers
- File locks
- Kernel processes

- Kernel semaphores

- Load balancing for multiple processors

- Maximum number of open files

- Memory for NLM™ programs

- Router/server advertising

- Routing buffers

- Service processes

- TTS transactions

- Turbo FAT index tables

In addition to the parameters configured by NetWare, you can adjust the value of many server parameters to optimize the server for your network. See "Setting Server Parameter Values" on page 43 or refer to MONITOR and SET in *Utilities Reference* in the NetWare 5.1 online documentation.

Java-Based Components of NetWare 5

NetWare 5 includes the following Java-based components:

- "The Novell JVM for NetWare and the Just In Time Compiler" on page 24, along with the Java Naming Directory Interface (JNDI) and Java Class Libraries (NJCL) for Novell, enable you to run Java-based applets and applications on the server.

- "The Novell Object Request Broker (ORB)" on page 24 enables you to run CORBA*-compliant Java-based applications on the server.

The Java-based components are installed automatically when you install NetWare 5. To use Java-based components, you must use TCP/IP. Instructions for using Java-based components are found in "Managing" on page 51.

The following NetWare 5.1 components may also be of interest:

- Java-based ConsoleOne™ server management utility. See *ConsoleOne User Guide* or ConsoleOne in *Utilities Reference* in the NetWare 5.1 online documentation.

- NetWare Enterprise Web Server. See NetWare Enterprise Web Server Administration Guide in the NetWare 5.1 online documentation.

The Novell JVM for NetWare and the Just In Time Compiler

The Novell JVM for NetWare is comprised of several NLM programs that let the NetWare server run Java-based applications and applets, including multi-threaded applications and applications that use a graphical interface.

The JVM can run any application certified as 100% Pure Java, as described by JavaSoft*. However, applications that are not 100% Pure Java must be ported to NetWare.

NetWare 5 includes the Symantec* Just In Time Compiler (JIT) to improve the performance of Java-based applications.

NetWare 5 also includes drivers for popular video cards and a utility that automatically recognizes and configures your video card during NetWare 5 installation.

To run the Novell JVM, you need a minimum of 48 MB RAM and at least 64 MB to run graphical applications. The more memory your server has, the more Java-based applications it can run.

For information about Java Class Libraries for Novell and the Java Naming Directory Interface (JNDI), download the Novell Developer Kit (NDK) from the Novell DeveloperNet Web site (http://developer.novell.com/ndk/netware.htm#java).

The Novell Object Request Broker (ORB)

The Common Object Request Broker Architecture (CORBA) is a specification adopted by the Object Management Group (OMG), a consortium of platform vendors, ISVs, and end users. The CORBA specification describes a software bus, called an Object Request Broker (ORB), that provides an infrastructure for distributed object computing.

NetWare 5 includes the server component of the Novell ORB, based on VisiBroker for NetWare. The Novell ORB server component supports the execution and management of distributed objects on the NetWare 5 server. The Novell ORB requires the TCP/IP protocol and DNS naming services.

For information about loading the Novell ORB on the server, see .

To load and run CORBA-compliant applications on the network or to provide a development environment for CORBA applications, you will need the Novell Developers Kit (NDK).

The NDK contains the client component of the Novell ORB, development tools, and online documentation for developing and administering VisiBroker for NetWare applications.

You can download a copy of the NDK free of charge from the Novell DeveloperNet Web site (http://www.developer.novell.com/ndk) or contact your Novell Authorized Reseller.

2 Setting Up

For information about installing a NetWare® server, including hardware and software requirements and installation instructions, see *NetWare 5.1 Installation Guide* in the NetWare 5.1 online documentation.

For information about migrating from IPX™ to TCP/IP, see Migrating IPX to IP in *NetWare Server Communications* in the NetWare 5.1 online documentation.

After installation, you might want to use these setup procedures:

The server's default language is English, but the server and the clients can use different languages. For information about the various localized components and procedures for changing them, see

Changing the Server's Software Configuration

After installing NetWare®, you can make changes, including

- Changing time synchronization. See *Network Time Management Guide* in the NetWare 5.1 online documentation.

- Adding or changing volumes. See *Traditional File Services Administration Guide* in the NetWare 5.1 online documentation.

- Modifying the Directory tree. See Directory Services *Understanding NDS* or *NDS eDirectory Administration Guide* in the NetWare 5.1 online documentation.

Before changing the server's configuration, view the current configuration by entering the CONFIG command at the server console prompt:

```
CONFIG
```

The CONFIG command displays the following information:

- Server name, internal network number, server uptime.

- Hardware settings, node (station) addresses, external network number of the cabling scheme, board name, frame type, and communication protocol for each network board.

- The server's NDS® tree and bindery context.

- On some systems, CONFIG might display information about NetWare Loadable Modules™ (NLM™ programs). The kind and amount of NLM information depends on the system.

See CONFIG in *Utilities Reference* in the NetWare 5.1 online documentation.

Copying Additional NetWare Files after Installation

If necessary, you can copy files from the NetWare CD-ROM or another server after installation. Use the Copy Files Options of NWCONFIG. Follow this procedure.

Prerequisites

❑ NetWare installation CD-ROM

Procedure

1 At the server console prompt, enter

```
[LOAD] NWCONFIG
```

2 Select Copy Files Options.

The system displays a box containing the default source path from which the files will be copied.

3 Press Enter to accept the default path, or press F3 to specify a different path.

If you press F3, the system displays a prompt with the current source path. Backspace to delete the path and enter the new path.

Once you have specified the source path, the system displays the prompt Specify a server boot path:. This is the destination directory—the location to which the files will be copied. This directory must be the boot directory.

4 Enter the path to the boot directory.

The system displays a list of file groups. An X next to each group means the group is preselected.

5 Delete the X next to any group(s) you do not want to copy.

To delete the X, use the arrow keys to move the cursor to the desired group and press Enter.

To reselect a group, move the cursor to the group and press Enter again.

6 When finished selecting groups, press F10.

The system copies the files.

See NWCONFIG in *Utilities Reference* in the NetWare 5.1 online documentation.

Installing, Uninstalling, and Configuring a Server Product

The NWCONFIG utility allows you to install, uninstall, and configure other products such as name space modules and NLM™ programs.

If you have questions during the installation or configuration of a product, refer to the documentation that came with the product.

Some products might not have configuration or uninstall options. A message explaining this is displayed if you try to perform unsupported operations.

1 At the server console prompt, enter

`[LOAD] NWCONFIG`

2 Select Product Options > View/Configure/Remove an Installed Product.

The list of Currently Installed Products appears. If no products are currently installed, the list is empty.

3 Do one of the following:

- ◆ To install a product, press Insert and follow the prompts.

- ◆ To uninstall a product, select the product from the list and press Delete.

- ◆ To set configuration options for a product, select the product from the list and follow the prompts.

For more information, see NWCONFIG in *Utilities Reference* in the NetWare 5.1 online documentation.

Changing the Language NetWare Uses

The default language for NetWare® is English, but other languages are available. To change the language of your NetWare server and its NLM™ programs, see the following sections:

Code Pages

A code page is a table storing a character set supporting one or more language scripts. When you press a key on a keyboard (a letter, symbol, or number), the computer receives a numeric code that represents that keystroke. Code pages store these numeric codes. Many personal computer operating systems support multiple code pages and allow you to switch among them.

For example, DOS uses code page 437 for several languages that use Roman alphabetical characters, including English, French, and German, but requires code page 850 for Portuguese. DOS code page 850 (Portuguese) removes the symbol for f (franc) and inserts an (O acute). Different computer operating systems use different code pages for the same language. For example, DOS uses code page 437 for English, but Windows 95 uses code page 1252.

In a single-byte code page, up to 256 codes are available to represent lower and upper-case letters, numbers, punctuation marks, and all the mathematical symbols on your keyboard.

However, 256 codes are not sufficient to represent all the letters and characters used in the writing systems of every language. Some non-alphabetic writing systems, such as Chinese, Japanese, and Korean, contain thousands of characters and require a double-byte code page.

Differences between single-byte and double-byte code pages usually cause display and readability problems. For example, a document created with Windows 95 in Japan is probably created with code page 932. The same document will not look the same when displayed on a Windows 95 computer using code page 1252 in the United States . Unrecognized characters will be replaced with a symbol such as a heart. In the past, these substituted characters might cause a database such as NDS™ to fail to recognize objects.

To help resolve these problems, a convention, called Unicode*, has been adopted.

Using Unicode

Unicode is a 16-bit character representation, defined by the Unicode Consortium, that supports up to 65,536 unique characters. Unicode allows the characters for multiple languages to be represented using a single Unicode representation.

Any character that your code page does not understand is substituted in your display by the 4-digit hexadecimal value of the Unicode character, surrounded by square brackets, for example: [00FF]

Because NDS supports Unicode, substituted characters do not prevent NDS from recognizing an object. For example, your company's European office might create an Organizational Unit object to represent Finance in western Europe. They might use DOS code page 852 to make the generic currency symbol a part of the object name (OU=¤W-Euro).

When this object is accessed in the United States, using DOS code page 437 or Windows 95 code page 1252, the currency symbol (¤) is replaced by square brackets surrounding the Unicode number for the currency symbol, [00A4]. NDS recognizes the Unicode number, so the object can still be opened and accessed.

However, the object name (containing the square brackets and unicode number) will be difficult for users to understand. If the name is too difficult to interpret, the only solution is to determine which code page was used to create the object, then view the object using that code page. Changing code pages can be troublesome; see "Changing Code Pages" on page 36 for guidelines.

The following table shows ranges of Unicode numbers, with a description of each range and a list of code pages that might be used to view the character correctly. However, switching to one of the suggested code pages does not guarantee that you will see the correct results. For example, characters in the range 4E00-9FFF (Han Ideographs) are used in Japan, China, and Korea. But switching to code page 932 (Japanese) does not display the character correctly if the character is used only in China.

The most reliable way to determine the character is to refer to the Unicode Standard, Version 2.0. Access the Unicode World Wide Web site for more information: http://www.unicode.org. The web site also includes charts of Unicode characters.

Table 1   Unicode Ranges, Descriptions, and Code Pages

Unicode Range	Description	Geographical Region	Windows Code Pages	DOS Code Pages
0080 - 00FF	Extended Latin	Western Europe		437, 850,860, 863, 865
0100 - 01FF	Extended Latin	Central Europe	1250, 1257	852, 775
0300 - 03FF	Greek	Greece	1253	737
0400 - 04FF	Cyrillic	Russia	1251	855, 866
0590 - 05FF	Hebrew	Israel	1255	862
0600 - 06FF	Arabic	Middle East	1256	864
2500 - 26FF	Line Drawing and Graphics	N/A	N/A	Most DOS code pages
4E00 - 95FF	Han Ideographs	Far East	932, 936, 949, 950	932, 936, 949, 950
AC00 - D7FF	Hangul Syllables	Korea	949	949

Unicode Range	Description	Geographical Region	Windows Code Pages	DOS Code Pages
FE70 - FEFF	Arabic Presentation Forms	Middle East	N/A	864
FF00 - FFEF	Full and Half Width Variants	Far East	932, 936, 949, 950	932, 936, 949, 950

Changing Server Message Files

English is the default language for both the NetWare® operating system and its NLM™ programs and utilities.

You specified a language for the server when you installed it. To change the server language later, you must first copy new language files to the server, then set the server to the new language and restart the server.

Prerequisites

❑ Installation CD-ROM or access to another NetWare server containing the language files

Procedure

NOTE: This procedure requires you to restart the server because executing server.exe sets the server language.

1 If you are copying the files from the NetWare installation CD-ROM, insert the CD.

2 At the server console prompt, enter

`[LOAD] NWCONFIG`

3 Select Product Options > Choose an Item or Product Listed Above > Install an Additional Server Language.

The screen displays a box containing the path from which you last installed files. Make sure this path is to the language files. The language files on the NetWare CD are located at:

Drive or volume:`\NW50\INSTALL\`*current_language*

4 If the path is correct, press Enter; if the path is incorrect, press F3 and type in the correct path to the language files.

If you are installing the files from another server, type the path to that server; the system might prompt you for a user name and password. Follow the prompts.

The system displays a window listing groups of language files.

5 Use the arrow keys to move the cursor to the language you want to install and press Enter.

The system marks the selected language with an X. You can specify several languages, if desired.

To deselect a language, move the cursor to the language and press Enter again.

6 When you have finished selecting languages, press F10.

The system copies the selected language files.

7 Press Esc until the Other Installation Items/Products menu is displayed.

8 Select Change Server Language.

The screen displays a box containing the path from which you last installed files.

9 Press Enter to accept the path.

The system displays a menu listing the available languages.

10 Select the desired language from the menu.

If this is the first time you have changed the language, the system displays a prompt specifying the default destination where the language files are to be placed. The location is the default boot directory, c:\nwserver.

The language files must be placed in your boot directory.

11 Accept the default or type the path to your boot directory.

Once you specify the boot directory, the system loads the language files.

12 Restart the server for the change to take effect.

See NWCONFIG in *Utilities Reference* in the NetWare 5.1 online documentation.

Changing NLM Message Files

Use the LANGUAGE command to change the language for subsequently loaded NLM™ programs. The LANGUAGE command does not change the language for currently loaded modules.

IMPORTANT: If you change the NLM language without changing the server language, the NLM still displays some character strings and screen titles in the server language. For consistent language display, you should change the server language as explained in the section, "Changing Server Message Files" on page 33.

1 At the server console prompt, enter

   LANGUAGE LIST

   The server displays a list of languages and their ID numbers. Not all languages in the list are currently supported.

2 Note the name or number of the language you want to use.

3 At the server console prompt, enter

   LANGUAGE *Language_name* |*number*

   Any subsequently loaded NLM programs will be displayed in the new language.

See LANGUAGE in *Utilities Reference* in the NetWare 5.1 online documentation.

Changing the Server Keyboard Type

NetWare® allows you to use keyboard types other than U.S. English by loading the KEYB utility. The language you specify with KEYB must match the language of your keyboard, not the server language. The keyboard type can be changed without restarting the server.

IMPORTANT: Changing the keyboard type causes some of the keys on your keyboard to represent different characters. Do not use this command unless you have the appropriate keyboard for the language you are specifying, and you are familiar with the keyboard's use. Otherwise, you might not know which keys to use to change the keyboard back to its original language.

1 At the server console prompt, enter

   [LOAD] KEYB

2 From the list of keyboard types, find the keyboard type that matches the one you are using.

3 To change the keyboard type to match your keyboard, enter

`[LOAD] KEYB <keyboard_type>`

For example,

`[LOAD] KEYB GERMANY`

See KEYB in *Utilities Reference* in the NetWare 5.1 online documentation.

Changing Code Pages

Changing code pages on the NetWare® server or on DOS can usually be done while the computer is operating. However, changing code pages on a Windows 3.1*x* or a Windows 95 workstation might require installing additional software and restarting Windows. For background information about Unicode and other code pages, see "Code Pages" on page 30.

To change the code page on . . .	Do the following . . .
NetWare Server	At the server console prompt, type CHARSET CP*xxx* where *xxx* is the number of the code page you want to load. The following code pages are supported: 437, 737, 850, 852, 855, 857, 860, 861, 863, 865, 866, 869.
DOS	Follow instructions that come with the DOS operating system.

To change the code page on . . .	Do the following . . .
Windows 3.1*x*, Windows 95, Windows NT	Follow instructions that come with the operating system. You might be required to install a new set of Unicode translation tables, found on the NetWare product CD. You will need the following: ◆ UNI_*newpage#.platform*: Translates the new code page to Unicode and Unicode to the new code page ◆ UNI_MON.*platform*: Converts characters to lower case to facilitate comparisons ◆ UNI_UPR.*platform*: Handles upper case characters Platform extensions include: .W16 (Windows 3.1*x*) .W32 (Windows 95, Windows NT) .DOS (DOS)

See CHARSET in *Utilities Reference* in the NetWare 5.1 online documentation.

3 Optimizing

Optimizing the NetWare® server requires staying up-to-date with Novell® Technical Support (http://support.novell.com/).

Make sure that you install the latest patches, updated modules and drivers for NetWare 5.1 and for third-party components. See "Applying Patches" on page 40 for information on where and how to obtain the most recent operating system updates. Then patch your server before you optimize.

Optimizing the server also requires isolating and resolving bottlenecks. (Bottlenecks are never really eliminated—they just move from one component to another.) Because your system is constrained by its worst-performing components, be sure that your hardware components are well matched for power and potential performance. Upgrade poorly performing components as soon as possible. See "Matching Performance Capabilities" on page 40.

Although NetWare® is largely self-tuning and provides excellent performance off the shelf, some parameters can be tweaked to improve performance. When your server is patched, the modules and drivers updated, and your hardware components are matched and upgraded, see "Setting Server Parameter Values" on page 43 for information on server defaults and settable parameters.

To identify where you can adjust the value of a server parameter and tune your server for its particular processing load, see "Monitoring the NetWare Server" on page 65.

Protocols can also create bottlenecks. See how the tips in "Minimizing Replication Traffic" on page 50 and "Service Advertising" on page 50 can help reduce network traffic.

Applying Patches

Novell® makes every attempt to solve problems in the NetWare® operating system software by periodically releasing updates you can install on your server. The latest operating system update contains all previous updates, so be sure to install the most current file. It will keep your operating system current.

The latest operating system updates can be found at the following locations:

- In the patch lists on Novell's technical support World Wide Web site http://support.novell.com. If you have an internet connection, click on the Novell logo on the documentation browser to access http://support.novell.com.

- By File Transfer Protocol (FTP): Anonymous FTP to ftp.novell.com.

- By Gopher: gopher.novell.com.

- On the Novell Support Encyclopedia™ (NSEPro™): Released monthly on CD-ROM and sent to subscribers.

Review the NetWare README file for information about installing NetWare patches.

Matching Performance Capabilities

Each component's performance characteristics can have an effect on the system's performance as a whole. Bottlenecks can be created by a great number of subcomponents and component interactions. Protocols create bottlenecks. Specific software functionality creates bottlenecks. In fact, every part and process of a system is a potential bottleneck. However, it's important to keep in mind that only one bottleneck—the system's weakest point—can exist at one time.

Another point to remember is that all systems have a weak point somewhere. Your goal is to match the performance capabilities of your system's components in such a way that no single component hampers the performance of any other component. The following figure shows a system with matched components.

Figure 2   A Well-Designed System

a,b,c,d,e represent the performance capabilities
of each system component
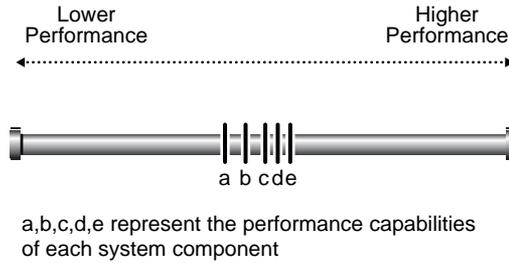
Note that all components in a well-designed system are within the same range of performance. But in this case, a less than optimum component is cost effective. The components are so closely matched that upgrading the lower-end component *a* would not increase performance enough to make it worth the cost.

The following figure shows a poorly designed system with an inefficient mix of low- and high-performance components.

Figure 3   A Poorly Designed System

f,g,h,i,j represent the performance capabilities
of each system component
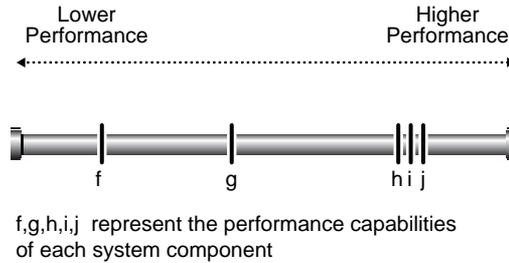
In this system, components *f* and *g* have performance characteristics that are considerably inferior to components *h*, *i*, and *j*. With component *f* as the bottleneck, components *h*, *i*, *j*, and even *g* are constrained by *f* so that they run much more slowly than their designs would otherwise permit. In this system, the bottleneck is significantly hampering the system's performance.

This is a poorly designed system because the high-performance components aren't able to perform anywhere near their full potential. In fact, because of the high-performance characteristics of *h*, *i*, and *j*, this system may have cost more than the system in Figure 3. But it cannot perform as well because of the greater disparity between its low- and high-performance components.

The unbalanced system in the following figure would benefit noticeably if you were to upgrade component *f* to the performance level of *g*. But if you were to upgrade *f* to a performance level beyond *g*—as shown in the following figure—all additional performance characteristics in *f* will be lost because the bottleneck moves to component *g*.

