Server Operating System Administration Guide

Novell®

NetWare®

6.5 SP8

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Contents

About This Guide

Welcome to the NetWare® 6.5 *Server Operating System Guide*. This guide is divided into the following sections:

Audience

This guide is intended for network administrators.

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation, or go to www.novell.com/documentation/feedback.html and enter your comments there.

Documentation Updates

The latest version of this *NW 6.5 SP8: Server Operating System Administration Guide* is available at the NetWare 6.5 SP8 Documentation Web site (http://www.novell.com/documentation/nw65).

Additional Documentation

For additional information about the installing and managing your server operating system in the network, see the information in Table 1.

Table 1   *Additional Documentation Reference*

If you want to	Refer to
Begin installing the server	*NW65 SP8: Installation Guide*
Use a multiprocessing computer as your server and you want more information on the higher level of support for multiprocessing	"NetWare Integrated Kernel" on page 12
Decide which protocol to use	*NW 6.5 SP8: Novell Server Communications Administration Guide*

If you want to	Refer to
Learn about how the Novell eDirectory™ database and eDirectory tree are the foundation for convenient network administration	"Understanding Novell eDirectory" in the *Novell eDirectory 8.8 Administration Guide*
Decide which file system to use	*NW 6.5 SP8: NSS File System Administration Guide*
Learn more about use of memory by NetWare	*NW 6.5 SP8: Server Memory Administration Guide*
Learn more about installing NetWare on a Xen-based virtual machine	"Installing and Managing NetWare on a Xen-based VM" in the *OES 2 SP2: Installation Guide*

Documentation Conventions

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

A trademark symbol ($^{®}$,™, etc.) denotes a Novell trademark. An asterisk (*) denotes a third-party trademark.

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

NetWare Server Overview

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The following information in this section can assist you in learning about your NetWare® server:

1.1 NetWare Server Basics

Although it is frequently more convenient to refer to the computer where NetWare resides as the server, the NetWare server is the network operating system that is installed on a server class computer. NetWare 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 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.

The principal executable for NetWare, `server.exe`, 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 can be copied to the startup directory where they overwrite previous versions or the bound-in versions of the same modules.

NetWare is based on an integrated kernel. The multiprocessing kernel (MPK) is completely multithreaded, supports pre-emption, and—as an integrated kernel—runs on both multiprocessor and uniprocessor systems. NetWare supports as many as 32 processors.

Although NetWare has minimum hardware requirements (see "Meeting Hardware and Software Requirements" in the *NW65 SP8: Installation Guide*), we recommend that you provide a high-performance hardware platform so you can get the full benefit of the power and scalability that NetWare offers.

To ensure that no component of your system hampers the performance of any other, see also .

1.2 NetWare Integrated Kernel

The core of the NetWare operating system is the 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, see the following:

1.2.1 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.

TIP: 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" has been quoted above.

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). It could also be handled 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 might 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 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 scheduler highly scalable compared to an implementation using a global run queue. To address load imbalance, NetWare uses a sophisticated load balancing algorithm.

1.2.2 Load Balancing

Two important requirements of any load balancing scheme are stability (*not* overreacting to small load imbalances) and the ability to distribute the processing load quickly.

The NetWare 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* for the threshold would prevent excessive thread migration while addressing load imbalance only as needed.

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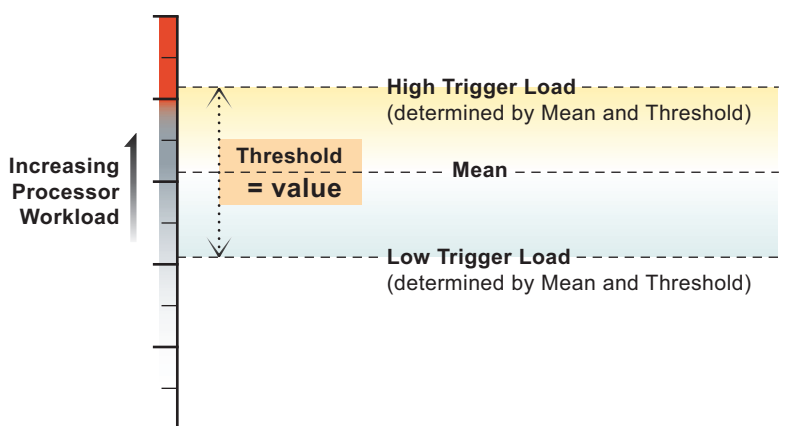
Without the margin provided by the threshold, threads would constantly move from one processor to another, thereby compromising the productivity of the system.