Figure 4   Moving the Bottleneck

Upgrade f (partial return on investment)
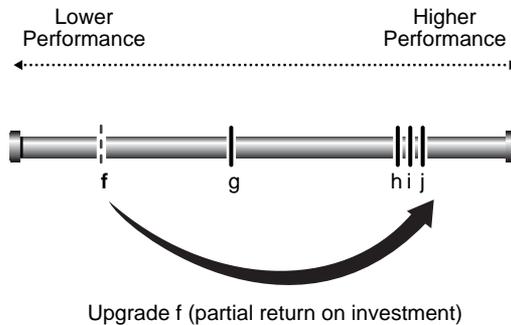
Thus you derive only a partial return on your investment in the upgrade. To accomplish more than moving the bottleneck, both components must be upgraded to the level of *h* before a full return on investment in *h*, *i*, and *j* can be reached.

It is useless to test any single component of a system to its fullest capacity without allowing for the possibility that another component is actually bottlenecking system performance. You can upgrade system components, but you won't see any significant improvement until you isolate the system bottleneck, assess its relationship to the performance characteristics of the entire system, and take appropriate action.

Bottleneck isolation is critical if you're building high-performance systems. You need to know how and where your system is bottlenecking. Moreover, you need to know how tightly that bottleneck is coupled with the performance characteristics of the rest of the system. If the poorly performing component is in a different performance category than the other components, you may obtain a greater return on investment by making the necessary upgrades to move the bottleneck to the highest possible performance level.

This discussion is taken from Performance Analysis: Isolating the Real Bottleneck in a System, in the January 1996 *AppNotes*™ (http://developer.novell.com/research/appnotes/1996/january/04/index.htm).

Setting the Load Balancing Threshold

The load balancing threshold applies only to multiprocessor servers. Through extensive testing, Novell has determined the optimum threshold for load balancing across multiple processors—it addresses serious load imbalance while avoiding excessive thread migration. Without that play in the load balancing mechanism, threads would constantly move from one processor to another.

The optimum threshold has been preset by Novell and, in most cases, it provides the most efficient processor utilization. Although we strongly recommend that you do not change the threshold, this value is configurable.

WARNING: Adjusting this threshold should be done only with considerable research and consultation. Experimenting with different threshold levels can best be done in an isolated test system. Do not experiment in a production environment. Remember that you can always return to the optimum setting.

Use this procedure to set the load balancing threshold.

1 In MONITOR's Available Options, select Server Parameters > Multiprocessor.

The multiprocessor parameters appear in the upper window.

2 Highlight the System Threshold field.

The pop-up window displays the current setting and the range of valid values. The optimum value is 1536.

3 To change the threshold setting, press Enter and type a new value in the field.

4 To exit MONITOR, press Alt + F10.

See MONITOR and SET Multiprocessor Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

Setting Server Parameter Values

Default values for NetWare® server parameters provide maximum performance for most systems. You should seldom need to modify these values. But when you need to modify the default values, we recommend that you read the topics listed here.

- "Understanding Server Defaults" on page 44
- "Accessing MONITOR" on page 65

Understanding Server Defaults

NetWare 5™ has been tuned for the specific duties of a network server. It has been thoroughly tested with software tools designed to identify inefficiencies so they can be eliminated. NetWare gives outstanding off-the-shelf performance.

NetWare is also self-tuning: the following parameters are dynamically configured by the operating system:

Packet receive buffers
File cache buffers
Directory cache buffers
Memory for NLM™ programs
Service processes
Kernel processes
Kernel semaphores
Load balancing for multiple processors
File locks
Maximum number of open files
Turbo FAT index tables
TTS transactions
Router/server advertising

To tune the server for its particular processing load, two utilities are available to check or set server parameter values:

- ◆ SET is a command line utility executed at the server console prompt. If you are an experienced NetWare administrator, you might find that using SET is faster for routine tuning as soon as you become familiar with the names of the server parameters. See SET in *Utilities Reference* in the NetWare 5.1 online documentation.

- ◆ MONITOR is a character-based menuing utility, the key NetWare tool for performance monitoring at the server level. MONITOR also allows you to configure SET parameters from its Server Parameters option. This means you can set server parameter values from within MONITOR without memorizing parameter names and their valid values. See MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation.

Parameter values are persistent and are stored in a hidden configuration file. A NetWare 5 server retains any settings that have been modified from the default values—even when it is taken down and then rebooted. The server will come up again with all the settings you have made to tune the server.

Finding Current Parameter Values from MONITOR

Use this procedure to explore parameter settings in MONITOR. For more information, see MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation.

1 At the server console prompt, enter

   MONITOR

2 Select Available Options > Server Parameters.

3 Press F1 for descriptions of the server parameter categories.

4 Press Esc to return to the menu of parameter categories.

5 Select a parameter category.

   The parameters are displayed in the upper window. As you highlight the field for each parameter, a popup window displays a description of the parameter, its current setting, and its range of valid values.

6 When you have finished, press Esc until you return to the Available Options menu.

Printing Current Parameter Values to a File

Settings for NetWare 5 server parameters are now persistent, whether you set them using MONITOR or whether you use the SET command. Nevertheless, you should record your optimum server configuration as part of documenting your network.

Use this procedure to write current values of settable parameters to the sys:\system\setcmds.cp file.

1 At the server console prompt, enter

MONITOR

2 Select Available Options > Server Parameters.

3 Press F3 to write the current parameter values to sys:\system\setcmds.cp, the default file for recording the value of settable parameters.

4 From a workstation, open the file with a text editor and print it.

Put the printout in the notebook that you use for documenting your network.

For more information, see MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation.

Finding Current Parameter Values with SET

Use this procedure to explore parameter settings in SET.

1 At the server console prompt, enter

SET

A numbered list of server parameter categories is displayed.

2 Enter the number associated with one of the categories.

A list of parameter names is displayed. The name of each parameter appears highlighted in white with the current setting highlighted in yellow. The information also includes the limits (or range of valid values), the .ncf file the parameter can be set in, and a brief description.

If necessary, press any key to display additional parameters in the same category. Press Escape to exit the category.

3 Run SET again to select another category.

For a complete description of SET parameters and guidelines for their use, see SET in *Utilities Reference* in the NetWare 5.1 online documentation.

Checking Current Parameter Values with DISPLAY ENVIRONMENT

You can also check parameter values by using two new console commands: DISPLAY ENVIRONMENT and DISPLAY MODIFIED ENVIRONMENT.

- The DISPLAY ENVIRONMENT command displays the current search paths and the current values of the settable server parameters. (Hidden parameters are not displayed.)

  At the server console prompt, enter

  `DISPLAY ENVIRONMENT`

  The name of each parameter appears highlighted in white. The current value appears in yellow. The limits (or range of valid values) and the default setting (if applicable) also appear.

- In comparison, the DISPLAY MODIFIED ENVIRONMENT displays *only* the server parameters that have values modified from the defaults.

  At the server console prompt, enter

  `DISPLAY MODIFIED ENVIRONMENT`

  The display is similar to that of DISPLAY ENVIRONMENT. The difference is that only modified parameters values are shown.

For more information, see DISPLAY ENVIRONMENT and DISPLAY MODIFIED ENVIRONMENT in *Utilities Reference* in the NetWare 5.1 online documentation.

When to Modify Defaults

NetWare 5 defaults were chosen after thorough testing to provide both excellent performance and system balance.

Before modifying defaults, use the MONITOR utility to track and log performance statistics. See "Accessing MONITOR" on page 65. You will also find the server log files useful in assessing the server's performance. See "Checking Server Error Logs" on page 84.

You can modify default values to

- Compensate temporarily for a poorly performing subsystem, allowing the server to remain in service.

- Resolve inefficiencies.

- Optimize performance and tune the server for its processing load.

For example, if your server has a slow hard disk or insufficient RAM, you can compensate temporarily by modifying defaults. The long-term solution is to replace the disk or to add RAM. See "Matching Performance Capabilities" on page 40.

When Not to Modify Defaults

If you were to modify some defaults, you could sacrifice the system's balance and performance.

NetWare 5 defaults have been chosen after thorough testing. We recommend, for example, that you do not modify the default settings of the Load Balancing Threshold or the Transaction Tracking parameters.

Restoring Default Values with RESET ENVIRONMENT

If you want to restore the default values of the settable server parameters, you can use the RESET ENVIRONMENT command.

When you run RESET ENVIRONMENT , you are prompted at each changed server parameter value.

At the server console prompt, enter

RESET ENVIRONMENT

When the first parameter with modified values appears, you can choose to reset *all* values to their defaults, or just reset the value of the parameter that is displayed. Or you can also skip to the next modified parameter.

For more information, see RESET ENVIRONMENT in *Utilities Reference* in the NetWare 5.1 online documentation.

Monitoring Dynamic Statistics

MONITOR reports many useful statistics and updates most of them every second with the return values from direct calls to the operating system. However, not all statistics are of equal value to the network administrator. The key dynamic statistics are displayed in MONITOR's General Information screen, which appears as soon as MONITOR is accessed. For a description of these statistics, see "What to Monitor and Why" on page 66.

ConsoleOne also allows you to monitor server performance. To access ConsoleOne from the server GUI, access the X Server -- Graphical Console > click Novell > ConsoleOne.

Using Optional Commands in Startup Files

During initialization, NetWare executes two server boot files that are created by the install process and that reside in the System directory:

- **startup.ncf**. This file executes first and loads the server's disk drivers, name spaces, and some SET parameters.

- **autoexec.ncf**. This file stores the server name and IPX™ internal network number, loads the LAN drivers and settings for the network boards, binds the protocol to the installed drivers, and loads other NLM™ programs.

-

    IMPORTANT: Even if you use IP, the internal network number stored in this file serves as a unique server ID. IP uses this number to provide passive IPX support called Compatibility Mode.

An .ncf file executes all the commands within it; the commands are not optional. However, you can make a command optional by placing a question mark (?) in front of it. For the procedure, see "Making a Command Optional in a Server Batch (.ncf) File" on page 60.

Using SET Commands in Startup Files

Remember that some SET commands can be executed only from the startup.ncf file. To find out whether a SET command must be executed in startup.ncf, refer to the explanations of the SET command parameters in SET in *Utilities Reference*.

When you install the server operating system, the installation process adds SET commands to the autoexec.ncf file—commands that control time zone and daylight savings time information, bindery context, and time server type.

You can add more SET commands to the autoexec.ncf file, if desired. Use NWCONFIG to modify server batch files. When the server is rebooted, any parameter values set by commands in the autoexec.ncf file override previous values for those parameters.

Minimizing Replication Traffic

Careful choice and placement of tree replicas can minimize replication traffic on the network.

- Make sure that the replica containing the user object is on the server nearest the user.

- Do not create more partition replicas than you need. The more replicas, the more traffic required to synchronize them all.

For more information about optimizing NDS®, see Managing Partitions and Replicas in *NDS eDirectory Administration Guide* in the NetWare 5.1 online documentation.

Service Advertising

For IPX internetworks, NetWare Link Services Protocol (NLSP) is a faster way to advertise network services than Service Advertising Protocol (SAP). Replace SAP/RIP segments of your network with NLSP segments. For more information about NLSP, see *NLSP Migration* in the NetWare 5.1 online documentation.

4 Managing

Managing the NetWare® server operating system involves such tasks as

Explains how to start the server, how to bring down the server through an orderly shutdown procedure that prevents data corruption, and how to restart the server after a brief shutdown.

Explains how to start and stop individual processors in a multiprocessing server. Only secondary processors can be handled this way.

Explains how to use .ncf batch files to load modules, execute console commands, and configure subsystems.

Explains how to access help for server utilities and console commands, discusses types of NLM programs, and provides instructions for loading and unloading an NLM.

Explains why and what to monitor and how to use the MONITOR utility.

Explains how to use utilities and commands for disabling login, clearing connections, controlling resource allocation, sending messages, and working with watchdog packets.

Explains how to set environment variables for Java, load and unload java.nlm, run Java-based applets and applications, and load and unload the Novell ORB.

- "Common Maintenance Tasks" on page 84

  Explains checking error logs, drives, cache statistics, free space, user accounts, the UPS, and includes documenting the network.

- "Preventive Maintenance Tasks" on page 88

  Explains how to prevent memory problems and power supply errors.

- "Using Accounting" on page 90

  Explains how to enable accounting on the server, set up charge rates, and view accounting statistics.

Starting and Stopping the Server

For information and procedures on starting the server, bringing it down using an orderly shutdown, and restarting the server without exiting to DOS, see

Starting the Server

To start the server, change to the startup directory (usually C:\nwserver) and enter the following at the DOS prompt:

SERVER

HINT: You may also place the command to execute server.exe in the DOS autoexec.bat file. Then, whenever the server computer is powered up, the server starts automatically.

When you execute server.exe, the Novell® logo is displayed. To prevent the Novell® logo (server splash screen) from displaying, you can load SERVER with the -nl (no logo) command option.

If the splash screen is active and you want to see a list of modules as they load, you can still display the system console screen by using the procedure below to toggle between server console screens.

1 Press Alt + Esc, tapping Esc until the system console screen is displayed.

A list of modules scrolls up the screen. If you have a color monitor, the color in which each module name is displayed indicates how the module is loaded.

Cyan (light blue) indicates a module is loaded by server.exe

Red indicates the module is loaded from the startup directory

White indicates a module loaded from the autoexec.ncf file

Purple indicates a module is loaded by other modules

2 After the server is running, you can display a list of all loaded modules by entering the following at the server console prompt:

MODULES

The module names are displayed in colors that represent the functional group they belong to, as described above.

For more information, see SERVER and MODULES in *Utilities Reference* in the NetWare 5.1 online documentation.

Bringing Down the Server

To ensure data integrity, use the DOWN command at the server console before turning off power to the server. DOWN writes all cache buffers to disk, closes all files, updates the appropriate Directory Entry Tables and File Allocation Tables, and exits the network.

If you want to bring the server down and then restart the server immediately, without exiting to DOS, use the RESTART SERVER command instead of DOWN.

NOTE: Bringing down or restarting a server during a remote console session terminates the session.

1 Use MONITOR to inform all users that they should close all files and log out.

   1a From Available Options, select Connections.

   1b Highlight each connection you want to inform and press F5 to mark it.

   1c Press F4 to display a Message Text window.

   1d Type the message and press Enter to send the message to the designated connections.

For example, you might send a message like this:

Please close files and log out from <*servername*>
Going down in 5 minutes

2 Execute one of the following commands at the server console prompt:

2a To bring down the server and exit to the local operating system, enter

`DOWN`

You can now shut off power to the system, if necessary.

2b To reboot the server without exiting to DOS, enter

`RESTART SERVER`

Although most modules, including those in protected address spaces, unload automatically when you down or restart the server, some modules might require that you unload them individually first. You can unload them manually with the UNLOAD command. Or you can create a batch file called shutdown.ncf and place the unload commands in it. If you create shutdown.ncf, it is executed automatically whenever you down or restart the server.

For more information about creating batch files, see "Using EDIT to Create and Edit Text and Batch Files" on page 57. For more information about these commands, see UNLOAD, DOWN, and RESTART SERVER in *Utilities Reference* in the NetWare 5.1 online documentation.

Starting and Stopping Processors

When the Platform Support Module (PSM) is loaded, NetWare 5 can start the secondary processors from the SET Auto Start Processors = ON command in the startup.ncf file.

HINT: Server console commands for processors affect only secondary processors. Processor 0 cannot be taken offline while the server is running.

You can start or stop secondary processors at any time while the server is running by using the console commands, START PROCESSORS and STOP PROCESSORS. (If you choose to start secondary processors manually, you can change the value to SET Auto Start Processors = OFF in the startup.ncf file.) When any secondary processor is stopped, the associated threads are automatically switched to another processor.

The procedures are

- "Starting Processors" on page 55
- "Displaying Processor Information" on page 55
- "Stopping Processors" on page 56

Starting Processors

To bring a specific secondary processor online, enter at the console prompt:

START PROCESSORS *n*

To specify two or more processors to be brought online (but not all secondary processors), enter at the console prompt:

START PROCESSORS *n n*

To bring all secondary processors online, enter at the console prompt:

START PROCESSORS

For more information, see START PROCESSORS in *Utilities Reference* in the NetWare 5.1 online documentation.

If you choose to start secondary processors automatically when the server boots, make sure the startup.ncf file contains the command, SET Auto Start Processors = ON.

Displaying Processor Information

To determine which processors are currently online, run the DISPLAY PROCESSORS command.

You can also obtain generic processor information from the console command, CPUCHECK. Per-processor statistics are also available from MONITOR's Available Options > Kernel > Processors.

Displaying Processor Status

Before stopping a secondary processor, determine whether it is online by entering at the console prompt:

DISPLAY PROCESSORS

Displaying Processor Information

To determine processor speed and other generic information, enter at the console prompt:

CPUCHECK

For example, with a single processor, the output for CPUCHECK might be similar to the following:

```
Processor Speed 199 MHZ, CPUID 52C:1BF
 Family 5, Model 2, Stepping C
```

For more information, see DISPLAY PROCESSORS, CPUCHECK, and MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation.

Stopping Processors

Processor 0 is the boot processor and cannot be taken offline.

If your server platform has multiple processors, use DISPLAY PROCESSORS to identify which processors are currently online and to obtain their ID numbers. See "Displaying Processor Information" on page 55.

To take a secondary processor offline, specify the processor number when you enter the command at the console prompt:

STOP PROCESSORS *n*

To specify more than one of the secondary processors to take offline, enter at the console prompt:

STOP PROCESSORS *n n*

To take all secondary processors offline, enter at the console prompt:

STOP PROCESSORS When a secondary processor is taken offline, the threads running on that processor are switched to another processor automatically.

For more information, see DISPLAY PROCESSORS and STOP PROCESSORS in *Utilities Reference* in the NetWare 5.1 online documentation.

Using Server Batch Files

Information on server batch files and procedures includes the following:

A server batch file is an executable file containing server console commands. You execute the file by entering its name at the server console prompt. NetWare then executes all the commands in the file in order.

By default the NetWare installation process creates two batch files that are always executed whenever the server is booted:

- **startup.ncf**—This file is executed first. It loads the server's disk drivers and name spaces, and can execute certain server parameters that cannot be executed anywhere else.

- **autoexec.ncf**—This file is executed after startup.ncf. It sets time synchronization parameters and the bindery context, stores the server name, loads the communication protocol, loads the LAN drivers and settings for the network boards, binds the protocol to the installed drivers, loads other NLM programs, and executes server parameters.

In addition, you can create a batch file called shutdown.ncf to execute commands whenever you down the server. The DOWN command executes shutdown.ncf automatically whenever the server is downed.

You can create any other batch files you need. Simply create a text file with a .ncf extension. Place NetWare console commands into the batch file in the order in which you want them executed.

Using EDIT to Create and Edit Text and Batch Files

NOTE: Each time you save the file, you can increase the file size by up to 4 KB.

1 At the server console prompt, enter

`[LOAD] EDIT [`*`path`*`]`

If you specify a path, include both the directory and file name. The file must be located on a mounted volume or on a local drive of the server.

If you do not specify a path, the system displays a prompt at which you can either enter the filename or display a browse window.

◆ To enter the filename, type either the complete file path (volume, directory, and file name) or just the filename, and press Enter.

If you enter only the filename, the system assumes a default location of sys:system.

If the file does not exist, EDIT displays a prompt that asks whether the file should be created. Choose Yes to create the new file or No to redisplay the file name prompt. If you choose Yes, EDIT displays a blank screen so you can enter text into the file.

◆ To display the browse window, press Insert.

To see the contents of a volume or directory, highlight the volume or directory name and press Enter. Use the arrow keys to scroll up and down the list of files and directories. To display a file, highlight the file name and press Enter.

2 Create or edit the file as needed.

The keys used to edit text are described in the following table.

Table 2   Editing Keys Available in the EDIT NLM

Key	Function
Arrow keys	Move up/down one line or left/right one character.
Backspace	Delete character to left of cursor.
<Ctrl>+<PageUp>	Move to beginning of document.
<Ctrl>+<PageDown>	Move to end of document.
<Delete>	Delete the character at the cursor location or delete blocked text.
<End>	Move to end of line.
<Esc>	Exit the file. You are prompted to save any changes.
<F5>	Highlight (block) text for copying or deleting. Toggles highlighting on and off.
<F6>	Copy highlighted (blocked) text to a buffer.

Key	Function
<Home>	Move cursor to beginning of line.
<Insert>	Insert text from buffer.
<PageUp>	Move up one page
<PageDown>	Move down one page.
<Tab>	Move cursor four spaces to the right.

3 When finished, press Esc. Select Yes to save the file or No to exit the file without saving changes.

The system redisplays the path name prompt.

4 To edit or create another file, enter the file path name. To redisplay the console prompt, press Esc.

See DOWN in *Utilities Reference* in the NetWare 5.1 online documentation.

Using NWCONFIG to Create and Edit Startup Batch Files

The following procedure explains how to use NWCONFIG to create or edit the startup.ncf and autoexec.ncf files.

1 At the server console prompt, enter

`[LOAD] NWCONFIG`

2 Choose NCF Files Options.

The system displays a menu containing options to create or edit both the startup.ncf and autoexec.ncf files and to convert a NetWare 3.1*x* autoexec.ncf file to NetWare 5.

3 Highlight the desired option and press Enter.

If you select the option to upgrade the NetWare 3.1*x* file, follow the screen prompts. NWCONFIG compares the file with the current NetWare configuration and makes changes to the file as necessary. You can edit the file before saving it.

If you select an option to edit one of the files, the selected file appears in a window.

If you select an option to create one of the files, the system displays the existing file, if there is one, in one window and a new file with default entries in another window, so you can compare the two.

The default entries include only essential contents of the file and reflect the current system setup. For example, the default entries for autoexec.ncf might include time zone information and load and bind commands for currently installed LAN drivers, but would not include custom configuration settings you have in the original file.

The cursor is active in the new file. Press Tab to toggle between the two files.

4 Edit the new or existing file as necessary.

Editing and navigation keystrokes are listed at the bottom of the screen. For additional help, press F1.

5 When finished, save the file by pressing F10 and selecting Yes when prompted. To exit without saving, press Alt + F10.

IMPORTANT: Each time you edit the autoexec.ncf file or the startup.ncf file, NetWare saves the previous version as autoncf.old or startncf.old.

NOTE: Changes to the file take effect once you reboot the server.

See NWCONFIG in *Utilities Reference* in the NetWare 5.1 online documentation.

Making a Command Optional in a Server Batch (.ncf) File

By default, an .ncf file executes all the commands within it. However, to make a command optional, you can place a question mark (?) in front of it.

The question mark causes the .ncf file to pause at the command and prompt you to execute it. You can respond either Yes or No. You can also specify a default response.

For example, the following line in the autoexec.ncf file causes the file to pause and ask whether to execute the LOAD MONITOR command:

```
? LOAD MONITOR
```

When the autoexec.ncf file is executed, it displays the following prompt:

```
LOAD MONITOR? y
```

The default response is Yes. If you do not respond to the prompt, the default response is executed after 10 seconds.

Both the default response and the time period are configurable.

Setting the Default Response

There are two ways to configure the default response to the command prompt:

- Specify the default on the command line in the .ncf file. Place the default response (a Y or N) immediately following the question mark. For example,

  ?N LOAD MONITOR

  In this example, the default response is N. If the user does not respond to the prompt, MONITOR is not loaded.

- Set the Command Line Prompt Default Choice parameter to either ON or OFF. ON means the default response is Y; OFF means the default response is N. The parameter is in MONITOR > Available Options > Server Parameters > Miscellaneous.

  The parameter setting is overridden by a default specified on the command line.

Setting the Time Period

To configure the time period before the default response is executed, set the Command Line Prompt Time Out parameter to a time in seconds. The parameter is in MONITOR > Available Options > Server Parameters > Miscellaneous. The default value is 10 seconds.

Changing Server Name and IPX Internal Address in Autoexec.ncf

The server's name is stored in the autoexec.ncf file. You can change the server name by editing the file. However, changing the server name in the autoexec.ncf file does not affect NDS® server objects. You must use NetWare Administrator to rename NetWare Server objects.

IMPORTANT: Be sure to use NetWare Administrator to update any references to the former server name in the Directory tree and in the timesync.cfg file.

The server's IPX internal network number is also stored in the autoexec.ncf file. Even if you use Novell's Native IP protocol, the internal network number

is used as a server ID and will still be stored in the autoexec.ncf file. Do not delete the number.

To change either the server name or the IPX internal network number in the autoexec.ncf file, use NWCONFIG or EDIT at the server console, and then reboot the server.

To use NWCONFIG to change the settings, see "Using NWCONFIG to Create and Edit Startup Batch Files" on page 59. To use EDIT, see "Using EDIT to Create and Edit Text and Batch Files" on page 57.

Using Server Utilities and Console Commands

Server utilities are NetWare Loadable Modules™ (NLM™ programs). Some NLM programs are loaded whenever you start the server, some are loaded by other NLM programs when they are needed, and some must be loaded manually.

Server console commands are executed by entering the command at the server console prompt.

HINT: When you enter a command at the server console prompt, the command is stored in the command queue. To repeat a command, press the Up-arrow key until the desired command is displayed. You can make changes to the command or press Enter to execute the command. Up to 16 commands can be saved in the queue.

For more information, see the following topics:

- "How to Access Help for Utilities and Console Commands" on page 62
- "Using NetWare Loadable Modules" on page 63
- "Loading and Unloading NetWare Loadable Modules" on page 64
- "Accessing MONITOR" on page 65

How to Access Help for Utilities and Console Commands

- For a complete list of all utilities and console commands, with descriptions, syntax, and examples, see *Utilities Reference* in the NetWare 5.1 online documentation.

- To display a list of console commands on the server console, enter the following at the server console prompt:

    HELP

- To see online help for a console command, enter either of the following at the server console prompt:

  HELP *command_name*

  or

  HELP ALL

- To see online help for an NLM that displays a menu, such as MONITOR, load the NLM, then press F1. You can also press F1 at subsequent menus, lists, and information windows.

Using NetWare Loadable Modules

When loaded, an NLM program is dynamically linked to the operating system, and the NetWare server allocates a portion of memory to it.

The amount of memory an NLM program uses depends on the task. Some tasks make calls that cause the operating system to allocate more memory. The NLM uses the memory to perform a task, and then returns control of the memory to the operating system when the NLM is unloaded. When an NLM is unloaded, all allocated resources are returned to the operating system.

NetWare has five types of NLM programs:

- **NWPA drivers** (.cdm and .ham extensions) control communication between the operating system and host adapters.

- **LAN drivers** (.lan extension) control communication between the operating system and the network boards.

  You can load and unload LAN drivers while the server is running and while users are logged in.

- **PSM modules** (.psm extension) provide support for multiple processors in server class computers.

- **Management utilities and server applications modules** (.nlm extension) allow you to monitor and change configuration options.

  For example, you can run VREPAIR on a dismounted volume or use MONITOR to view server statistics.

  Once you finish your tasks, you can unload the utility and free memory for other server functions.

- **Name space support** (.nam extension) allows non-DOS naming conventions to be stored in the directory and file naming system.

Some NLM programs, such as utilities, can be loaded, used, and then unloaded. Other NLM programs, such as LAN driver and disk driver NLMs, must be loaded every time the server is started.

NCF files (startup.ncf and autoexec.ncf) allow you to store commands that load NLM programs every time the NetWare server is started.

Most NLM programs included with NetWare are copied to sys:system during installation. As you acquire additional NLM programs, decide where you want to copy them. The operating system must be able to find the NLM programs when a LOAD command is issued.

NLM programs can be copied to any of the following areas:

- Sys:system directory
- Any network directory on the NetWare server
- A local drive of the NetWare server

For more information about using NLM programs, see LOAD, UNLOAD, and SEARCH in *Utilities Reference* in the NetWare 5.1 online documentation.

Loading and Unloading NetWare Loadable Modules

To load a NetWare Loadable Module (NLM), enter the following at the server console prompt:

**`[LOAD] [`*`path`*`]`*`NLM_name`*

- If the NLM is stored in the sys:system directory or if you have a server search path to the directory where the NLM resides, enter just the NLM name (instead of the complete path). For information about server search paths, see SEARCH in *Utilities Reference* in the NetWare 5.1 online documentation.
- If you want the NLM to be loaded whenever the server boots, add the command to autoexec.ncf.
- If you want the NLM to be displayed in a language other than English, see "Changing NLM Message Files" on page 35.

NOTE: In most cases you can load an NLM by entering just the name of the NLM at the console prompt . The exception is if there is a .ncf file of the same name as the NLM. In this case, you must use the LOAD command. Using the LOAD command tells the server to load the NLM instead of executing the file of the same name. For information about the LOAD command, see LOAD in *Utilities Reference* in the NetWare 5.1 online documentation.

To unload a NetWare Loadable Module (NLM), enter the following at the server console prompt:

UNLOAD *NLM_name*

To unload an NLM from a protected address space, enter the following at the server console prompt:

UNLOAD ADDRESS SPACE = *space_name module_name*

For more information about loading and unloading modules, see LOAD and UNLOAD in *Utilities Reference* in the NetWare 5.1 online documentation. For more information about unloading modules from protected address spaces, see Unloading Protected Address Spaces in *NetWare Server Memory* in the NetWare 5.1 online documentation.

Monitoring the NetWare Server

Monitoring the server allows you to

- ◆ Isolate performance bottlenecks
- ◆ Optimize server performance
- ◆ Troubleshoot and resolve server problems

MONITOR is the key NetWare® tool for performance monitoring at the server level. It runs in the NetWare kernel so that it can make calls directly to the operating system. Most statistics are updated every second.

You can also use the Java-based ConsoleOne for monitoring. For more information on using ConsoleOne, see *ConsoleOne User Guide* in the NetWare 5.1 online documentation.

Accessing MONITOR

- ◆ To load MONITOR at the console prompt, enter

    [LOAD] [path] MONITOR

    The LOAD command is necessary *only* if you have a batch file with the same name as the NLM. (Using the LOAD command indicates that MONITOR is a loadable module.)

    The path is specified only if you moved the utility from its default directory sys:system to a directory that does not have a search path.

- If MONITOR is running but is not the active screen at the console, there are two ways to toggle to the MONITOR screen:

  Press Alt + Esc. To cycle through other console screens, continue to hold Alt down and tap Esc until the current MONITOR screen reappears. Use the bar at the top of the screen for navigation.

  Or press Ctrl + Esc. A numbered list of available console screens appears. Enter the number for the NetWare 5 Console Monitor.

- To exit MONITOR, use either of the following procedures:

  Repeatedly press Esc until the Exit confirmation box appears. Then press Enter to return to the console prompt.

  Or to bring up the Exit confirmation box immediately, press Alt + F10. Then press Enter to return to the console prompt.

What to Monitor and Why

A monitoring utilitycan be overwhelming in the volume of information and statistics it provides. To simplify your access to key parameters, "MONITOR's General Information" on page 66 includes most of them on one screen, including performance indicators that pertain to memory utilization and disk I/O.

See "Monitoring Allocated Services" on page 69 for an explanation of the interaction of three types of configurable parameters that control dynamically allocated services. The guidelines allow you to be proactive in maintaining the level of service your users require.

"Other Information and Statistics to Monitor" on page 70 includes error logs, available free disk space, and users accounts. To be prepared for power supply interruptions, test your UPS (uninterruptable power system) periodically.

Becoming familiar with your server's day-to-day performance and its characteristic response to its unique load will help you to better interpret the information and statistics the monitoring utilities provide.

MONITOR's General Information

Most of the important performance indicators that can be used to track, diagnose, and resolve server problems appear in the Figure 5 on page 67. This window is displayed when you load MONITOR.

Figure 5   General Information Screen in MONITOR


```
NetWare 5 Console Monitor  5.15                NetWare Loadable Module
Server name: 'TS_BACK' in Directory tree 'DT_BACK'
Server version: NetWare Prototype 5.00 - Beta 3.0 (Build 972,   ) - May 20, 1
┌──────────────────────────────────────────────────┐
│                 General Information               │
│   Utilization:                           80%      │
│   Server up time:                   0:02:49:21    │
│   Online processors:                       1      │
│   Original cache buffers:             15,325      │
│   Total cache buffers:                 6,658      │
│   Dirty cache buffers:                     0      │
│   Long term cache hits:                  99%      │
│   Current disk requests:                   0      │
│   Packet receive buffers:                132      │
│   Directory cache buffers:                29      │
│   Maximum service processes:             130      │
│   Current service processes:               6      │
│   Current connections:                     2      │
│   Open files:                            172      │
└──────────────────────────────────────────────────┘
                  ┌─────────────────────────┐
                  │ │File open/lock activity │
                  │▼│Disk cache utilization  │
                  └─────────────────────────┘
Tab=Next window    Alt+F10=Exit                            F1=Help
```

The onscreen performance indicators are described following.

- ◆ **Utilization.** Average of the server's total processing capacity that was used during the last second, expressed as a percentage. The remainder of the time is spent in an idle loop. Monitor the patterns of utilization.

  Does utilization go to 100 percent? Does it reach a plateau or does it peak for a few seconds and then drop? What time and how frequently does it peak?

- ◆ **Server Up Time.** This is the amount of time that has elapsed since the server was most recently started. If your server has Auto Restart enabled, use this field to determine whether your server has abended and restarted. You can also use this information to detect power failures or intruders who bring down the server.

- ◆ **Online Processors.** The number of enabled and online processors. The Platform Support Module (PSM), loaded from startup.ncf, enables NetWare to use secondary processors in a multiprocessing platform. The default is to autostart all processors.

- ◆ **Total Cache Buffers.** This number shows how many cache buffers are currently available for file caching. This number decreases as you load NLM programs.

  Because file caching has a dramatic impact on server performance, you want this number to be as high as possible.

Managing   **67**

- **Dirty Cache Buffers.** This number shows how many buffers contain data which has been changed but not yet written to disk.

  Monitor this number to see whether it is increasing. If it is, you might have a bottleneck in the file system.

- **Long Term Cache Hits.** This number shows the cumulative percentage of requests for disk blocks that were already in cache. (When the requested data is already in memory, disk reads don't need to be made.)

  Use this percentage to assess overall disk cache utilization. If this value falls below 90%, the disk thrashes and server performance degrades. The solution is to install more physical memory (RAM).

  For another MONITOR statistic that is useful in assessing RAM, see Understanding LRU Sitting Time in *NetWare Server Memory* in the NetWare 5.1 online documentation.

- **Current Disk Requests.** This number shows how many read requests are pending.

  Monitor this number to see whether it is increasing. If it is, a slow hard disk might be your bottleneck.

- **Packet Receive Buffers.** This number shows how much memory was allocated for holding client requests while the server processes them. The server allocates more packet receive buffers as needed (within minimum and maximum values). Buffer size depends on the network adapter.

  This number is the result of the interaction of three configurable parameters. Monitor the current value to ensure that it does not reach the maximum value.

- **Maximum Service Processes.** This number shows how many task handlers that the server can allocate to service client requests. As the number of client requests increases, the server creates more service processes. When no more service processes can be allocated, server performance is adversely affected.

  Monitor the current service processes to ensure that it does not reach this value.

- **Current Service Processes.** This number shows how many task handlers are currently being used to service client requests.

  Use this number to determine whether the server has enough free task handlers to service client requests. If the number of current service processes reaches the maximum, the value of the Maximum Service

Processes parameter must be increased. (In MONITOR, from the Available Options menu, select Server Parameters > Communications Parameters.)

- **Current Connections.** The number of active connections, whether licensed or unlicensed, authenticated or Not Logged-In.

- **Open Files.** The number of files currently being accessed by the server and by other clients. Certain files are always open, such as the hidden files that support NDS.

Monitoring Allocated Services

There are limits to resources in every computing environment. NetWare allocates resources according to need and availability. When a request is received, the operating system doesn't immediately allocate new resources. It waits a specified amount of time to see if existing resources become available to service the demand.

Dynamically allocated services are controlled by the interaction of three types of settable parameters. If you understand how they work together, you can interpret the statistics that you monitor and know how to configure the system's response to demand. The three types of parameters that interact to control allocation are

- **Maximum limits** control the amount of server resources the operating system can allocate for a particular service.

- **Minimum limits** allow the operating system to allocate a minimum amount of resources as soon as a request is received.

  Low minimum limits will slow the growth of a particular service. High minimum limits allow rapid growth.

- **Wait time limits** control how rapidly the operating system can allocate a new resource.

  If resources become available, no new resources are allocated. If they don't become available within the time limit, new resources are allocated. The time limit ensures that sudden, infrequent peaks of server activity don't permanently allocate unneeded resources.

Consider, for example, the allocation of directory cache buffers. If the minimum number of directory cache buffers is set to 20, the system allocates another buffer resource as soon as a request is made—until 20 cache buffers have been allocated.

When 20 directory cache buffers are allocated, the system waits 2.2 seconds (default) when a request comes in, and then allocates another buffer if the request is still active.

However, if the minimum number of directory cache buffers is set to 40, the system allocates 40 directory cache buffers before it starts slowing the growth by waiting 2.2 seconds after each request.

Other Information and Statistics to Monitor

Common maintenance tasks also include monitoring:

- "Checking Server Error Logs" on page 84.
- "Checking Disk Drives" on page 85.
- "Reviewing Server Cache Statistics" on page 85.
- "Checking Free Space on Server Disks and Volumes" on page 85.
- "Reviewing User Accounts" on page 86.
- "Testing the Uninterruptible Power Supply" on page 86.

Displaying Server Alerts

You can enable the server to display alert messages under various conditions, such as when NLM programs fail to relinquish control of a processor. Many alerts are controlled by server parameters that set a threshold when the alert will be generated.

To hear a bell whenever an alert is received, set the following server parameter (MONITOR > Available Options > Server Parameters > Miscellaneous):

`Sound Bell for Alerts = On`

Available alert parameters are described in the following table.

Condition that Generates Alert	Relevant Parameters
Spurious interrupts are detected	Display Spurious Interrupt Alerts
	Spurious Interrupt Alert Threshold
	(See SET Miscellaneous Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.)

Condition that Generates Alert	Relevant Parameters
Lost interrupts are detected	Display Lost Interrupt Alerts
	Lost Interrupt Alert Threshold
	(See SET Miscellaneous Parameters in *Utilities Reference*.)
NLMs fail to relinquish control of processor	Display Relinquish Control Alerts
	CPU Hog Timeout Amount
	(See SET Miscellaneous Parameters in *Utilities Reference*.)
Incomplete IPX packets are received	Display Incomplete Packet Alerts
	(See SET Miscellaneous Parameters in *Utilities Reference*.)
Available file cache buffers are nearing minimum	Minimum File Cache Report Threshold
	(See the SET File Caching Parameters in *Utilities Reference*.)
A volume is becoming full	Volume Low Warn All Users
	Volume Low Warning Threshold
	Volume Low Warning Reset Threshold
	(See the SET File System Parameters in *Utilities Reference*.)

Many other alerts can be generated by the system, but are not controlled by server parameters. For example, if the address of a server on the network is changed, an alert will be broadcast on other server consoles. You can control these alerts with the ALERT command. For more information, see ALERT in *Utilities Reference* in the NetWare 5.1 online documentation.

Managing Workstation Connections

You can perform management tasks for workstation connections to the NetWare® server from the Connections option in MONITOR's Available Options menu. Console commands that serve the same purpose are also listed for some tasks.

- ◆ "Using MONITOR for Connection Management Tasks" on page 72
- ◆ "Monitoring Workstation Connections to the Server" on page 72
- ◆ "Sending Console Messages to Workstations" on page 75
- ◆ "Clearing a Workstation Connection" on page 75
- ◆ "Disabling and Enabling Logins" on page 76
- ◆ "Controlling Resource Allocation with Locks" on page 78
- ◆ "Configuring Watchdog Packets" on page 79
- ◆ "Enabling Console Message when Watchdog Logout Occurs" on page 80

Using MONITOR for Connection Management Tasks

The tasks for which you can use MONITOR include

- ◆ View a list of active workstation connections on the server
- ◆ Determine which users are logged in
- ◆ View information about a connection
- ◆ Configure a watchdog to monitor connections for activity
- ◆ View a list of files that the connection has open
- ◆ Terminate one or more workstation connections

  You can also use CLEAR STATION n or CLEAR STATION ALL at the console prompt. See CLEAR STATION in *Utilities Reference* in the NetWare 5.1 online documentation.

- ◆ Send a message to one or more workstations

Monitoring Workstation Connections to the Server

The following table contains tasks and procedures.