IMPORTANT: 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 it 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.

You can modify the threshold through Novell Remote Manager. For details, see .

1.2.3 Concurrency and Parallelism

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.

With NetWare, 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 GroupWise® provides.

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

1.2.4 Pre-emption

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

NOTE: Earlier versions of NetWare implemented a non-pre-emptible round-robin (First-in, First-out) 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 section boundaries might 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.

1.2.5 Platform Support Module

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

NOTE: Use the PSMs that load during installation. The PSMs for NetWare 4.11 `smp.nlm` do not work for NetWare 5 or later.

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 detects multiple processors by reading the MP configuration table in BIOS and then determines which of the available NetWare 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.

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.

In addition to scalability, NetWare multiprocessing offers these benefits:

 * Backward compatibility for applications written for NetWare 4.11 `smp.nlm`. In fact, NetWare 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.

1.2.6 HyperThreading Support

NetWare 6 or later operating system provides full kernel support of HyperThreading technology. Administrators implementing a NetWare-based HyperThreading platform also need the ACPI (Advanced Configuration and Power Interface) Platform Specific Module (PSM). By taking advantage of idle hardware resources, Intel HyperThreading technology can offer advantages over dedicated processor configurations. For many programs, HyperThreading technology can increase CPU performance and achieve greater processing throughput. Novell NetWare 6 and later supports this technology and can help build the ideal platform for a HyperThreading system.

For more information, see the article "Incorporating Hyper-Threading Technology into a NetWare-Based Platform" (http://www1.us.dell.com/content/topics/global.aspx/power/en/ps3q02_henriksen?c=us&%20;cs=555&l=en&s=biz) on the Web.

1.3 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

The server console also supports more than one interface:

- **Command line.** Commands can be entered at the System Console prompt, with or without options and parameters. The prompt is indicated by the server name followed 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 X Server--Graphical Console lets you access several Java applications from the server.

  From the Desktop menu of the X Server--Graphical Console application, you can:

  - Run Java utilities such as ConsoleOne®, Install, RConsoleJ, Console Log, Editor, File Browser, Novell Remote Manager, and Server Console.

  - Control settings for the Java environment and GUI backgrounds.

  - Run any console command.

  - Close the X Server--Graphical Console application.

    To restart the Graphical Console, enter `startx` at the *System Console* prompt.

When NetWare is installed, the server console defaults to the Graphical Console 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 .

TIP: For information on bypassing the server splash screen or replacing it with a screen of your own choice, see and “Server” in *NW 6.5 SP8: Utilities Reference*.

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 .

  Use the secure console command to secure your console against breaches of security. (See “SECURE CONSOLE” in *NW 6.5 SP8: Utilities Reference*.)

  You can also use the screen saver and console-locking features in scrsaver. (See “SCRSAVER” in *NW 6.5 SP8: Utilities Reference*.)

- **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.

1.4 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 request. 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 40.

1.5 NetWare Registry

In NetWare 6.5 the interaction of the NetWare registry was changed to remove problems with corruption that might have occurred in previous versions of NetWare.

Now, when the server boots, the DOS copy of the registry, `servcfg.000`, is opened and its contents are copied into the server's cache. After this is done, the DOS file is closed. There is no copy of this file on volume sys: that is kept open while the server is operating. The server checks every five minutes (this time is adjustable by the "set cdbe flush time" Set parameter) to see if there are updates that need to be pushed down from cache to the DOS copy of the registry. If there are no updates, nothing is done.

If there is an update that needs to be made, the update is written to the `c:\nwserver` directory as the `servcfg.tmp` file. After the file is completely written and closed, an update sequence begins where the oldest copy of the registry (`servcfg.002`) is deleted and the `servcfg.001` is renamed.