Table 3   Monitoring Server Connections

To	Do
View a list of active server connections Determine which users are logged in	1. Select Available Options > Connections. The list of Active Connections appears. 2. (Optional) Press F3 to re-sort the connection list. List items without an asterisk (*) represent logged-in users. List items with an asterisk (*) are unlicensed connections (this means they do not count against a server's total licenses). These connections are authenticated to NDS but are not logged in.
View information about a connection ◆ Connection number ◆ Connection name ◆ Elapsed connection time ◆ Network node address ◆ Read/write requests ◆ Authentication and license status ◆ Files in use ◆ Locks and semaphores in use ◆ Supervisor rights	1. Select Available Options > Connections to display the list of Active Connections. 2. Highlight a connection from the list. 3. Press Tab to activate the Connection Information screen in the upper window. 4. For an explanation of the information fields and statistics, press F1.
Configure a watchdog to monitor connections for activity	See "Configuring Watchdog Packets" on page 79 and "Enabling Console Message when Watchdog Logout Occurs" on page 80.
View a list of files that the connection has open. Use this procedure when you want to determine whether a crashed workstation has open files remaining on the server.	1. Select Available Options > Connections. 2. Select the connection from the list. 3. After determining whether files are open on the server, press Esc to return to the Active Connections list.

To	Do
Terminate one or more connections	1. Select Available Options > Connections.
Use this procedure to clear the connection when a workstation has crashed and left open files on the server.	2. Highlight the connection (or for multiple connections, highlight each one and press F5 to mark it).
Note: Transaction monitoring (TTS) provides automatic backout for database records or files stored on the server if a workstation has crashed and left those files open on the server. Also a file is protected if the Transaction (T) file attribute is set for it.	3. Press Delete.
	4. At the Clear Connection? prompt, select Yes. Deleted connections are no longer listed.
	Press F6 to clear all unlicensed connections, indicated in the connection list by an asterisk (*). These connections are authenticated but are not logged in and therefore do not count against a server's total licenses.
	Note: If you know the connection number, you can also terminate a connection at the server console prompt with **CLEAR STATION n**. Use **CLEAR STATION ALL** to terminate all connections. See CLEAR STATION in *Utilities Reference* in the NetWare 5.1 online documentation.
Send a message to one or more workstations	1. Select Available Options > Connections.
Use this procedure when you need to warn users to log out before you down the server.	2. Highlight the connection (for multiple connections, highlight each connection and press F5 to mark it and then press F4 to confirm your selections).
	3. In the text-entry box that appears, enter the message.
	4. At the confirmation prompt, select Yes to send the message or select No to redisplay the text-entry window.
	Note: In the Active Connections list, items *without* an asterisk (*) represent logged-in users.

For an explanation of NDS connection types, see "Network Connections" on page 21.

Sending Console Messages to Workstations

To send a message from the server console to all workstations or to a single user, access MONITOR.

1 Choose MONITOR's Available Options > Connections.

2 Press F8 to display more options on the task bar.

3 On the list of Active Connections, highlight the connection for the user you want to send a message to. Or use F5 to mark additional recipients.

4 To display the message composition box, press F4.

5 Type your message in the message box and press Enter to send it.

A confirmation box appears.

6 You can either choose to send the message immediately or you can press Esc to discard it.

For more information, see MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation. For information about receiving and clearing messages at the workstation, see the documentation for the client you are using.

Clearing a Workstation Connection

You can use either MONITOR or CLEAR STATION to clear a client connection when the workstation has crashed and left open files on the server.

NOTE: If you clear the connection while the workstation is in the middle of a transaction or a file update, the files might be saved with incorrect data.

Using MONITOR to Clear the Connection

1 Select Available Options > Connections.

A list of active connections appears.

2 (Optional) To view a workstation's open files, select the workstation's connection.

After viewing files, press Esc to return to the Active Connections list.

3 Clear one or more connections, as follows:

◆ To clear one connection, highlight the connection and press Delete. At the Clear Connection? prompt, select Yes.

- To delete multiple connections, highlight each connection and press F5 to mark it. Then press Delete. At the Clear Connection? prompt, select Yes.

- To clear all unused (not logged in) connections, press F6.

Deleted connections are no longer listed on the Active Connections list.

Using CLEAR STATION to Clear the Connection

1 To determine the workstation's connection number, from MONITOR's Available Options, select Connections.

2 Highlight the appropriate connection in the Active Connections list.

The connection information, which includes the connection number, appears in the upper window.

3 Note the connection number.

4 Press Alt + Esc and then tap Esc until you cycle to the server console prompt.

5 At the server console prompt, enter either

```
CLEAR STATION n
```

or

```
CLEAR STATION ALL
```

Replace *n* with the connection number of the workstation, or use the ALL parameter to clear all connections.

For more information, see CLEAR STATION or MONITOR in *Utilities Reference* in the NetWare 5.1 online documentation.

Disabling and Enabling Logins

If you need to make repairs to the server, you can prevent users from logging in by entering the following at the server console prompt:

```
DISABLE LOGIN
```

This does not affect users who are already logged in to the network. However, a user who logs out cannot log in again until you execute ENABLE LOGIN.

To allow users to log in again, enter the following at the server console prompt:

```
ENABLE LOGIN
```

You can also use ENABLE LOGIN to enable a SUPERVISOR account when it has been locked by the intruder detection function.

See DISABLE LOGIN and ENABLE LOGIN in *Utilities Reference* in the NetWare 5.1 online documentation.

Clearing a Connection that Uses Auto Reconnect

Client 32 has automatic reconnection capabilities that make possible a complete restoration of the user environment after a network failure. Because auto-reconnect is enabled by default, you need to prevent workstations from reconnecting while you are trying to perform some function on the server.

Client 32 also supports file caching on the client side, which allows files to be cached as they are read from the server and as they are written to the server. With the default settings for the Auto Reconnect Level and the File Cache Level parameters, Client 32 will restore all files to their actual state before the workstation connection was cleared (or the server went down). The workstation monitor displays a message:

```
Client32: Please wait while Application retries
request to ServerName. To stop waiting, press Enter.
NetWare will then return an error and try to
reconnect in the background.
```

You can combine the use of console commands to prevent clients from reconnecting for long enough to complete your work on the server.

- To warn users, see "Sending Console Messages to Workstations" on page 75.

- To prevent auto-reconnect users from reattaching to the server while you are working on it, enter DISABLE LOGIN at the console prompt before you clear the connections. See "Disabling and Enabling Logins" on page 76.

- Then use CLEAR STATION to terminate the connection as in "Clearing a Workstation Connection" on page 75. With login disabled, a workstation with auto-reconnect enabled will still try to reestablish its connection automatically, but the necessary services on the login server won't be available. (After the connections are cleared, workstation attachments appear as *NOT-LOGGED-IN entries in MONITOR's Active Connections window.)

- When you have completed your server tasks, enter ENABLE LOGIN to allow users to log in again.

  HINT: Note that if you don't clear a workstation's connection and a communication failure occurs (such as a broken or unplugged network cable), the workstation will be able to auto-reconnect when the problem is fixed.

For a more complete discussion, refer to Disconnecting NetWare Client that Have Automatic Reconnection Enable, in the February 1997 *AppNotes™*

Controlling Resource Allocation with Locks

A lock prevents a file or record from being updated by more than one user at a time. By controlling the number of file and record locks available to a workstation or a server, you control access to files and records.

You can increase the number of locks if clients cannot open files. Or you can limit the number of locks to prevent overuse of file resources.

Preventing Workstations from Overusing File Resources

If you are running out of file resources, use MONITOR to limit the number of locks for the server and for each connection.

Before limiting file and record locks, make sure the workstations have an adequate number of locks to access the files and records they need. Limiting needed locks can cause applications to generate errors.

1 From MONITOR's Available Options, select Server Parameters > Locks.

  NOTE: You can also set locks parameter values with SET. See SET Locks Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

2 To edit a parameter value, highlight it and enter the new value.

3 For the server, limit the total number of file and record locks allowed by decreasing the values of the following parameters:

```
Maximum Record Locks
Maximum File Locks
```

The changes to the parameter values take effect immediately and are persistent.

4 For each client, limit the total number of file and record locks allowed by decreasing the value of the following parameters:

```
Maximum Record Locks Per Connection
Maximum File Locks Per Connection
```

5 Press Esc until you return to Available Options.

Increasing File Record Locks

Use MONITOR to provide more file record locks if applications fail either because clients cannot open enough files or because not enough record locks are available.

1 From MONITOR's Available Options, select Server Parameters > Locks.

> **NOTE:** You can also set locks parameters with SET. See SET Locks Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

2 To edit a parameter value, highlight it and enter the new value.

3 Increase the values of the following parameters to increase the number of file and record locks allowed for the server:

```
Maximum Record Locks
Maximum File Locks
```

The changes to the parameter values take effect immediately and are persistent.

4 Increase the values of the following parameters to increase the number of file and record locks allowed for each workstation:

```
Maximum Record Locks Per Connection
Maximum File Locks Per Connection
```

The changes to the parameter values take effect immediately and are persistent.

5 Press Esc until you return to Available Options.

Configuring Watchdog Packets

The server sends watchdog packets to a workstation to determine if the workstation connection is still active. If there is no response from the workstation within a set amount of time, the server terminates the connection.

To provide an early warning that a connection has failed, set the values of the watchdog parameters so that the server sends twice the default number of packets in the shortest amount of time allowed.

If you enable an alert, a console message displays when the server terminates a connection. For this procedure, see "Enabling Console Message when Watchdog Logout Occurs" on page 80.

1 From MONITOR's Available Options, select Server Parameters > Communications.

2 Change the following watchdog parameters to the following values:

```
Number of Watchdog Packets=20
Delay Between Watchdog Packets=10
Delay Before First Watchdog Packet=16
Console Display Watchdog Logouts=ON
```

3 Press Esc until you return to Available Options.

Enabling Console Message when Watchdog Logout Occurs

If you enable an alert, a console message displays when the server terminates a connection.

1 From MONITOR's Available Options, select Server Parameters > Communications.

2 Change the following parameter to the indicated value by highlighting the parameter and pressing Enter:

```
Console Display Watchdog Logout=ON
```

The changes to the parameter values take effect immediately and are persistent.

3 Press Esc until you return to Available Options.

Using Java on the Server

Most of the information you need about JVM for NetWare can be located at VisiBroker for NetWare documentation site (http://www.developer.novell.com/ndk/doc_orb.htm).

See the following sections for information about using and managing Java-based components on the NetWare 5.1 server:

◆ "Environment Variables for Java" on page 81
◆ "Using the Novell ORB" on page 82

Environment Variables for Java

The Novell JVM for NetWare is automatically installed when you install NetWare 5. The installation process sets default values for key environment variables. Setting environment variables for Java is necessary to run Java-based applications and applets.

The installation process places some of the variables into the sys:\etc\java.cfg file. The java.cfg file is read whenever you load Java. You can modify or add to the java.cfg file.

The following table describes some key environment variables. Other key environment variables for Java are available in the Novell Developer Kit (NDK) doc.

Environment Variable	Description
OSA_HOME	Specifies the location of libraries. The default value is sys:\java.
JAVA_HOME	Specifies the location of the JVM.
XLOCALEDIR	Specifies the location of files needed to support other languages, including keyboard and font files.

Viewing and Setting Variable Values

To view current variable values and to set values, follow these steps:

1 To load java.nlm at the server console prompt, enter:

```
java
```

2 To view current environment variables and variable values, enter the following at the server console prompt:

```
envset
```

3 To set a value for the current session, enter the envset command as follows:

```
envset variable=value;value
```

Make sure there are no spaces on either side of the equal sign or between values. To set multiple values for variables such as CLASSPATH, separate the values with semicolons.

The value of a variable set with **envset** lasts until Java is unloaded.

To append a value to the CLASSPATH variable, use $CLASSPATH to represent the existing values, for example:

```
envset CLASSPATH=$CLASSPATH;sys:myclasses
```

4 To make lasting changes to variable values, enter the **envset** command line in the sys:\etc\java.cfg file. The java.cfg file is read whenever Java is loaded.

To edit the file, use EDIT at the server console prompt, or use a word processing program at a workstation.

Using the Novell ORB

The following ORB runtime components are installed automatically when you install NetWare® 5:

- ◆ ORB .jar files

  The .jar files make up the Novell ORB.

- ◆ orbcmd.nlm

  The ORBCMD makes ORB commands available at the server console. Once ORBCMD is loaded, the syntax for issuing ORB commands at the server console is identical to the VisiBroker command syntax. See the VisiBroker for NetWare online documentation included in the Novell Developer Kit (NDK) available at the VisiBroker for NetWare Documentation site (http://developer.novell.com/ndk/graveyard.htm).

- ◆ osagent.nlm

  The OSAGENT is a directory of CORBA objects and services. It enables the ORB to find objects and services when requested by a client.

IMPORTANT: To run CORBA applications on the network or to provide a development environment for CORBA applications, you will need the client component of the Novell ORB, development tools, and the VisiBroker online documentation for developing and administering VisiBroker applications.

These components and tools are available on the Novell Developer Kit (NDK). You can download a copy of the NDK free of charge from the Novell DeveloperNet Web site (http://www.developer.novell.com) or contact your Novell Authorized Reseller.

The following procedure explains how to load and unload the server component of the Novell ORB and make ORB commands available in the NetWare environment when you install and run a distributed application.

Prerequisites

❑ 64 MB RAM on the server (the more memory your server has, the more CORBA applications it can run).

❑ 85 MB available disk space in the Sys volume.

❑ TCP/IP installed and configured, DNS running, and a sys:\etc\hosts file on the server containing an entry for host name and IP address. If you did not select TCP/IP and enable DNS during NetWare 5 installation, you must do so before trying to run CORBA applications. See *NetWare Server Communications* and *Novell DNS/DHCP Services Administration Guide*.

❑ The paths to the following Java archive files in the CLASSPATH environment variable: sys:\java\lib\vbjapp.jar, sys:\java\lib\vbjorb.jar, and sys:\java\lib\vbjtools.jar. See .

Procedure

1 Install the files for a CORBA application in the same volume where the Novell ORB resides.

2 Enter the application pathnames into the CLASSPATH environment variable.

See .

3 Load ORBCMD at the server console prompt.

orbcmd

ORBCMD automatically loads other NLM programs, including the Novell JVM, and enables the use of CORBA commands such as **osagent** at the server console. You must load orbcmd.nlm before you run any other ORB-based application clients, servers, or tools from the NetWare server console.

4 Start the osagent at the server console prompt:

osagent

The osagent command starts the Smart Agent, which provides Novell ORB's directory service and failure detection services.

5 Install client components and set up the distributed environment.

Refer to the NDK, available free of charge from the Novell DevelopNet Web site (http://www.developer.novell.com/ndk).

6 To unload the Novell ORB, enter the following at the server console prompt:

```
unload osagent
unload orbcmd
```

Common Maintenance Tasks

Backing Up

Maintaining a daily backup schedule is crucial to the security of your data.

For information about the backup software included with NetWare, see Backup and Restore Services Administration Guide.

Checking Server Error Logs

Check server error logs at least once a week, even if you don't believe there have been errors. Problems caught early are easier to solve. View the error logs with EDIT at the server console or with a text editor from a workstation. See EDIT in *Utilities Reference* in the NetWare 5.1 online documentation.

When needed, NetWare creates the following error logs, the first four in sys:system:

- **boot$log.err** for errors generated during the process of starting the server
- **sys$log.err** for server errors, including system messages, alerts, and security violations
- **vol$log.err** for volume errors
- **tts$log.err** for data backed out by the Transaction Tracking System
- **abend.log** for information generated by the abend process. This file is moved to sys:system as soon as the server is started after the abend.

To keep error log files from using too much disk space, modify the values of the relevant Error Handling server parameters. See SET Error Handling Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

Checking Disk Drives

Once a week check the Storage Devices statistics in MONITOR to make sure that the operating status of each disk is active.

If you rarely use the diskette drive on your server, you might want to test the drive about twice a year to make sure it's running properly.

Reviewing Server Cache Statistics

For more information about monitoring and optimizing server memory, see Optimizing in *NetWare Server Memory* in the NetWare 5.1 online documentation.

1 Review file server cache statistics weekly.

These statistics are found on the General Information screen in MONITOR.

2 Divide the value of Total Cache Buffers by the value of Original Cache Buffers to determine the percentage of available cache.

Ideally, file server cache should be 70% or more of the total cache.

3 If the percentage falls below 50%, add more memory to the server.

Checking Free Space on Server Disks and Volumes

1 Check server disks and volumes weekly to make sure they have enough free space.

To determine the amount of free space, load MONITOR and select Volumes. The Mounted Volumes screen lists all mounted volumes, their capacity, and the percentage of the volume that is full.

Keep at least 15% to 20% free space on any disk.

Keep at least 20% free space on the Sys volume and at least 10% free space within other volumes. If the Sys volume fills up, your server hangs.

2 If the free space is less than the recommended values, increase the size of the volume or remove unneeded files and directories.

You can use the VREPAIR utility to repair volumes. See VREPAIR in *Utilities Reference* in the NetWare 5.1 online documentation.

Reviewing User Accounts

1 Review all users and objects on the network once a month to make sure that there are no intruders, obsolete accounts, or unauthorized accounts.

The network administrator should know all objects and accounts on the network.

2 Make sure accounts are closed for all users who have left the system.

Testing the Uninterruptible Power Supply

If your network has an Uninterruptible Power Supply (UPS), check it twice a year to make sure it's running properly. Choose a time when no users are logged into the network.

1 Down the server and exit to DOS, but do not turn off the computer,

2 While the computer is still running, unplug it.

If your UPS system is working properly, the computer should continue to run.

If the server powers off, your UPS batteries are probably low or dead. Check and replace them.

Documenting the Network

It is important to document your network. Keeping records of network layout, hardware and software inventory, configuration, repairs, and backup schedules will save you time and work if you need to rebuild or replace parts of the network, justify new equipment, or restore the network after a disaster. You will need much of this information if you ever need to call Novell Technical Support. You might want to keep documentation in a three-ring binder or online in a database.

WARNING: Whether you store your network documentation in a binder or in a database, keep multiple copies and update them regularly. Always store one or more copies offsite—along with your taped backups. Documentation does no good if it's destroyed with the network itself in a major disaster.

Information you should keep in your network documentation includes the following:

◆ **Inventory of all hardware and software.**

Version numbers, serial numbers, warranty information, date purchased, license information, etc.

- **Configuration information for workstations**.

  Copies of autoexec.bat, net.cfg (for DOS and Windows 3.1x clients) or the registry (for Windows 95 and Windows NT).

  Any standard directory structures.

- **Configuration information for server.**

  Copies of the autoexec.ncf, startup.ncf, and autoexec.bat files

  Contents of the DOS partition

  Record of hardware interrupts, port addresses, frame types and other settings (type CONFIG at the console prompt to see the settings)

  Services provided by each server, such as file and print, databases, etc.

  General directory structure of each volume.

  Settings of all server parameters, especially if you have modified the defaults to optimize your servers (use MONITOR to copy all the parameter settings to a file. See "Printing Current Parameter Values to a File" on page 46.)

- **Configuration information for printers.**

  For queue-based printers: map of printers, print queues, and print servers, the version of PSERVER, and the dates and versions of print drivers.

- **NDS™ tree structure.**

  Print out the NDS structure from NetWare Administrator. Document replicas and partitions.

- **Procedures.**

  Login processes and backup procedures. Most important, procedures for restoring the system from backups.

- **Backup information.**

  Rotation schedule of backup media, labeling system, names and phone numbers of backup operators, and locations of backup disks and tapes.

- **User information.**

  Login scripts, special menus.

- **Software and hardware repairs and service calls.**

  Repair records and receipts, service calls log, solutions in case the same problem occurs again.

- **Diagram of network and cable plant**.

  Locations of servers, workstations, printers, routers, hubs, etc.; name of each element; the kinds of cables and connections.

- **Changes to the system.**

  Record any updates to the network or its components.

Preventive Maintenance Tasks

The following sections provide tips for avoiding common server problems.

Preventing Memory Problems

- Make sure you have adequate memory installed on the system
- Unload unneeded TSR (terminate-and-stay-resident) programs (DOS clients only).
- Modify the net.cfg file to load only necessary drivers.
- Modify the config.sys file to load only necessary drivers.
- Check the autoexec.bat and config.sys files to make sure no memory managers, such as himem.sys, or emm386.exe, are being loaded, and that there is no DOS=HIGH statement in either file. Make sure no DOS device drivers are being loaded.

For information about freeing up memory on a server, see "Resolving Server Memory Problems" on page 125.

Preventing Power Supply Errors

An inconsistent power source is the most common cause of hardware problems. It also produces the most devastating results.

Power outages cause workstations, network servers, print servers, and backup devices to reboot. When this happens, all information stored in RAM is lost, and sometimes hardware is damaged.

Power spikes and brownouts can also cause a variety of hardware errors.

You can have reliable network performance only if you plan for power outages and fluctuations and protect against them. The following tips can help you do this:

◆ Add a dedicated power feed and ground line from your breaker box to critical equipment. Make sure the ground line connects to earth ground.

◆ Install an uninterruptible power supply (UPS) or a standby power system (SPS) to provide power to critical equipment for 15 minutes after a power outage.

The capacity of such power supplies is limited, so you may not want to plug nonvital hardware (such as monitors or printers) into the UPS or SPS line.

◆ Train users to save data and log out of the network when the lights go out. Then you can bring down the NetWare® server in an orderly fashion without forcing users off the system while the server is running on UPS or SPS power.

◆ Install a surge suppressor or power conditioner on all power lines that are used by computers. Many UPS and SPS devices already have this feature.

◆ Do not allow anyone to plug fans, printers, copy machines, vacuum cleaners, or other motor-driven appliances into the dedicated line or into any power line with computers.

Insert dummy plugs into open outlets to prevent people from plugging such appliances into computer power sources.

Preventing Static Electricity Problems

An electrostatic discharge (ESD) must equal about 3000 volts before you can feel it, but sensitive electronic components such as microchips and circuit boards can be damaged by ESDs of as little as 20 or 30 volts. These small discharges do not cause a component to fail immediately, but can cause the component to degrade over time and fail at a later date.

Novell recommends you take the following precautions to protect electronic components from electrostatic discharge:

◆ Ground yourself and your equipment with a proper wrist strap and mat before working on computers and computer boards. Test grounds daily to make sure they have not become loose or intermittent.

WARNING: DO NOT use a wrist strap when working on monitors! They can carry a large voltage that can reach you through the strap.

- Never touch components or integrated chips by their electrical leads.

- Do not allow anyone to touch you when you are working on boards that contain integrated circuits. They may cause a static charge.

- Transport and store boards and integrated circuits in *static-shielding* bags, usually grey-silver in color. The bags must be in perfect condition because tiny pin holes will defeat their purpose. *Anti-static* bags (blue or pink) do not shield their contents from external static fields and should not be used.

- Keep nonconductors, such as polyester clothing and plastic, away from open computers and components. Nonconductors are a source of static charges.

- Never place components on any conductive surface, such as metal.

- Keep the humidity of any area where you have open computers at 70 to 90 percent. Static electricity problems are more likely to occur in low humidity.

Using Accounting

Accounting allows you to monitor [®]NetWare server usage and charge users for server resources.

Setting Up Accounting

The following procedure explains how to set up accounting:

Prerequisites

- ❑ A workstation running Windows 3.1*x* or Windows 95, and NetWare Administrator.

- ❑ 6 MB of available memory on the Windows workstation.

- ❑ Supervisor object right to the Server object where you are setting up accounting.

Procedure

1 Start NetWare Administrator.

NetWare Administrator is found in sys:\public or sys:\public\win95.

2 Select the Server object you want to set up accounting for.

The Object menu appears.

3 Select Details > Accounting.

4 Confirm that you want to install accounting on this server.

Accounting page buttons appear on the right side of the dialog box with the other page buttons.

5 Use the accounting buttons to edit the accounting pages.

6 Click OK.

Calculating Charge Rates for Accounting

Charge rates for using server resources are specified as multipliers and divisors. To set the charge amount to No Charge, enter 0 as the multiplier. Use the following formula to calculate a charge rate:

$$\frac{\textbf{CHARGE (charge rate multiplier)}}{\textbf{ESTIMATED USAGE (charge rate divider)}} = \textbf{CHARGE RATE}$$

For example, if you want to charge $200 per month for server disk storage, and there are usually 100,000 blocks used each month on your hard drive:

- 20,000 would be the multiplier (number of cents in $200)

- 100,000 would be the divisor (disk block usage per month)

- Therefore, users would be charged two-tenths of one cent per disk block used.

$$\frac{\textbf{20,000 cents}}{\textbf{100,000 blocks read}} = \textbf{1 cent / 5 blocks read}$$

Viewing Accounting Totals

The ATOTAL utility provides a total for the accounting services used on your network. ATOTAL compiles information from the system accounting records and lists the following:

- ◆ Total connect time in minutes
- ◆ Total service requests
- ◆ Total blocks read
- ◆ Total blocks written
- ◆ Total disk storage in blocks per day

❑ A workstation running DOS 3.30 or later, Windows 95.

❑ Accounting set up on the NetWare server. (See "Setting Up Accounting" on page 90.)

❑ Supervisor object right to the Server object you want to see accounting information for.

1 Change to the sys:system directory.

2 To view daily and weekly totals for accounting services, enter

   ATOTAL

3 To redirect ATOTAL data to a file, enter

   ATOTAL > *filename*

5 **Troubleshooting**

See "A Troubleshooting Methodology" on page 94 for the steps to follow when you troubleshoot any server problem.

See "Preventive Maintenance Tasks" on page 147 for links to information that will help you prevent network problems.

See "Creating a Core Dump" on page 100 for information on creating full core dumps and cacheless core dumps.

The following symptoms indicate common error conditions. Each section includes procedures to troubleshoot the problems.

A Troubleshooting Methodology

Novell's Technical Support Representatives recommend that you follow the same basic steps in all troubleshooting efforts. Following a standard procedure helps you solve technical problems faster and in an orderly way.

The following tasks are the ones that a Novell Support Representative would ask you to perform if you called Technical Support. By following these steps on your own, you may be able to resolve problems without assistance. If you do need to call Technical Support, you will already have the information prepared to help support representatives solve your technical problems more quickly.

- "Keep Your Servers Patched" on page 94
- "Eliminate Obvious Causes" on page 95
- "Gather Information" on page 96
- "Simplify the System" on page 97
- "Use Research Tools" on page 97
- "Develop Hypotheses and Perform Tests" on page 98
- "Look for Additional Help" on page 99
- "Document the Solution" on page 100

Keep Your Servers Patched

Many problems you might experience with your server will have already been solved by Novell and provided in the form of a patch file. It is essential that you load all server and client patches. See "Applying Patches" on page 40. Use the File Finder (http://support.novell.com/filefinder/) to locate patches for server.nlm and updates for other modules. Copy updated modules to the server's startup directory where they will overwrite the previous versions.

In addition, be sure you use up-to-date drivers for NetWare 5. Use drivers that ship with the software, drivers that are tested, certified, and made available on Support Web site (http://support.novell.com/), or certified drivers released by hardware vendors. Check product certification bulletins on DeveloperNet Web site (http://developer.novell.com/yespgm/) to learn which versions are most recent.

ODI (Open Data-Link Interface)™ HSM Specification 3.31 supports NBI (NetWare Bus Interface), HIN (Hardware Instance Number), instance unload,

and industry-standard PCI Hot Plug technology. Do not mix use of a driver written to the 3.3x/1.1x ODI Specification with 3.2 ODI Specification support modules. The LAN driver certification bulletin will list the specification a LAN driver is written to. In some cases, you will need to contact the IHV (Independent Hardware Vendor) who wrote the driver.

NetWare 5 drivers for storage devices and host bus adapters are written to the NWPA (NetWare Peripheral Architecture™) Specification. The .dsk drivers are no longer supported.

Eliminate Obvious Causes

Before taking other steps, be sure to eliminate any *obvious* causes for network problems—such as checking to be sure everything is plugged in and the power is on.

For example, consider the following:

- Check Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for known problems with software and hardware.

  HINT: If you are reading this documentation from your Netscape browser and you have access to the internet, click the Home icon in the toolbar at the lower part of the navigation column. Then click either the Novell Links button in the the navigation column or `Novell.` (in red) at the top of that column. In the pop-up window, click Novell Technical Support.

- Inventory the hardware and cabling systems to make sure everything is plugged in, connected, and terminated properly.

- Check for user errors.

- Make sure all hardware is Novell certified. Check Novell's World Wide Web site (http://developer.novell.com) for a list of hardware and software products certified to run with NetWare.

  HINT: Again, if you are reading this documentation from your Netscape browser and you have access to the internet, click the Home icon in the toolbar at the lower part of the navigation column. Then click either the Novell Links button in the the navigation column or `Novell.` (in red) at the top of that column. In the pop-up window, click Novell Technical Support.

- Make sure there are no rights problems. Insufficient rights prevent you or your users from accessing volumes, directories, and files and from performing file operations.

Gather Information

Once you have updated your server with current patches, modules, and drivers and have eliminated any obvious causes, start gathering information about the context of the problem.

Ask yourself the following questions:

- When does the problem happen? For example, a problem that occurs regularly at midnight could be related to file compression. A problem occurring in the morning could be related to spikes in network usage as users log in.

- Can you duplicate the problem? Or is it constant or intermittent? If intermittent, at what intervals does it happen ?

- Can the problem be associated with other activities happening on the network at the same time or with specific hardware and software? For example, does the problem occur only when the network activity is highest? Does it occur only on certain workstation platforms?

- Did anything change shortly before the problem began to occur? For example, was new software installed?

- What components of the network are involved? the server? some or all of the workstations? printers? other peripheral devices?

- What error or console messages are displayed? What module is the source of the message? Check server error logs.

- What do configuration and log files reveal? If you think you will need to call Novell Technical Support, gather information about your server and network, including log files such as abend.log, sys$log.err, and vol$log.err. Also have your hardware and software configuration and version numbers available.

  You can download a Server Configuration Information tool from the Minimum Patch List on http://support.novell.com. Extract the utility by running confg$x$.exe (where x represents the current version number). It allows you to create a text file that lists all modules loaded on the server; the contents of the startup.ncf, autoexe.ncf, config.sys, and autoexec.bat files ; a directory of sys:system and your local drive; and other configuration information.

- If you suspect NDS® problems, gather the following information:

  Number of servers in the tree
  Structure of the tree

Number of objects per partition

Error messages

Names of servers holding master replicas

Versions of DS on pertinent servers

- ◆ Compare the affected machines to similar machines. Do some have the problem, while others do not? If so, what is different between the affected and unaffected machines.

Simplify the System

If there is *any* danger of losing data, back up the system before you do any further troubleshooting.

Simplify the system and eliminate as many variables as possible to isolate the source of the problem:

- ◆ Try running the server without the autoexec.ncf file or startup.ncf file. You can either comment out the commands in the .ncf files or you can execute SERVER with the -na or -ns options. (To comment out a command, type REM and a space at the beginning of the command line.) For an explanation of these load options, see SERVER in *Utilities Reference* in the NetWare 5.1 online documentation.

- ◆ Unload all NLM programs. Remove all nonessential products, including virus scanners and server metering modules, until the server software is in bare bones form.

- ◆ Remove or disconnect peripheral devices.

- ◆ Remove extra network boards or LAN adapters.

When you have simplified the server and taken it to bare bones, note whether the problem happens again. To determine whether the OS is the source of the problem, restore each component of the system, one-by-one, checking to see whether the addition of the component generates the problem.

Use Research Tools

Novell and other vendors provide research tools you can use to resolve problems, for example:

- ◆ The Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for Technical Information Documents (TIDs) and patches. You can browse by product or search using partial filenames and

wildcards. You might look for the Top 20 Downloads or the most recently released files.

  ◆ Support forums at http://support.novell.com where you can post technical questions and receive a response from a Novell Certified System Operator (SysOp). You can also browse responses that have already been posted.

  ◆ Novell's development World Wide Web site, containing information about third-party products certified to run with NetWare, at http://developer.novell.com. You can use a form-based search facility to located tested and approved bulletins by category.

  ◆ NetWare user groups, located in most cities and countries. NetWare Users International (NUI) offers NetWare support forums on the World Wide Web.

  ◆ Vendor World Wide Web sites provide information and updated software to download.

  ◆ NetWare utilities, such as MONITOR. This utility can provide important clues to the source of server or network performance problems.

  ◆ ManageWise®, Novell's network management application. ManageWise provides an integrated set of management services for managing and controlling servers and Simple Network Management Protocol (SNMP) devices. It lets you monitor and analyze network traffic trends on ethernet, token ring, and FDDI networks.

  ◆ NetWork analyzers. Analyzers are good tools for gathering troubleshooting information about packet traffic on the physical network.

Develop Hypotheses and Perform Tests

Once you have gathered information, eliminated obvious causes, or simplified your system, it's time to determine what you think is the most likely cause of the problem. You might develop several hypotheses. If so, decide which is the most likely, the next mostly likely, and so on. Base your hypotheses on the data you've gathered and your own experience with the system.

Once you have developed your hypotheses, test them, keeping these tips in mind:

  ◆ Decide which hypotheses seem the most likely and test these first. Test the least likely hypotheses last. The only exception might be a hypothesis that is very quick and easy to test; in which case, you might want to eliminate it first.

- Break hypotheses down into the smallest possible components and test each one separately. For example, if you suspect the problem is with the physical network, try to isolate which cable segments, cards, or connectors might be the source of the problem and then test each one individually. Test only one thing at a time.

- Try swapping components. If you suspect a faulty component is causing the problem, replace it with a component that you know is good. Be sure to swap only *one* component at a time.

- Simplify the system. If you haven't already done so, try programs removing components from the system. If the problem still occurs, you have a smaller set of components left that can be the source of the problem. If the problem goes away, start reloading components one at a time. After each addition, note whether the problem occurs. See

Look for Additional Help

Be prepared, when asked, to tell the support representative what troubleshooting steps you have already taken.

Using Novell Authorized Resellers

Locate Service Partners by locality or area. Check Novell's World Wide Web site (http://novell.com or http://support.novell.com) for a list of resellers and distributors worldwide.

Opening a Support Incident

An incident is defined as the resolution of one Novell issue, problem or question, regardless of the number of communications required to achieve resolution.

Novell customers may purchase technical support on a per-incident basis. Per-incident support can be charged to a major credit card, or can be pre-purchased in any quantity with a personal check, credit card, or purchase order. To purchase single incidents as needed, call your regional Novell Support Center. To pre-purchase technical support incidents in any quantity, call 1-888-321-4272 in the United States or Canada, or call your regional Novell Support Center.

Current telephone numbers for Novell Support Centers for the Americas, EMEA (Europe, Middle East, and Africa), and Asia-Pacific are available

under Novell Telephone Support at http://support.novell.com. For the Americas, the Technical Support telephone numbers are 1-800-858-4000 and +1-801-861-4000.

If the problem is a NetWare bug and no patches were previously available, then there will be no charge.

Depending on the type of prepaid service agreement your company has in place, you may be able to open an electronic incident, update an already open incident, or check the status or history of your incident.

Document the Solution

Once you resolve a server or network problem, document the solution thoroughly. The information will be helpful if similar problems occur in the future. Be sure to document changes to the server or network configuration, software and hardware updates or additions, new version numbers, work-arounds, etc.

Creating a Core Dump

Novell may request a core dump when a server experiences a lockup or abend and other troubleshooting has failed to resolve the problem. A core dump is a copy of a NetWare server's memory at the time the server abended. Core dumps can be analyzed by Novell engineers and are often the key to finding software bugs. However, now that servers typically use large amounts of RAM, creating a core dump is less likely to be a routine troubleshooting procedure. Your abend.log file may be equally valuable for diagnosis.

IMPORTANT: Novell will expect you to install all necessary patches before requesting a core dump. To send a core dump file to Novell, you must first open a support incident, which will be billable. You will not be charged until the incident is resolved or closed. If the problem is a NetWare bug and no patches were previously available, then there will be no charge.

The procedure is explained following, but your support representative can walk you through it when you call.

You can perform the following types of core dumps:

- **Full core dump.** Copies all server memory to a local drive or device.

- **Full core dump minus cache.** Copies all server memory except file cache (disk cache) to a local drive or device. The cacheless core dump is smaller, but it provides as much useful information as a full core dump.

A core dump can be started two ways:

◆ By responding to the core dump choices displayed by NetWare after an abend has occurred.

The prompt—Type?—allows you to specify a full core dump or a cacheless core dump, as explained above.

The prompt— Device?—allows you to specify a local drive or a DOS-writable device.

NOTE: Other types of core dumps may become possible in the future. Your Novell Technical Support Representative will inform you if that is the case.

◆ By forcing a core dump by typing **.c** while in the NetWare debugger.

If the server is not completely frozen, you can enter the debugger by pressing these keys: Shift + Shift + Alt + Escape.

HINT: Press the left Shift key with the left hand, and press both the right Shift key and Alt with the right hand. Then press Escape with the most convenient finger of the left hand.

Then type **.c**. The server then displays core dump choices.

When the core dump is finished, enter **g** to exit the debugger and to redisplay the server console prompt. Or else enter **q** to exit to DOS.

Performing a Core Dump to a Local Drive

After you start the core dump, you are asked to specify the DOS drive letter and file path to which the memory image file will be written. The size of the full image file will be approximately equal to the total RAM installed in the server. For a cacheless core dump, the size of the image file will be approximately equal to total RAM minus the amount of file cache (disk cache memory).

The drive can be any writable DOS device that contains enough storage space. But remember that it must be set up, not only before the server abends—but before the server is booted.

When the image is written to a local hard drive on the server, the default name of the image file is c:\coredump.img. Once the file is on the hard disk, it can be compressed, copied to diskettes, backed up to tape, or sent by FTP to ftp.novell.com (if you have opened a support incident).

The image file can also be written to a NetWare drive later, after the server is up and running. This can be done using an NLM called imgcopy.nlm or any

other third-party NLM that provides this functionality. Use File Finder to locate imgcopy.nlm on Novell's World Wide Web site, http://support.novell.com.

Sending the Core Dump to Novell

Before sending the memory image to Novell, contact a support representative to open a support incident. You will be assigned to a Technical Support Engineer who will help you analyze the memory image file. The Technical Support Engineer will make arrangements to receive the image either in the regular mail or through the internet and will advise you on the best media format to use.

Slow Network, Performance Problems

Resolving Slow Server Response

To diagnose slow server response problems, identify whether the following conditions exist:

- The workstation network board is slow or faulty.
- Network cabling is faulty.
- The server network board is slow or faulty.
- Too many users are using the network.
- The server speed is not set to the highest speed.
- The server hard disk is slow or faulty.
- The server is low on memory.
- The volume has too many deleted files that have not been purged.
- Network traffic is extremely high.
- The cabling system is experiencing too much interference.
- A hard disk has failed or is failing.
- Insufficient directory buffers, cache buffers, or packet receive buffers have been allocated.
- An EISA controller board needs to be configured to use interrupts.

To resolve slow server response problems, perform the following actions.

- Check the computer's documentation for switch information. Set the processor speed to its highest setting. Use SPEED to verify that the processor is running at the appropriate speed.

- If a workstation or the server seems slow, insert a new network board into the slow computer to check performance. If the speed is still below normal, reinstall the original network board and then replace the cable attaching the workstation or server to the network.

- Load MONITOR to check the status of packet receive buffers and service processes. Compare their values to the maximum allowable value.

  In MONITOR, in the Available Options menu, select Server Parameters to increase the values for the following parameters if your system has reached the maximum value: Maximum Service Processes and Maximum Packet Receive Buffers. (You can also use SET at the command line.) Also see Assessing Server RAM in *NetWare Server Memory* in the NetWare 5.1 online documentation.

- In MONITOR, in the Available Options menu, select Storage Devices and check the Hot Fix™ status of all hard disks that use the Traditional NetWare file system. Verify that all mirrored disks are still mirrored.

- Run the NetWare Administrator utility to purge deleted files. Or you can set the Purge attribute on files you want to be purged immediately after being deleted.

- In MONITOR, in the Available Options menu, select LAN/WAN Drivers and check the LAN driver statistics. If you have more than one network board, compare the boards' Total Packets Transmitted statistics. If one board is receiving most of the traffic, recable the network so that the boards have equal loads.

- If you are on a multiserver network or an internetwork, recable the system with a backbone to reduce network traffic.

- Check the cabling for interference from fluorescent lights, microwaves, radar, X rays, and copy machines. Either move the cable or shield it from the source of interference.

Insufficient Packet Receive Buffers, No ECB Available Count Errors

The ECB (Event Control Block) counter is incremented when a device sends a packet to your NetWare server, but no packet receive buffer is available.

The server allocates more packet receive buffers after each incident until it reaches its maximum limit (configured with a server parameter).

If you are using an EISA busmaster board (such as the NE3200™ board), you will probably need to increase both the minimum and maximum number of packet receive buffers.

See Minimum Packet Receive Buffers and Maximum Packet Receive Buffers in SET Communications Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

No ECB Available Count messages can also indicate that the driver is not configured correctly or that the Topology Specific Module (TSM) and the Hardware Specific Module are incompatible.

This value is maintained by the TSM module.

High Utilization Statistics in MONITOR

Network performance is a key concern for network administrators and for Novell as well. Unfortunately, there is sometimes confusion about performance indicators and what their statistics mean.

For example, the idea that processor utilization is the key performance indicator for NetWare is much too simple. Some network administrators are concerned when the Utilization value in MONITOR, General Information screen approaches 100%—on the assumption that the higher the percentage, the worse NetWare's performance is. This is entirely *false*.