The file goes through this complete transition:

1. Delete `servcfg.002`
2. Rename `servcfg.001` to `servcfg.002`
3. Rename `servcfg.nbk` to `servcfg.001`

4. Rename `servcfg.000` to `servcfg.nbk`

5. Rename `servcfg.tmp` to `servcfg.000`

If a file called `servcfg.tmp` is ever found when the server is just coming up, it is deleted because the file is assumed to be in a transitional state that never made it through the complete steps. This ensures that the registry files that are present were completely written out and this minimizes chances for corruption.

IMPORTANT: With these enhancements, the underlying core registry structures and files have not changed, nor have any of the internal functions that create, delete, and read registry keys and values. Much of the complexity of the registry (dynamically growing the registry files, version comparisons, event handling, and background gremlin activities) have been reduced or eliminated.

The size of the registry is fixed to 2 MB to eliminate the need to dynamically grow the file size. This size is approximately three times the size that most normal configurations will require.

Although this new interaction and design is much more stable, some rare opportunities still exist for registry file data loss. For example:

An application modifies the registry (adds or deletes key values) and these modifications have not been pushed down to the DOS registry file. Then if the server abends, loses power, or someone breaks into the debugger and quits to DOS, any modifications that were still in memory would be lost. You could change the five minute interval; however, in most cases registry changes are rare. Exceptions are during server installation, server boot, and during the server down process.

1.6 Java-Based Components of NetWare

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

The Java-based components are installed automatically when you install NetWare. To use Java-based components, you must use TCP/IP. Instructions for using Java-based components are found in "Using the Novell JVM (NJVM) for NetWare on the Server" on page 68.

1.6.1 The Novell JVM for NetWare

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.

To run the Novell JVM, you need a minimum of 48 MB RAM and at least 128 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), see the Novell Class Libraries for Java documentation at the Novell DeveloperNet® Web site (http://developer.novell.com/ndk/doc/njcl/njcl_enu/data/bktitle.html).

1.6.2 The Just In Time Compiler

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

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

What's New

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This section includes the features that were updated in the NetWare® server operating system since its release in NetWare 6.0, including:

- Section 2.1, "What's New (NetWare 6.5 SP 7)," on page 21
- Section 2.2, "What's New (NetWare 6.5 SP6)," on page 21
- Section 2.3, "What's New (NetWare 6.5 Support Pack 5)," on page 22
- Section 2.4, "What's New (NetWare 6.5 Support Pack 3)," on page 22
- Section 2.5, "What's New (NetWare 6.5 Support Pack 2)," on page 23
- Section 2.6, "What's New (NetWare 6.5 Support Pack 1)," on page 23
- Section 2.7, "What's New (NetWare 6.5 Initial Release)," on page 24

2.1 What's New (NetWare 6.5 SP 7)

In this release of NetWare, the following features have been added to the base server operating system:

Table 2-1   *New Features in NetWare 6.5 SP6*

Functionality	For More Information
The NetWare operating system is modified to run in the paravirtual mode on a Xen-based host server.	"Running NetWare in a Virtualized Environment" on page 157

2.2 What's New (NetWare 6.5 SP6)

In this release of NetWare, the following features have been added to the base server operating system:

Table 2-2   *New Features in NetWare 6.5 SP6*

Functionality	For More Information
You can get server health information from the command line using the HEALTH command.	"Health Command" on page 96
On volume dismount, the swap file is transferred to another volume, if one is available, when the current volume is dismounted. If the volume being dismounted has a swap file and it is the only volume available, a message is displayed that indicates that the server will likely abend if the volume is dismounted.	"Using Swap Files" in the *NW 6.5 SP8: Server Memory Administration Guide*

2.3 What's New (NetWare 6.5 Support Pack 5)

In this release of NetWare, the following features have been added to the base server operating system:

Table 2-3 *New Features in NetWare 6.5 SP5*

Functionality	For More Information
No command buffer on the System Console screen.	"Executing Console Commands" on page 54
Save System Console history to the `console.txt` file.	"Saving the Console Screen History to a File" on page 54
The System Console screen now has online help.	"System Console Screen" on page 53
Added the module load time to the information displayed by the modules command so you can see exactly when a specific module was loaded.	"Loading and Unloading NetWare Loadable Modules" on page 67

2.4 What's New (NetWare 6.5 Support Pack 3)

In this release of NetWare, the following features have been added to the base server operating system:

Table 2-4 *New Features in NetWare Support Pack 3*

Functionality	For More Information
Create a logical volume to store core dumps.	"Saving a Dump to a Local Partition (HDISK Option)" on page 119.
Format command added to allow formatting of diskettes or other devices not previously formatted.	"Format" in the *NW 6.5 SP8: Utilities Reference*
The system console screen is scrollable.	"Viewing and Accessing Server Console Screens" on page 52
A console operator or a member of a group that has been assigned as a console operator and is a trustee of the Server object can unlock the SCRSAVER on the System console if locking has been enabled.	"Unlocking the Server Console" on page 85

2.5 What's New (NetWare 6.5 Support Pack 2)

In this release of NetWare, the following features have been added to the base server operating system:

- **New Console commands:**
    - HIDESCREEN: Lets you hide specific screens from displaying at the server console.
    - SHOWSCREEN: Lets you restore screens that have been hidden.

    For more information, see "Viewing and Accessing Server Console Screens" on page 52

2.6 What's New (NetWare 6.5 Support Pack 1)

In this release of NetWare, the following features have been added to the base server operating system:

- NetWare now installs and runs on machines built on the Pentium* M processor (Centrino chipset) or the Pentium 4 Prescott processor.
- **Maintenance mode:** During the server load process, you can enter the server maintenance mode by pressing the F8 key. During this maintenance mode, you have the following options:
    - Confirm the loading of each module during the server boot process by pressing any key at each prompt
    - Abort the loading of the operating system by pressing the Esc key
    - Continue loading the server without further pausing by pressing the C key

    For more information, see "Maintenance Mode" on page 48.
- **New Console commands:** The following console commands have been added, which allow these tasks to be scheduled using the Schedule Task feature in Novell Remote Manager.
    - INVENTORY: Lets you gather server-wide inventory information on the server.
    - PURGEVOLUME: Lets you purge deleted files on a specified volume.
- **USB devices automatically mounting:** When a formatted USB device is plugged in to the server, it mounts automatically rather than requiring the LFVMOUNT command.
- **Core dump to local USB devices:** When the server abends, a formatted USB device can be plugged in; it mounts automatically so it is available for core dumps while the server is in the debugger.

    For more information, see "Creating a Core Dump" on page 118.

2.7 What's New (NetWare 6.5 Initial Release)

In this release of NetWare, the following features have been added to the base server operating system:

- Support for USB storage devices (CD, DVD, floppy, Zip, Jaz, and hard drives, including thumb drives).

  These devices are recognized by Hot Plug, auto-detect, format NSS, or Traditional partitions and volumes.

  To see what is already mounted, enter the LFVOLUMES command.

  Core dumps to writable USB storage devices are also supported. For more information, see "Saving a Dump to a Local Partition (HDISK Option)" on page 119.

- The following support has been added for servers running an Intel* Pentium* 4 processor:
  - ACPI HyperThreading (processor doubling)

    For more information, see "HyperThreading Support" on page 16.
  - Power Management SET options

    For more information, see "Bringing Down the Server" on page 50.

- Additional functionality was added to the server Logger screen. For more information about using the Logger screen, see "Logger Screen" on page 55.

- When the server is starting up, there is a several-second window during which you can press Esc to exit to DOS. For more information, see "Starting and Stopping the Server" on page 47.

- Executing the KF8 ON command lets you pause after each line of execution of a `.ncf` file. Executing KF8 OFF turns off this functionality. For more information, see "Checking the Execution of .ncf Files" on page 64.

- You can edit the server GUI taskbar through the Menu Editor.

  Through the Menu Editor you can add, change, or delete items from the server GUI taskbar menu. For more information, see "Configuring the Taskbar" on page 70.

- Interaction with the NetWare Registry has been improved. For details, see "NetWare Registry" on page 18.

- The `dbnet6.nlm` module, which allows for remote (over-the-wire) core dumps, is loaded by default on every server. For details, see "Creating a Core Dump" on page 118.

- Many SET parameters have been updated and the defaults changed. For more information see "SET" in the *NW 6.5 SP8: Utilities Reference*.

- Improvements in the way the server processes work.

  For more information, see "Managing Server Processes" on page 61.

Setting Up the NetWare Server

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For information about installing a NetWare® server, including hardware and software requirements and installation instructions, see the *NW65 SP8: Installation Guide*.