What Is Normal?

Consider first what the Utilization value represents: the average of the server's total processing capacity that was used during the last second (update interval). The remainder of the capacity was spent in the idle loop process. In other words, it is an indication of how much of that time the processor had something to do. A high utilization value means that NetWare is using that percentage of the processor's capacity and wastes less time doing nothing.

Some processes make efficient use of the processor and as a result may cause 100% utilization. This type of utilization is entirely appropriate. Most of the time when utilization moves up to 100%, it means that the thread is using the processor efficiently. It may stay at 100% for a couple of minutes. This is normal.

It is *not* normal, however, when the utilization is at 100% for 15 to 20 minutes, when connections are dropped, and server performance deteriorates noticeably. High utilization with these conditions indicates a problem. If you're not seeing these conditions, your utilization may be normal, even when it's at 100%.

How do you know what is normal for your server? You will recognize problems if you baseline your server. Know what is normal and know the difference between a cosmetic problem and a true performance problem. (You can test for a cosmetic problem by loading or unloading any NLM. This will cause the processor information in MONITOR to be recalculated.)

What Are the Most Common Solutions?

Before troubleshooting high utilization problems, make sure that you have followed the steps in "A Troubleshooting Methodology" on page 94. Check the Novell Support Connection at http://support.novell.com for NetWare 5 patches or updated modules. Available patches will contain fixes for reported high utilization problems related to the actual code of the operating system and NDS.

However, there are also a number of high utilization conditions that can still result from problems with configuration, levels of NLMs, and with tuning issues. You can use the following list to help you resolve problems.

The items in the list are categorized, but are otherwise in no particular order. The list represents the collective experience of Novell Technical Support Representatives . We recommend that you review each item, using each to carefully analyze your system. Except for problems new to NetWare 5, you will be able to resolve the problem on your own in almost every case.

Operating System Issues

◆ Server resources. Server resources can be divided into LAN, disk, and processor resources. LAN and disk resources are the number of buffers available. Processor resources are the number of service processes available. When a network packet arrives or when a disk read or write is performed, a buffer should be available to hold the data until a service

process is available to service it. Running low on either buffers or service processes for even a brief period can cause high utilization on the server and delay for the users.

To understand how server parameters work together to control the allocation of server resources, see "Monitoring Allocated Services" on page 69.

For the procedure to configure the allocation of packet receive buffers (communication buffers, see Increasing Maximum and Minimum Packet Receive Buffers in the *NetWare Server Communications* manual; and for parameter descriptions see, SET > Communications Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

For information on controlling the allocation of directory cache, see Tuning Directory Cache in *NetWare Server Memory* manual and SET Directory Caching Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

For parameter descriptions, see also the service processes parameters in SET > Miscellaneous Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

Novell suggests that the following server parameters be set as indicated to avoid running low on server resources. This is especially important if you have 100 or more users. As a guideline, 2 to 3 per connection is recommended for the minimum values. You can use SET commands at the System Console prompt or use MONITOR, in the Available Options menu, select Server Parameters.

```
Minimum Packet Receive Buffers=value
Maximum Packet Receive Buffers=4000
Minimum Directory Cache Buffers=value
Maximum Directory Cache Buffers=4000
Maximum Service Processes=1000
New Service Process Wait Time=0.3
```

◆ Processor speed. Use the SPEED command at the server console. In a few cases, a system board drops the processor speed after the server boots. A processor speed rating drastically lower than what is expected may indicate a configuration problem. See SPEED in *Utilities Reference* in the NetWare 5.1 online documentation.

◆ Processor hog. Use MONITOR, in the Available Options menu, select Kernel > Processors to determine whether one thread is hogging the

processor. You can set the CPU Hog Timeout Amount to a value lower than the default. Specify the amount of time in seconds to wait before terminating a thread that has not relinquished control of the processor. See SET Miscellaneous Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

Storage Devices and Adapter Issues

◆ Drivers. See "Keep Your Servers Patched" on page 94. For a brief explanation of NetWare Peripheral Architecture (NWPA), see Drivers for Host Adapters and Storage Devices in *NetWare Server Disks and Storage Devices* in the NetWare 5.1 online documentation.

◆ Free blocks. Adequate Free Blocks are essential. A Free Block is a disk block that has no salvageable files stored there. A file that has been both deleted and purged becomes free space. Maintain a minimum of 1000 free blocks on each NetWare volume that has suballocation enabled.

Suballocation, normally a low priority process, uses free blocks to perform its function. When free blocks are low, suballocation can go into an "aggressive" mode. Maintaining over 1000 free blocks will usually avoid this problem.

To check how many Free Blocks you have on a volume, use In MONITOR, in the Available Options menu, select Volumes > Volume Information > Free Blocks. If there are not at least 1000 free blocks on the volume, run (at a workstation) PURGE /A from the root of the volume. This removes all deleted files from the directories and subdirectories and increases your free disk space. See PURGE in *Utilities Reference* in the NetWare 5.1 online documentation.

If you have applications that create large numbers of temporary files you may want to set the P (Purge) flag on the directories where these files are stored. Every temporary file that is created will be put on the deleted file list. These files are kept on the disk until PURGE is run. You could also run SET Immediate Purge of Deleted Files=ON at the server console prompt.

◆ Suballocation. Use a disk block size of 64 KB. It is very important to monitor the disk space. Novell Technical Support recommends keeping 10% to 20% of the volume space free to avoid suballocation problems. Suballocation does not have any server parameters to adjust. See Checking Available Disk Space in *NetWare Server Disks and Storage Devices* in the NetWare 5.1 online documentation.

◆ Compression. When using compression with the Traditional File System, it is essential to have the server patched. Because it takes processor cycles to compress and decompress files, compression needs to be monitored carefully to avoid utilization problems. For compression take this into consideration, the default SET > File System Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

For example, file compression is set by default to occur during off-hours or periods of low server usage. Make sure that change have not been made that are causing high utilization problems.

File decompression occurs on the fly. However, a very large file, such as 100 MB, can take a noticeable amount of time even with a Pentium* processor.

The SET Deleted Files Compression Option= 2 causes the immediate compression of files that have been deleted. This can cause high utilization because the processor immediately compresses files upon their deletion.

Directories that are flagged IC (Immediate Compression) can cause excessive decompression during work hours. Users with disk space restrictions may flag their home directories to IC in an attempt to save disk space. This can affect server performance.

To ensure that frequently used files are not compressed, you can specify an appropriate value for the SET Days Untouched Before Compression parameter

To proactively eliminate compression as a possible problem, use SET Enable Files Compression=OFF. This will cause files to be queued for compression but the files will not be compressed. However, accessing compressed files causes them to be decompressed.

Memory Issues

◆ Insufficient RAM. Memory resources are critical in a server environment. The best indicator for assessing server RAM for the Traditional file system is displayed in MONITOR, in the Available Options menu, select Disk Cache Utilization > LRU Sitting Time. The value of this field should be a minimum of 15 to 20 minutes. A number lower than this indicates that the server's memory resources may be low. For more information, see Assessing Server RAM in *NetWare Server Memory* in the NetWare 5.1 online documentation. Another good indicator, Long Term Cache Hits, is displayed in MONITOR on the General Information screen.

◆ See also "Memory Error Messages, Memory Problems" on page 122.

Directory Services Issues

- Directory Services partitions. Novell recommends having no more than three replicas of each partition in the tree. Efficient tree design is essential to avoid utilization problems. Because NDS needs to maintain synchronization among all servers in the replica ring, the more replicas there are of any partition, the more traffic will be on the wire. Three replicas are enough to provide fault tolerance and to allow for NDS recovery if a database were to become corrupt.

- Directory Services synchronization. To test the possibility that NDS synchronization is the problem, turn off inbound and outbound synchronization for an hour by setting dstrace=!D60. Do to this in MONITOR, in the Available Options menu, select Server Parameters > Directory Services. For more information, see SET > Directory Services Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

  After turning synchronization off, wait 5 to 15 minutes to allow the server to catch up with queued work. Cancel the test by setting dstrace=!E.

- Directory Services errors. To test for other errors, run SET dstrace=ON. Or use MONITOR, in the Available Options menu, select Server Parameters > Directory Services. Check for persistent synchronization errors on the Also see SET > Directory Services Parameters in *Utilities Reference* in the NetWare 5.1 online documentation.

- Bindery emulation. Only one thread is created for all bindery connections; consequently printers using bindery emulation can monopolize a processor.

Printing Issues

- Bindery emulation. Eliminate printers using bindery emulation or reduce them to a minimum. Only one thread is created for all bindery connections; consequently bindery connections can monopolize a processor. NDPS (Novell Distributed Print Services) is the preferred print service for NetWare 5.1 and is fully compatible with existing queue-based printing resources. This means that you can make the transition from your legacy printing setup gradually.

- Number of printers. No more than 40 printers can be serviced from one server. More than that will degrade server performance. However, this number depends on the type of printing that is being done. Printing CAD/CAM designs take much more processor time than text documents. If you are concerned about utilization problems, we recommend that you set your print devices to do the processing instead of the server. This will slow down printer output but will relieve the utilization on the server.

Client Issues

- ◆ Hung connections. Check for them and clear them. See "Clearing a Workstation Connection" on page 75.

- ◆ Client software. You can identify client problems by changing NCP Parameters SET parameters. You can use MONITOR in the Available Options menu, select Server Parameters > NCP.

  By setting these server parameters to ON, the server displays a warning each time a bad packet is received at the server. The warning message also includes the MAC (Media Access Control) addresses of devices where the packets originated.

  ```
  Display NCP Bad Component Warnings=ON
  Reject NCP Packets With Bad Components=ON
  Display NCP Bad Length Warnings=ON
  Reject NCP Packets With Bad Length=ON
  ```

  Update client software.

- ◆ Cabling. If you have installed high speed 100 MB network boards, you may need to upgrade your cabling, too.

- ◆ RConsole. If RConsole is run from a DOS window on Microsoft* Windows* and you leave it running while you open another DOS window or toggle to it, server utilization will exceed its limits (max out).

  In addition, REMOTE and RSPX, the two server modules that enable a workstation to access the server console remotely, can aggravate high utilization, can aggravate its effects.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for high utilization problems involving particular software or hardware products; and contact a Novell Authorized Reseller or Novell Technical Support.

Suspected Multiprocessing Problems

Perform the following steps if you suspect a multiprocessing problem. You will be able to eliminate most probable causes.

1. Are the secondary processors online?

   If the server is already up, run DISPLAY PROCESSORS at the server prompt. Online processors appear in green, and offline processors are in red. (Processor 0 cannot bot be taken offline.) Run STOP PROCESSORS.

   If the server is down, add the command SET Auto Start Processors=ON to startup.ncf. Then bring up the server and then run STOP PROCESSORS.

   If the problem still occurs, go to Step 2. If not, go to Step 4.

2. To verify that this is *not* an interrupt issue, remove the PSM. The mps14.psm, cpqmpk.psm, or *.psm in startup.ncf is the interrupt abstraction layer and communicates with the APIC (Advanced Programmable Interrupt Controller) rather than the PIC for interrupt handing in the machine.

   Then bring up the server and run STOP PROCESSORS again.

   If the problem still occurs, it *not* a multiprocessing issue. If it no longer occurs, go to Step 3.

3. Check with the hardware vendor and make sure you have the latest machine updates (current ROM BIOS, etc.), If you confirm that your hardware is current and the problem still occurs, it's possible that you are using a new version that wasn't available at the time Netware 5 was released. Whatever is different about the hardware requires a newer PSM to work with the machine.

   NOTE: Problems that occur only in a multiprocessing environments are not necessarily MP problems. More likely, it is an issue with a piece that has been loaded in an MP environment and that does not function properly.

4. Gather information as explained in "A Troubleshooting Methodology" on page 94. Use startup.ncf and autoexec.ncf to determine what software pieces are running. Check with the software vendors and developers and tell them what steps you have taken and give them enough information to duplicate the problem.

If the problem still occurs, review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for recent TIDs that might resolve your problem; and contact Novell Technical Support.

Unable to Communicate with Server, -625 Errors

Communication problems among servers can generate messages such as Unable to communicate with server or messages that a Directory partition operation can't be completed. If DSTRACE is set to on, -625 errors appear in the DSTRACE output because the Directory cannot be synchronized among the servers.

Follow these steps to troubleshoot server-to-server communication problems.

1. Is the server down? Has it abended?

   Run DISPLAY SERVERS at the server console prompt to see if the server is visible on the network.

   If the server is down, restart it. If the server has abended, troubleshoot the abend. See "Server Abends" on page 133.

2. Is time synchronized?

   Enter TIME at the server console to see if server time is synchronized to the network.

   If time is not synchronized, troubleshoot the time synchronization problem. For general information about time synchronization, see Network Time Management Guide *Network Time Management Guide*.

3. Is the IPX internal network number of the server unique? Are IP addresses unique? Do all replicas have the correct address for each server?

   If all the servers in a replica ring cannot communicate with one of the servers in the ring, there is probably an address problem.

   Make sure all addresses are unique. Make sure all replicas have the correct address for each server. Load DSREPAIR, select Advanced Options > Replica and Partition Operations > (select a replica) > Display Replica Information.

4. Do all replicas have the correct server name?

   Incorrect or duplicate server names in Directory replicas make it impossible to communicate with the server. Make sure all replicas have the correct name for each server. Load DSREPAIR, select Advanced Options > Replica and Partition Operations > (select a replica) > Display Replica Information.

If names are not correct, contact Novell Technical Support or an Authorized Novell Reseller for assistance in renaming servers.

5. If the servers share the same cabling system, are addresses unique for each cable segment?

   If addresses are not unique, change addresses as necessary.

6. Are LAN drivers loaded and protocols bound? Are LAN adapters and drivers the latest versions?

   Load and bind LAN drivers, if necessary. If drivers are not the latest versions, update the drivers. In addition, review Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for known problems with specific adapters. Replace adapters if necessary.

7. Is the LAN functioning?

   Ping the servers to see if the connection is active. Run TRACK ON at the server console to monitor traffic into and out of the server. View LAN statistics in MONITOR to make sure packets are being sent and received. (In MONITOR, in Available Options menu, select LAN/WAN Drivers > highlight a driver and press Tab to expand the information window.) Review statistics such as packets received and sent, collisions, and retries.

   If the LAN connection is malfunctioning, troubleshoot the physical link between the servers. See "Tips for Resolving General Communication Problems" on page 120.

8. Have servers just been upgraded from NetWare 3.*x*?

   Some routers don't have enough memory to buffer the increase in packets from NetWare 4.*x* or 5.*x* servers. Make sure the routers have enough memory.

9. If the servers are using IPX, are routers filtering SAP types 004, 26b, 278?

   If yes, remove the filters.

10. Have any other changes been made to routers before the problem started?

    If yes, try using the RESET ROUTER command to reset the server's internal router. Troubleshoot other routers.

11. Are servers separated by 56 KB WAN links?

    If yes, this could be the source of the problem. Consider the following:

    Is there a guaranteed transfer rate or does the rate decline when network traffic is heavy? If the rate declines, the link might not provide the performance you need to maintain consistent communication.

    Are you trying to transfer large files or an entire replica across the link? You might be able to synchronize replicas across a 56 KB link, but not transfer an entire replica.

    Do the servers have to traverse more than one 56 KB link?

    To solve the problem, you might need to provide faster links.

12. Do the affected servers have utilization at or close to 100%?

    If yes, take steps to reduce server utilization. See "High Utilization Statistics in MONITOR" on page 104.

13. If using IPX, are IPX connections set to the recommended value (2000)?

    If not, enter SPXCONFIG I = 2000 at the server console.

14. Is the database locked?

    If DSREPAIR is running, the database will be locked. Other applications might also lock the database while writing to it.

    If the database is locked, wait for DSREPAIR or other module to finish using the database or shut down the utility or module.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Transaction Tracking Errors, -621 Errors, FD93 Errors

Any error that contains -621 or FD93 means that the Transaction Tracking System (TTS) has shut down. The server operating system cannot track and write the transactions at the maximum transaction level set for the server.

The problem might be temporary, because a partition operation generated a large number of transactions, or it might be recurrent, because the server can't handle normal peak transaction requests.

To enable TTS after it has been disabled, enter the following at the server console prompt:

```
ENABLE TTS
```

To troubleshoot TTS shutdowns, follow these steps.

1. Have you attempted NDS partition operations, such as removing a replica? Has the server displayed messages such as Growing TTS memory tables?

    Certain NDS partition operations require the server to track and write more transactions than it can handle. When this happens, the server displays error messages such as Growing TTS memory tables.

    Reduce the value of the Maximum Transactions server parameter so the server can track and write transactions without becoming overburdened. You might also need to reduce the value of the TTS UnWritten Cache Wait Time parameter.

    To modify the parameters, load MONITOR, in the Available Options menu, select Server Parameters > Transaction Tracking and set parameter values as follows:

    - ◆ Reduce the value of the Maximum Transactions parameter to 5,000.

    - ◆ If TTS shutdown continues to occur, reduce the value of the Maximum Transactions parameter to 1,000.

    - ◆ If TTS shutdown continues to occur, reduce the value of the TTS UnWritten Cache Wait Time parameter to 11 seconds.

    - ◆ Before removing a replica, set the Maximum Transactions parameter to 1,000 and the TTS UnWritten Cache Wait Time to 11 seconds.

2. Has the server abended with a message such as Abend: CPU Hog Detected by Timer that lists Transaction Tracking as the running process?

    If the server abended because TTS was not relinquishing the CPU, TTS might simply need more time to finish backing out a large transaction.

    If your server experiences this abend, set the CPU Hog Timeout Amount parameter to 0 to shut off the CPU monitoring process (In MONITOR, in the Available Options menu, select Server Parameters > Miscellaneous). Restart the server and allow TTS to finish backing out its transactions. When finished, set the CPU Hog Timeout Amount parameter back to its original value.

3. Has the server experienced memory errors, such as Memory Allocator out of available memory, along with the TTS shutdown?

NDS operations, such as migrating objects, merging trees, or creating objects, sometimes create a large number of TTS transactions in a short amount of time and cause TTS to use up available memory.

To prevent the problem, follow these suggestions:

- Use the latest version of NDS.

- Reduce maximum transactions on the affected server to 100.

- Add more memory to the affected server.

4. Has the Sys volume become full?

TTS backs out its transactions to the Sys volume, so if the volume becomes full TTS must shut down.

Remove files from the Sys volume or increase the volume size.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Workstations Can't Communicate with Server

See the following sections to troubleshoot different kinds of workstation to server problems:

Errors Reading from and Writing to Network, Server Cannot Be Found Errors

When workstations can't communicate with the server, users lose their connections to the server or cannot log in at all. Users might see Server Cannot Be Found messages or errors about reading from or writing to the network.

Follow these steps to troubleshoot the problem.

1. Can other clients connect to the server?

If other clients can connect to the server, then the problem is with this client, not with the server or network. Consider the following:

◆ If the user cannot log in, did the user power off without logging out?

If the user powers off without logging out, the client connection remains open and the user will not be able to log in again until the connection is cleared. The server's watchdog process will retry the connection a designated number of times, then the connection will time out and the server will clear the connection. Once the connection is cleared, the user will be able to log in again.

Watchdog processes are controlled by SET parameters accessed through MONITOR (in MONITOR, in the Available Options menu, select Server Parameters > Communications).

◆ Has the user's password expired?

Sometimes users don't understand that they *must* change their passwords before they use up their grace logins.

◆ Are there other restrictions on the user account, such as time periods when the user is not allowed to log in? Check the user's properties in NetWare Administrator.

◆ Has intruder lockout been activated?

◆ Is the workstation LAN cable functioning?

2. Has the server abended?

If the server abended, the server will display an abend message on the console screen. If the abend auto recovery process restarted the server, the message might have scrolled off the screen. Check the abend.log file in Sys:system to read the message.

To troubleshoot a server abend, see "Resolving Abends" on page 137. For general information about types of server abends, see "Types of Abends" on page 134. To manage the abend auto recovery process, see "Managing the Abend Auto Recovery Mechanism" on page 143.

3. Is the server console hung?

If you cannot enter commands at the server console prompt, then the console is hung. In some cases, you won't be able to toggle among server screens.

Try pressing Ctrl + Alt + Esc. This should display a prompt to down the file server and exit to DOS. If the prompt is not displayed, try entering the debugger by pressing Shift + Shift + Alt + Esc. If you can enter the debugger, type q and press Enter to exit to DOS. Reboot the server. See "Server Console Hangs" on page 132 to troubleshoot the problem.

If neither of the commands just described works, the only way to exit the server is to force a non-maskable interrupt (NMI) error. Contact Novell Technical Support, a Novell Authorized Reseller, or your computer hardware vendor for assistance.

If you do not have time to obtain the assistance to generate an NMI, you can power off the server, but this can corrupt operating system files. Try this measure at your own risk.

4. Is the Sys volume mounted?

   Type VOLUMES at the server console to display a list of mounted volumes. If volume Sys is not mounted, mount it. The server does not broadcast to the network until volume Sys is mounted.

5. Are there LAN problems?

   At the server, execute TRACK ON to make sure that traffic is flowing into and out of the server.

   View LAN driver statistics to see if packets are being lost or if there are excessive collisions or retries. To see LAN statistics, in MONITOR, in the Available Options menu, select LAN/WAN Drivers, then press Tab to expand the information window, which contains the statistics.

   For tips on troubleshooting communications problems, see "Tips for Resolving General Communication Problems" on page 120

   If necessary, use LANalyzer® or a similar product to monitor network traffic and isolate the problem.

6. Is server utilization high?

   Check utilization statistics in MONITOR. For help in responding to high utilization, see "High Utilization Statistics in MONITOR" on page 104.

   If you suspect heavy LAN traffic is causing the problem, try unplugging the LAN cable. If heavy LAN traffic was the problem, utilization should drop.

7. Is the server receiving No ECB Available Count messages or messages about insufficient packet receive buffers?

   These messages could indicate that the server is running out of resources. For help in resolving these errors, see "Insufficient Packet Receive Buffers, No ECB Available Count Errors" on page 104.

8. Is the NDS database closed or locked by another utility, such as DSREPAIR?

If the NDS database is not functioning, the workstation clients will not display the login screen.

9. Are servers receiving -625 or other communication errors?

    See "Unable to Communicate with Server, -625 Errors" on page 112 or see the Novell Error Codes online documentation (http://www.novell.com/documentation/lg/nwec/index.html) > NDS Error Codes.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Connections Dropped Periodically

1. Is server utilization high?

    Check server utilization statistics in MONITOR. See "High Utilization Statistics in MONITOR" on page 104.

2. Are users using old NetWare clients?

    If so, upgrade to the newest version of the appropriate NetWare client.

3. Do any of the workstations have the same node number?

    Node numbers must be unique for each workstation. If there are duplicate node numbers, change numbers so that all workstations have unique addresses.

4. Are any network boards malfunctioning in the server or workstation? Are there old boards or drivers?

    Check the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for any known problems with your drivers and boards; update drivers; replace boards if necessary.

5. Are cables terminated correctly?

    Check all cables to make sure they are are firmly connected, terminated correctly, and not running near any equipment that might cause interference.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Tips for Resolving General Communication Problems

To resolve general network communication problems, perform the following actions:

◆ Check all hubs and repeaters to make sure they are on. Check concentrators and look for flashing yellow lights that indicate collisions.

◆ Make sure all routers are functioning properly and have enough memory. A router with insufficient memory becomes the weak link in the chain and can slow down an entire LAN.

◆ Check the cables for proper termination. Make sure cables are not running close to sources of interference.

◆ Make sure the server network adapter is seated properly and is initializing.

◆ Run CONFIG at the server console to make sure a protocol is bound to each board and to check the configuration of the network boards. Then bring down the server, turn off the power, and check the actual network board settings:

  ◆ Make sure all settings agree with the settings used to load the driver. If you load the driver with an interrupt that conflicts with the board's setting, the network board cannot broadcast on the network.

  ◆ Make sure the node address on the board is a legal address. (Addresses 0 and FFFFFFFFFFFF are reserved; do not use them.)

  ◆ Make sure that the memory range for the I/O ports and memory addresses do not overlap. If there are conflicts, reconfigure the equipment so that no conflicts exist.

◆ Make sure that adapters do not conflict with other boards, the monitor board, or ports in the server. Make sure no two pieces of hardware are using the same I/O port, interrupt, or memory address. Avoid interrupts 2, 9, and 15.

◆ Make sure the network adapter works correctly; replace it if it doesn't. Check the lists of certified products at http://developer.novell.com to make sure the adapter works with NetWare. Make sure drivers are the latest versions.

◆ Run VOLUMES at the server console. If volume Sys is not mounted, mount it. The server does not broadcast to the network until volume Sys is mounted.

- Check workstation addresses and server node numbers:

  Each node address on the network should be unique. Sometimes you can find the problem by turning off all workstations and turning them on one at a time

- Make sure workstations are using the correct frame type.

- Have a user log in to the network from a workstation. Load MONITOR in the Available Options menu, select Connections.

  If the Active Connections list shows the user's login name, the server is receiving and responding to the workstation's request.

  If the workstation receives a Server cannot be found error, make sure the server and workstation are using the same frame type.

  If using 10baseT, try using a cross-cable to connect the server directly to the workstation. If this solves the communication problem between the server and workstation, then something on the network is causing the problem.

Admin Account Has Been Deleted or Admin Password Is Unknown

There is only one solution when the Admin account has been deleted or the Admin password has been lost: Contact Novell Technical Support for assistance.

To avoid losing the Admin account, it is recommended that you create one or more additional user accounts with the same privileges as the Admin account.

IMPORTANT: Do not assign privileges to the additional accounts by setting up security equivalence with Admin. The accounts will lose security equivalence if Admin is deleted.

Memory Error Messages, Memory Problems

See the following sections to troubleshoot different kinds of memory problems, to resolve memory leaks, and to resolve memory problems by freeing memory:

- "NetWare Doesn't Recognize All the Memory in the Server" on page 122

- "Server Displays Memory Error Messages" on page 123

NetWare Doesn't Recognize All the Memory in the Server

1. Does config.sys or autoexec.bat include a DOS=HIGH statement, or commands to load memory managers or DOS device drivers? For example, is there a command to load himem.sys or emm386.exe? Both are memory managers.

   Comment out these statements from config.sys or delete config.sys altogether. Comment out these statements from autoexec.bat. (To comment out a command, type REM and a space at the beginning of the command line.)

   If there is a memory manager in the server, NetWare relies upon the memory manager to determine the amount of available memory, instead of registering the memory itself. Some memory managers cannot recognize more than 64 MB of memory. DOS device drivers take memory away from NetWare's memory pool.

   Make sure Windows 95 is not being used to boot the server. Windows 95 autoloads memory managers.

2. Is the server BIOS out of date?

   An out of date BIOS might be reporting the wrong amount of memory. Update the BIOS if a newer version is available.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Server Displays Memory Error Messages

Typical memory error messages include, Cache memory allocator out of available memory, Short term memory allocator is out of memory, and Cache memory allocator exceeded the minimum cache buffer limit.

1. Is the server loading a memory manager or a DOS device driver?

   Check the autoexec.bat and config.sys files to make sure no memory managers, such as himem.sys, or emm386.exe, are being loaded, and that

there is no DOS=HIGH statement in either file. Make sure no DOS device drivers are being loaded.

Comment out these statements from config.sys or delete config.sys altogether. Comment out these statements from autoexec.bat. (To comment out a command, type REM and a space at the beginning of the command line.)

If there is a memory manager in the server, NetWare relies upon the memory manager to determine the amount of available memory, instead of registering the memory itself. Some memory managers cannot recognize more than 64 MB of memory. DOS device drivers take memory away from NetWare's memory pool. Make sure Windows 95 is not being used to boot the server. Windows 95 autoloads memory managers.

2. Is the server BIOS out of date?

   An out of date BIOS might be reporting the wrong amount of memory. Update the BIOS if a newer version is available.

3. Is the Reserved Buffers Below 16 MB parameter value too low, for example under 200?

   If so, use MONITOR to increase the value (in MONITOR, in the Available Options menu, select Server Parameters > Memory). Increase the value to 200 or higher, especially if there is a CD-ROM or tape device that needs memory below 16 MB.

4. Is memory being registered manually?

   Manually registering memory can cause memory fragmentation. Some old system boards might require you to register memory manually, but the better solution is to upgrade to a newer board so that NetWare will register the memory automatically.

   If memory has been registered manually, reboot the server to free memory and do not manually register memory again. Upgrade the system board if necessary.

5. Do memory errors occur when a volume is mounting?

   If yes, the server might be low on memory.

   To free memory temporarily, see . To solve the problem, add more RAM.

6. Does the LRU sitting time, as shown in MONITOR, average less than 15 minutes during peak work hours?

If yes, the server might be low on memory.

To free memory temporarily, see "Resolving Server Memory Problems" on page 125. To use the LRU Sitting Time to tune memory, see Tuning File Cache. To solve the problem, add more RAM.

7. Do the LRU Sitting Time and Long Term Cache Hits gradually decline over time, even when network traffic has not increased and no new applications have been installed on the server?

If yes, the server might have a memory leak. See "Resolving Server Memory Leaks" on page 124.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Resolving Server Memory Leaks

The following information is available in more detail from Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp).

A memory leak means that an NLM or set of NLM programs has requested memory from the server, but has not returned the memory when finished with it. Over time, the amount of available memory decreases until eventually the server generates memory error messages. The memory leak may be slow or fast depending on the amount of memory requested each time.

If you reboot the server, the memory is returned to the memory pool, and the low memory error messages stop temporarily, until the memory leak ties up enough memory to generate the error messages again.

To see if the server has a memory leak, restart the server and monitor memory statistics over time. Note whether the LRU Sitting Time and the Long Term Cache Hits statistics gradually decline, when traffic hasn't increased and no new applications are installed on the server. If they do, follow the steps below to find the source of the problem.

1. Load all the latest patches on the server.

Server patches are available from Novell's web site and other locations. See "Applying Patches" on page 40 for a list of sources.

2. Restart the server to free memory and establish a baseline for memory use.

3. Load MONITOR, in the Available Options menu, select Loaded Modules. Highlight a module name you suspect might be the source of the leak and press Tab to view the memory statistics for the module.

   Write down the Bytes in Use value for the module. Use this number as the baseline as you monitor the module's memory use over time.

4. Repeat Step 3 for each NLM you suspect might be the source of a memory leak.

5. When the memory error messages occur again, repeat Step 3 to view the memory statistics for each suspected NLM. Note whether memory use increased substantially for any of the modules.

   If there is a memory leak, one or more modules will show a large increase in the Bytes in Use value.

6. When you discover the source of the memory leak, contact the module vendor to tell them about the problem. If possible, update the module or remove the module from the server.

Resolving Server Memory Problems

To free server memory temporarily (until you can add more memory to the server), do one or more of the following:

- Delete unused files and directories and purge them. Use the NetWare Administrator utility to purge deleted files.

- Use MONITOR to lower the value of the Minimum File Delete Wait Time parameter to shorten the time period before deleted files are purged. Or change the Immediate Purge of Deleted Files parameter to On so that files are purged immediately after they are deleted. Both parameters are found in MONITOR, in the Available Options menu, select Server Parameters > File System.

- Unload any NLM, such as NWCONFIG or MONITOR, that is not currently needed.

- Dismount volumes that are not being used and reduce the size or number of volumes that the server supports.

- Streamline the directory structure. Every subdirectory in the traditional file system takes at least one directory block (by default, a 4 KB block of memory). Thus, subdirectories with only one file require as much memory as directories with 32 files.

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

◆ Try converting volumes from the traditional file system to the NSS file system. It requires less memory to mount NSS volumes.

◆ If you are using the traditional file system, remove name space support. (The NSS file system does not use 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 modules except the volume's disk drivers. Dismount any mounted volumes.

To remove the name space, load VREPAIR, select Set VRepair Options and then select two options: Write All Directory and FAT Entries Out to Disk and Remove Name Space Support From The Volume. Then run VREPAIR > Repair a Volume on the volume that would not mount.

◆ As a last resort, back up all files in the volume, bring down the server, and use NWCONFIG to reinitialize the volume. Specify a block size of 64 KB and turn the Block Suballocation option to Off.

(This setting uses a lot of disk space but increases the amount of memory available.)

◆ Check the autoexec.bat and config.sys files to make sure no memory managers, such as himem.sys, or emm386.exe, are being loaded, and that there is no DOS=HIGH statement in either file. Make sure no DOS device drivers are being loaded

Disk Errors

See the following sections to resolve disk I/O, disk space, and mirroring problems.

General Disk I/O Errors

General disk I/O problems can produce error messages such as Device *name* deactivated by driver due to device failure, *Device_name* deactivated for unknown reason, Could not redirect block *number* on device *number*, and Some or all volume segments are missing.

Follow these steps to troubleshoot the problem.

1. Is all hardware installed and connected correctly?

   For example, are cables terminated correctly, are the connections firm, are disks installed correctly, and is the power on? If not, correct the problem and note whether the errors still occur. If they do, continue with the following steps.

2. Does NetWare recognize all devices?

   At the server console prompt, execute LIST DEVICES to make sure all devices are recognized.

   If devices are not recognized, run SCAN FOR NEW DEVICES and SCAN ALL to register the devices with the server.

   Execute LIST DEVICES again to make sure the devices are now recognized. If they are not, determine whether the correct CDMs are loaded for the devices not being recognized.

   If the device is corrupted, you might need to use a third-party application to salvage lost or corrupted volumes.

3. If this is a SCSI device, does the controller recognize devices when you start the server?

   If not, troubleshoot the hardware. Refer to your hardware documentation or contact the hardware vendor.

4. Are .ham drivers loaded for all disk channels and are they the latest versions?

   Some .ham drivers might have to be loaded reentrantly. Load the appropriate and most recent .ham for each disk channel.

5. Are .cdm drivers loaded for all devices and are they the latest versions?

   If not, load the appropriate and most recent .cdm for each device.

6. Are .hams and .cdms configured correctly?

Are interrupt, port, slot, and custom settings all correct for the hardware? Are interrupts unique for each driver? To see port, interrupt, and slot settings, load MONITOR, select Storage Devices, and highlight a .ham. Press Tab to expand the information window to see the settings for the selected module. Configure the drivers, if necessary.

7. Is there a valid partition on the device?

Load MONITOR, in the Available Options menu, select Storage Devices to see if partitions are visible.

Third-party software can be purchased to salvage lost or corrupted volumes. If you plan to use such a product, do not recreate the partition.

If partitions have been lost and you will not attempt to recover the data on them, you can use NWCONFIG to recreate partitions. Restore data from a backup.

8. Has the Hot Fix redirection area been used or has it been filled?

To see Hot Fix information, load MONITOR, in the Available Options menu, select Storage Devices. Scroll to highlight a Hot Fixed partition, then press Tab to expand the information window.

If the Hot Fix area is full or if it has grown since the last time you checked, the disk is probably failing. Troubleshoot or replace the disk.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Resolving Server Disk Space Problems

When a disk fills up, you will see error messages and alerts about insufficient disk space.

Follow these steps to troubleshoot the problem:

1. Does the volume have space available?

If yes, check the disk drives and disk channel to see if a failure has occurred.

If no, continue with the following steps.

2. Is there free (unassigned) space on the disk?

If yes, add the free space to the volume that is filling up. Load NWCONFIG, select Standard Disk Options > NetWare Volume Options; press Ins to add or modify volume segments.

3. Have deleted files been purged?

   When a file is deleted, it remains on the disk until it is purged. To purge all deleted files in a directory, start NetWare Administrator, select the directory containing the files, click Tools > Salvage > Purge. You can also purge selected files.

   Set the Immediate Purge attribute on files or directories so they are purged as soon as they are deleted.

4. Are there many unnecessary files, such as .tmp files and mail files or unneeded NLM programs?

   If yes, delete and purge the unneeded files and programs. If the Sys volume is full, users can still log on and delete files.

5. Are users restricted to a certain amount of disk space?

   If users are reporting that they are out of disk space, there might be restrictions on the amount of disk space they can use.

   If user restrictions are causing the problem, assign them more disk space or ask them to delete and purge unneeded files.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Mirrored Partitions Do Not Remirror Automatically

When mirrored partitions become unsynchronized, they should resynchronize automatically. If partitions do not resynchronize, follow these steps.

1. Load NWCONFIG and select Standard Disk Options > Mirror/Unmirror Disk Partitions. Highlight the out of sync partition and press F3 to manually start remirroring.

2. If the partitions still do not resynchronize, you must recreate the mirrored set. Follow these steps.

   Determine which disk partition has the data you want to save and mirror. Delete the other disk partition(s).
   Recreate new partitions in place of the ones you deleted.

Mirror the partition containing data to the new partitions.

For information about mirroring, see Mirroring and Duplexing Partitions.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Mirroring Takes a Long Time

If volumes are very large, mirroring can sometimes take several hours to complete; this is normal. The following steps might help to speed the mirroring process.

1. Are you using the latest disk drivers?

   If not, update drivers to the latest versions.

2. Are there any problems related to the disk drive or drivers?

   Refer to Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for known problems with specific hard disks or drivers. Contact the drive vendor to ask if there are ways to speed drive mirroring. For example, some drivers can be loaded with parameters that speed the mirroring process.

3. Is read-after-write-verify turned on in MONITOR?

   Most disk drives provide their own form of read-after-write verification; therefore, NetWare's read-after-write-verify feature is not needed and can increase the time required to mirror partitions.

   If the drive provides its own read-after-write verification, turn off read-after-write verify in MONITOR. For more information, see Turning Off Read-After-Write Verification in the *NetWare Server Disks and Storage Devices* in the NetWare 5.1 online documentation.

4. Is the Maximum Concurrent Disk Cache Writes parameter set to its default value or lower?

   If yes, try increasing the value of the parameter (in MONITOR, in the Available Options menu, select Server Parameters > File Caching). However, increasing the value too much can cause some disk controllers or drivers to fail. You must experiment to see if a larger value speeds the mirroring process.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Mirroring Stops Just Before It Is Finished

Sometimes, the mirroring process proceeds without error, but stops at 99% completion. Follow these steps to troubleshoot the problem.

1. Are there any faulty disk blocks?

   Review Hot Fix statistics in MONITOR to see if any redirection blocks have been used. Load MONITOR, in the Available Options menu, select Storage Devices > Hot Fixed Partition, and then press Tab to expand the information window.

   If there are faulty disk blocks, troubleshoot and replace the disk if necessary.

2. Are the latest disk drivers loaded?

   If not, update the drivers to the latest versions.

3. Are there any known problems with the brand or version of the hard disk?

   Check the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for information about known problems or contact the disk vendor.

4. Is the value of the Maximum Concurrent Disk Cache Writes parameter set to its highest value?

   If yes, reduce the value (in MONITOR, in the Available Options menu, select Server Parameters > File Caching).

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Server Console Hangs

If the server console locks up so that you cannot enter commands, but there is no abend message on the screen, follow these steps to troubleshoot the problem. If there is an abend message on the screen, see "Server Abends" on page 133.

1. Can you toggle among console screens?

   If yes, the problem might be caused by high server utilization. See "High Utilization Statistics in MONITOR" on page 104.

   If no, continue with the following steps.

2. Can you break into the debugger by pressing Shift + Shift + Alt + Esc?

   If yes, enter the debugger, then type q and press Enter to quit to DOS. Reboot the server. Continue with the following steps to help find the source of the problem.

   If the console is locked, you can't toggle among screens or exit to DOS, and you can't enter the debugger, contact Novell Technical Support or your computer vendor to learn how to generate a non-maskable interrupt to down the server.

3. Did the console hang as you unloaded an NLM?

   If yes, the NLM is probably the source of the problem. Contact the NLM vendor.

4. Are disk and LAN drivers the latest versions?

   If not, update disk and LAN drivers. See "Keep Your Servers Patched" on page 94 for information on NetWare 5 drivers.

5. Did the console hang after you mounted the last volume?

   If yes, the LAN adapter might not be seated correctly or might not be configured correctly. Check the board and its configuration and correct any problems.

If the problem still occurs, follow the troubleshooting steps in "A Troubleshooting Methodology" on page 94; review the Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp); and contact a Novell Authorized Reseller or Novell Technical Support.

Server Abends

See the following sections for a general overview of abends, and for information about types of abends, resolving abends using the abend.log file, and helping your server respond appropriately to abends:

Overview

The NetWare operating system is very resilient, but errors can arise. Serious problems are usually accompanied by abend (abnormal end) messages. When an abend message appears, either NetWare or the CPU has detected a critical error condition and started NetWare's fault handler. NetWare abruptly halts the server to protect it from data corruption. NetWare uses abends to ensure the integrity of operating system data.

When a server abends, users can't log into the server, workstations can't read from or write to the server, and an abend message usually appears on the server console. If NetWare's auto recovery mechanism is enabled, NetWare might restart the server automatically or suspend the offending process, depending on the nature of the abend. If NetWare suspends threads and restarts the server, a number in brackets appears as part of the server console prompt to indicate how many threads have been suspended.

If there is no abend message on the console, no abend.log file in sys:system, and no number in brackets within the server console prompt, but users still can't access the server, see "Workstations Can't Communicate with Server" on page 116. If there is no abend message, but the console is frozen so that you cannot enter commands, see "Server Console Hangs" on page 132.

When the server abends, it displays a message similar to the following:

Abend: SERVER-5.00-*message_number message_string*
ADDITIONAL INFORMATION: *message*

The Additional Information section states the probable cause of the abend. It indicates where the problem occurred and gives the name of any NLM

associated with the abend. This information helps you determine how to resolve the abend.

The abend message, along with additional information, is saved in the abend.log file on the C: drive. As soon as the server is restarted, the abend.log file is moved to sys:system.

Types of Abends

See the following sections for a discussion of various kinds of abends.

- If the abend message includes processor exception in the text, then the abend was detected by the CPU. See "Processor Exception Abends" on page 134.

- If the abend message does not include the words processor exception, then the abend was detected by NetWare. See "Software Exceptions" on page 135.

- If the abend message mentions NMI parity error or machine check, the abend was caused by a hardware problem. See "Hardware Abends" on page 136.

- If the abend message includes the text CPU Hog Detected by Timer, the abend occurred because a process would not relinquish the CPU in the time specified by the CPU Hog Timeout Amount server parameter. See "CPU Hog Abends" on page 137.

If more than one kind of abend message appears, troubleshoot hardware abends first.

Processor Exception Abends

When the abend is detected by the CPU, it is called a processor exception. Processor exceptions always include the words processor exception in the abend message, for example, Abend: Page Fault Processor Exception. A processor exception occurs when the processor encounters an invalid address or machine instruction.

The abend message displays additional information about the abend, including the process running at the time of the abend. If the running process is something other than the Server process, then knowing the process name is very helpful. It is almost always related to the abend in some fashion.

If the running process is an Interrupt Service Routine (ISR), then the problem is usually caused by a LAN or disk driver. Sometimes it can be caused by a hardware problem.

Remember these tips when resolving processor exception abends:

 ◆ Troubleshoot LAN drivers and devices first. LAN drivers are easy to replace and they are more likely to be the source of the problem than disk drivers and disks.

 ◆ Update drivers before devices. If the problem isn't solved, then replace devices.

 ◆ Make sure you use up-to-date drivers for NetWare 5. Use drivers that ship in the Novell red box, drivers that are tested, certified, and made available on Novell's Support Connection (http://support.novell.com), and certified drivers released by hardware vendors. Check product certification bulletins on DeveloperNet (http://developer.novell.com) to learn which versions are most recent.

   Do not mix the use of a driver written to the 3.3x/1.1x ODI Specification with 3.2 ODI Specification support modules. The LAN driver certification bulletin will list the specification a LAN driver is written to. In some cases, you will need to contact the IHV (Independent Hardware Vendor) who supplied the driver.

   NetWare 5 drivers for storage devices and host bus adapters are written to the NWPA (NetWare Peripheral Architecture™) Specification. The .dsk drivers are no longer supported.

 ◆ Simplify the server by removing software. If the server is stable when software has been removed, then start reloading software one module at a time until the problem recurs.

Software Exceptions

Abends detected by NetWare are called software exceptions. NetWare continually monitors the status of various server activities to ensure proper operation. If NetWare detects a condition that threatens the integrity of its data (such as an invalid parameter being passed in a function call or certain hardware errors), it abruptly halts the active process and displays an Abend message on the screen. (See Resolving Critical Server Issues, *AppNotes*™, February 1995, at http://developer.novell.com/research.)

Thus, abends are NetWare's way to ensure the integrity of its data and protect against data corruption.

To troubleshoot a software exception, simplify the server by removing software. If the server is stable when software has been removed, then start reloading software one module at a time until the problem recurs

Hardware Abends

Hardware abends are either non-maskable interrupt (NMI) errors or machine check errors.

There are two kinds of NMI error messages:

- Abend: NMI parity error generated by IO check. The source of an IO check abend could be anywhere in the server.
- Abend: NMI parity error generated by system board. The source of a system board abend could be anywhere in the system, but is most likely to be in the system board or its memory.

If your server experiences a hardware abend, run any diagnostic programs your hardware provides to help locate the source of the problem.

Try swapping hardware components to see whether the problem disappears when a particular component is replaced. Swap components in this order:

1. Memory
2. Power supply
3. System board

The following hardware problems have been found to generate errors:

- Faulty RAM
- Faulty system board
- Faulty I/O cards, especially cards with on-board memory
- Low or fluctuating power at the power source; power source or Uninterruptible Power Supply going bad
- Faulty memory extension boards
- System board memory that is mismatched in speed or brand
- Conflicting interrupts
- Cards, cables, and memory modules that are dirty or not seated properly
- Incompatibility among hardware pieces

- ◆ Static electric discharge

- ◆ Occasionally, a hard drive or a printer

CPU Hog Abends

CPU Hog abends occur when a process does not relinquish control of the CPU in the time specified by the CPU Hog Timeout Amount server parameter. When this happens, the CPU Hog Timeout process initiates the abend auto recovery mechanism to suspend the thread. Depending on how the auto recovery parameters are set, the server might be restarted, thus freeing the CPU.

Review the abend message or the abend.log file to determine the running process at the time of the abend. When a CPU Hog abend happens, the running process shown in the abend messages indicates exactly where in the code the problem occurred. Try removing the NLM indicated by the running process. If this prevents the abend from recurring, then contact the vendor of the NLM.

In some cases, the process controlling CPU cycles simply needs more time to finish. In this case, set the CPU Hog Timeout Amount parameter to 0 to disable it and thus allow the process to finish running (in MONITOR, in the Available Options menu, select Server Parameters > Miscellaneous). For example, CPU Hog abends sometimes occur when a particularly large volume is mounted. When the process has finished running, set the CPU Hog Timeout Amount parameter back to its original value.

Resolving Abends

Because abends can be caused by so many different conditions, there is no one way to pinpoint and resolve the problem. Follow the general guidelines in this section, and use tools such as the abend.log file to help you diagnose the problem.

See Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for more detailed troubleshooting information and for information about specific abends that have been reported to Novell.

In some cases, the best way to solve an abend is to have Novell Technical Support analyze a copy of the server's memory, called a core dump. Before sending a core dump to Novell you must contact Novell Technical Support and open a support incident. A support engineer will tell you whether a core dump is necessary, the kind of core dump to perform, and how to send the core dump to Novell. For information on creating core dumps, see "Creating a Core Dump" on page 100.

Preventive Steps

You can prevent many abends by taking the following steps:

- Always keep the server patched. Many problems your server might experience have already been solved by Novell and provided in the form of a patch file. See"Applying Patches" on page 40.

- Update LAN and disk drivers to their newest versions. Many abends can be avoided simply by keeping all drivers up to date.

- Update outdated NLM programs. The most recent versions of Novell modules can be downloaded from Novell's technical support web site, http://support.novell.com, or from other locations where you download patches. Check with other vendors to make sure you have the most recent versions of third-party NLM programs.

- Virus scan the DOS partition on the server.

- Clean and reseat cables and adapters, make sure cables are terminated correctly, and SCSI IDs are correct. Make sure all fans are operating.

- Take precautions to prevent static electric discharge. Static discharge can cause computer systems to degrade over time. See "Preventing Static Electricity Problems" on page 89 for more information.

- Review Novell Knowledgebase (http://support.novell.com/search/kb_index.jsp) for known problems.

General Troubleshooting Tips

Consider the following as you diagnose the problem:

- What is the physical environment of the server?

  Is the air conditioning off when the computer abends? Is the environment dry, dusty, or hot? Excessive heat can cause server problems and increase static electricity.

  Is there any new electro magnetic force (EMF) near the server or cabling? Large motors, transmitters, fluorescent lights, and even vacuum cleaners can cause problems.

  Has the computer been handled with appropriate static protection? Excessive static can cause computer hardware to degrade over time. See "Preventing Static Electricity Problems" on page 89.

  Is the power source consistent? If the power source is filtered, is the filtering still functioning?

- What happens at the same time as the abend?

  What resources are being used when the server abends, such as printing, backup software, databases?

  Look for consistency: Are there certain activities, applications, or server processes that are always present when the server abends? If these elements are removed, does the server function normally? Does the abend always happen at the same time?

- What has changed since the server started to abend?

  Has traffic increased? Has new software or hardware been installed? Have there been power outages? Have there been changes to the LAN?

- What other errors or problems are occurring at the same time?

  Are users dropping connections? Are files corrupted? Have drives deactivated? Are there printing problems?

- Do server statistics indicate a problem?

  Review the sys$log.err and abend.log files. See "Resolving Abends Using the Abend.log File" on page 140.

  Load MONITOR and look for high server utilization, packet receive buffers that have reached their maximum, no ECB available counts, cache buffers lower than 60 - 70%, LRU sitting time less than 15 minutes during peak traffic, LAN errors, and service processes that have reached their maximum.

If the source of the abend proves to be a third-party product, please contact the product vendor, even if the product is one that ships with NetWare, such as a driver. Only the product vendor can supply the patch or replacement you need.

Resolving Abends Using the Abend.log File

The following information is excerpted from Troubleshooting Server Problems Using the Abend.log File and Memory Images (Core Dumps) in *AppNotes,* October 1997 (http://developer.novell.com/research). This information will help you pinpoint the source of an bend.

When an abend or lockup occurs, NetWare writes a summary of the state of the server to a file called abend.log on the C: drive. After the server is restarted, the abend.log information is appended to a file with the same name in the sys:system directory.

The abend.log file contains the following information:

- File server name
- Date and time of the abend
- Text of the abend message
- Contents of the registers on the server
- Name of the module or process that was suspended
- Name of the process that was running at the time of the abend
- Stack pointer and limit
- Stack trace
- Modules list

Server Name

The server name is the first piece of data saved in the abend.log file. The name of the server can be useful if you have multiple servers. It is important to know which servers experience the abend and which do not. Many times a simple comparison between a server that is experiencing an abend and one that is not provides valuable clues to the cause of the abend.

For example, suppose you have two identical servers, one of which abends while the other one does not. The only difference between the servers is that the one that abends is used for backups. In this case, the logical component to focus your troubleshooting efforts on is the backup software and hardware.

Date and Time of Abend

Because of the auto recovery process in NetWare, administrators might not notice that a server has experienced an abend, even when the error has occurred several times. But notice the server console prompt. If a number in brackets appears as part of the prompt, then the server has abended and faulty threads have been suspended. The number indicates how many threads have been suspended.

Looking at the abend.log file might be the only way to tell what kinds of abends happened to the server . Many times a pattern in the date or time of the abend will provide an important clue to the cause of the abend. For example, suppose you notice that a particular server has experienced the same abend five times, and every time the abend occurred at midnight. The logical starting place would be processes that run at midnight, such as compression or a backup.

Abend Message

Earlier versions of NetWare produced generic messages such as Page Fault Processor Exception. This describes an entire class of errors that can be caused by many different things. The abend.log file, on the other hand, contains more specific abend messages, such as Free detected modified memory beyond the end of the cell being returned. This message indicates that the running process tried to free memory that had been overwritten.

Often a combination of the abend message, the running process, and the stack trace will be sufficient to enable you to find a solution from the Novell Support Connection web site (http://support.novell.com) or CD-ROM.

Registers

The registers are most helpful when you can establish some sort of pattern from the contents of the registers in several abends. If the contents of the registers (especially the EIP register) are the same in each abend, it usually means the operating system followed the same code path to arrive at the abend. This indicates a software bug or possibly a corrupt file. Many resolutions to such problems are available from the Novell Support Connection or CD-ROM. Search for the running process and the NLM that triggered the abend.

ABENDed NLM

The ABENDed NLM is the module that owns the code that actually triggered the abend. However, this does not necessarily mean that this module caused the abend. A function in the named NLM might have been passed a bad value from another module. Knowing what module was active when the server experienced the abend is useful to identify which NLM or third-party product to troubleshoot. It is also very helpful in looking up known resolutions from the Novell Support Connection. The description of the resolutions usually includes the name of the module and often the running process, the abend message, register values, and functions from the stack trace.

Running Process

If the running process is the Server process, the abend could literally be caused by any application. Any module can make a request to the NetWare operating system, and the result of that request will show up as a Server process. If the running process is something other than the Server process, knowing the name of the process is usually quite helpful. Often the process belongs to the module

that is causing the abend. Almost always it is related to the abend in some fashion. For example, suppose your server abends, and the running process is identified as TCP/IP. A logical troubleshooting step would be to try to obtain a protocol analyzer trace during such an abend and examine the TCP/IP packets that are being sent to the server.

Stack Limit and Stack Pointer

The stack limit and stack pointer are used to determine if server memory corruption has taken place.

The stack is an area of memory set aside for the temporary storage of values. The stack limit is simply the smallest value the stack of the running process can reach. If the stack pointer is at a value lower than the stack limit, or if it is greater than the stack limit plus the stack size (3000 for server processes, other processes can have different stack sizes), then the current stack pointer (ESP) is incorrect, and the server has experienced memory corruption.

Stack Trace

The stack trace is a printout of the contents of the stack, one value at a time. If the value is an address located inside a module, the module name, function (if available), and offset are printed to the right side of the address. The stack trace values that are of concern are those that fall inside a module.

Once again, a pattern in the stack trace of several abends will provide clues to the possible cause of the abend. If the pattern shows that the stack trace of several abends is exactly the same, there is likely a code path to the abend, and there is a good chance that a fix is already available. Search the Novell Support Connection (http://support.novell.com) under the abended NLM name, the running process, and the function to find possible resolutions.

Modules List

Many problems that initially existed in the NetWare operating system and in the Novell® products that run on NetWare have already been fixed by Novell. These fixes are readily available from Novell.

The first thing to do if your server experiences abends is to look at the modules list and compare it to a list of the latest released versions from Novell. If you see modules that are outdated, update them, especially if one of them is the abended NLM. The modules list is complete with version numbers and dates to make it easy to tell which revisions were running on the server when it experienced the abend.

Managing the Abend Auto Recovery Mechanism

When a server abends, you can respond to the abend manually or have the server respond automatically.

When you respond manually, the server determines the nature of the abend and displays the appropriate response option on the screen, along with additional options for bringing down the server or executing a core dump. You must execute an option to respond to the abend.

When the server responds automatically, it executes the appropriate response without intervention.

Three server parameters control the Abend Auto Recovery Mechanism. How to use these parameters is described in the following sections. You can find these parameters in MONITOR in the Available Options menu, as follows:

- ◆ Auto Restart After Abend: select Server Parameters > Error Handling

- ◆ Auto Restart After Abend Delay Time: select Server Parameters > Error Handling

- ◆ Developer Option: select Server Parameters > Miscellaneous

IMPORTANT: Sometimes an abend (or a faulty NLM) can cause the server console to hang (stop functioning). In this case, the abend message is not displayed and you cannot enter commands at the console prompt.

If this happens, press <Ctrl>+<Alt>+<Esc>. The server displays a menu; select the first option, Down the File Server and Exit to DOS. The DOS prompt is displayed.

Responding to the Abend Manually

For information about automatic response to abends, see .

To respond manually to abends, change *either* of the following SET parameters to the values shown :

```
AUTO RESTART AFTER ABEND = 0
DEVELOPER OPTION = ON
```

Set Auto Restart After Abend in MONITOR, in the Available Options menu, select Server Parameters > Error Handling; set Developer Option in Server Parameters > Miscellaneous.

When an abend occurs, the server displays a short list of options appropriate to the nature of the abend. To respond to the abend, you must execute one of the options by typing the first letter of the option.

The following options might be displayed. Note that several of the options have the same first letter (such as R, S, or X). In a given abend situation, the option list will include only one option for any given first letter.

- ◆ S=Suspend the running process, update abend.log, and attempt to down the server.

  This option appears if the abend was software-detected, that is, detected by NetWare. It is important to save files, shut down the server, and try to solve the problem that caused the abend. Review the abend.log file to help determine the source of the problem.

  When you execute this option, the server stops the running process, updates the abend.log file, and sends a message every two minutes to users advising them to save their files and log out. The server then attempts to shut down and restart the computer.

  The amount of time before the server shuts down and restarts is determined by the parameter Auto Restart After Abend Delay Time (in MONITOR, in the Available Options menu, select Server Parameters > Error Handling). You can set this value from 2 to 60 minutes.

- ◆ R=Resume the running process, update abend.log, and attempt to down the server

  This option appears if the abend was an NMI (non-maskable interrupt) or machine check error, indicating a parity error or a machine check processor exception. It is important to save files, shut down the server, and solve the problem causing the abend. Review the abend.log file to help determine the source of the problem.

  When you execute this option, the server sends a message every two minutes to users advising them to save their files and log out. The server then resumes the running process, updates the abend.log file, and attempts to shut down and restart the computer.

  The amount of time before the server shuts down and restarts is determined by the parameter Auto Restart After Abend Delay Time (in MONITOR, in the Available Options menu, select Server Parameters > Error Handling). You can set this value from 2 to 60 minutes.

- ◆ S=Suspend the running process and update abend.log

This option appears if the abend was hardware-detected, that is, detected by the processor. All hardware-detected abends have the words processor exception in the abend message.

Common abends include page faults, general protection faults, and invalid op codes, but there can be many others. When this option is available, the server has determined that it cannot return the process to a safe state, but that it does *not* need to shut down the computer immediately to resolve the problem. You might still need to shut down the computer and restart it at a later time.

When you execute this option, the server suspends the currently running process, updates the abend.log file, but does not shut down the computer. Server performance may be poor, because a loaded NLM is probably malfunctioning.

Read the Additional Information part of the abend message to learn which NLM might be causing the problem. Wait until a convenient time, then shut down the server and restart it. Examine the abend.log file for more information about the source of the problem.

- `S=Return the running process to a safe state and update the abend.log file`

  Like the previous option, this option appears if the abend was hardware-detected, that is, detected by the processor. All hardware-detected abends have the words processor exception in the abend message.

  These abends include page faults, protection faults, and invalid op codes. When this option is listed, the server has determined that it *can* return the process to a safe state.

  When you execute this option, the server returns the running process to a safe state and updates the abend.log file, but it does *not* shut down the computer. In most cases, the machine completely recovers and no further action is necessary. This option resolves most page fault abends.

- `Y=Copy diagnostic image to disk`

  Execute this option to perform a core dump that can be examined to determine the cause of an abend.

- `X=Restart`

  This option appears only if DOS has been removed. Execute this option if you want to restart the server.

  NOTE: If DOS has been removed, the server will not create or update an abend.log file.

- X=Update abend.log and then exit

  Execute this option if you want to bring down the server and exit to DOS. If you power off the server without first executing one of the S or R options to resolve the abend, the server will not update the abend.log file.

- Otherwise, power off and back on to restart

  If the console has been secured, you must power off and then back on to restart the server. If you power off the server without first executing one of the S or R options to resolve the abend, the server will not update the abend.log file.

NOTE: When the server restarts, it moves the abend.log file from the DOS partition to sys:system.

Responding to the Abend Automatically

You can require the server to respond automatically to abends. Two automatic responses are possible.

- When both of the following parameters are set to the values shown, the server responds to the abend automatically by evaluating the source of the abend and executing the appropriate S or R option described in the previous section.

  AUTO RESTART AFTER ABEND = 1
  DEVELOPER OPTION = OFF

- When both of the following parameters are set to the value shown, the server responds to the abend by attempting to recover. If the server cannot recover, the auto recovery process waits for the restart time to elapse, and then downs the server and attempts to restart it.

  AUTO RESTART AFTER ABEND = 2
  DEVELOPER OPTION = OFF

Use the following parameter to specify how long the server waits after an abend before attempting to shut down and restart the computer:

AUTO RESTART AFTER ABEND DELAY TIME = *minutes*

Set Auto Restart After Abend and Auto Restart After Abend Delay Time in MONITOR, in the Available Options menu, select Server Parameters > Error Handling.

Set Developer Option in MONITOR, in the Available Options menu, select Server Parameters > Miscellaneous.

All parameters can be saved in the startup.ncf file.

IMPORTANT: Because the server responds to the abend automatically, you might not be aware that an abend occurred. Periodically check the abend.log file or the Server Up Time statistic on the General Information screen of MONITOR to determine if there have been any abends.

Preventive Maintenance Tasks

The following sections provide tips for preventing server problems:

- "Monitoring the NetWare Server" on page 65
- "Matching Performance Capabilities" on page 40
- "Preventing Memory Problems" on page 88
- "Preventing Power Supply Errors" on page 88
- "Preventing Static Electricity Problems" on page 89
- Preventing Cabling Problems
- "Documenting the Network" on page 86

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