For information about migrating from IPX™ to TCP/IP, see "Migrating IPX to IP" in the *NW 6.5 SP8: Novell Server Communications Administration Guide*.

For information about setting up the server's file system, see the *NW 6.5 SP8: NSS File System Administration Guide*.

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

- "Changing the Server's Software Configuration" on page 25
- "Installing, Uninstalling, and Configuring a Server or Other Products" on page 26
- "Changing the Language NetWare Uses" on page 26
- "Setting Up, Enabling, and Managing PCI Hot Plug" on page 29

3.1 Changing the Server's Software Configuration

After installing NetWare, you can make several changes, including

- "Installing, Uninstalling, and Configuring a Server or Other Products" on page 26
- "Setting Server Parameter Values" on page 40
- Changing time synchronization

  For more information on changing time synchronization, see "Configuring Timesync on Servers" in the *NW 6.5 SP8: Network Time Synchronization Administration Guide*.

- Adding or changing volumes

  For information about creating logical or traditional volumes, see "Managing NSS Volumes" in the *NW 6.5 SP8: NSS File System Administration Guide* or "Creating and Mounting a Traditional Volume" in the *NW6.5 SP8: Traditional File System Administration Guide*.

- Modifying the Novell® eDirectory™ tree

  For information on designing and modifying the Novell eDirectory, see "Designing Your Novell eDirectory Network" in the *Novell eDirectory 8.8 Administration Guide*.

Before changing the server's configuration, view the current configuration by entering `config` at the System Console prompt or by viewing and printing the configuration report in Novell Remote Manager.

The config command displays the following information:

- Server name, internal network number, and 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 eDirectory tree and bindery context.
- On some systems, the config command might display information about NetWare Loadable Module™ (NLM™) programs. The kind and amount of NLM program information depends on the system.

For more information about using the config command, see "CONFIG" in the *NW 6.5 SP8: Utilities Reference*.

The configuration report in Novell Remote Manager is much more complete and extensive. Printing or saving a copy of this report is a quick and easy method for documenting your server before you make any changes. For information about and instructions for creating this report, see "Configuration Report" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

3.2 Installing, Uninstalling, and Configuring a Server or Other Products

The NWCONFIG utility lets you 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 System Console prompt, enter

    [LOAD] NWCONFIG

2 Select *Product Options > View/Configure/Remove Installed Products*.

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 the *NW 6.5 SP8: Utilities Reference*.

3.3 Changing the Language NetWare Uses

In general, it is best to install the NetWare server in the language of its intended use. A new server install prompts for language selection at the first selection screen. The languages available for a new server install are English (default), French, Italian, German, Portuguese, Spanish, and Russian.

However, it is possible to change the server language after NetWare has been installed.The steps outlined in this section are for changing the language on an existing NetWare 6.5 server from English to a different language. You can make these changes with the server running, but you must reboot the server for the changes to take effect.

You can also make the changes while the server is down (using DOS commands for renaming files and editing the `startup.ncf` file).

WARNING: Novell does not recommend converting a non-English-language server back to English, nor do we recommend changing a non-English server to another non-English language. If either is done, it is possible that documents and folders named with or containing foreign characters will become irreversibly corrupted.

Not every module and utility is translated into all of the languages; untranslated utilities display in English.

To change the server language and the NLM language, as well as adjusting the code page and character set where necessary:

1 Swap in the new language's `lconfig.sys` file in the server startup directory:

   1a Copy the applicable `lc_xxx.xxx` file from the NetWare installation CD (located in `\install\lconfig`) to the server's startup directory (`c:\nwserver`). See Table 3-1 on page 28.

   1b Rename the English `lconfig` file (`c:\nwserver\lconfig.sys`) to `lconfig.eng`.

   1c Rename the newly-copied `lc_xxx.xxx` file to `lconfig.sys` (also in `c:\nwserver`).

      For example:

      If you are changing the language to German, you would copy the `LC_850.049` file and rename it to `lconfig.sys`.

      Among other things, this file specifies the server's DOS code page.

2 Add the Language command for the new language to `startup.ncf`.

   Edit the server startup file `c:\nwserver\startup.ncf`, and add the applicable `LANGUAGE xx` command at the end. See the language commands in Table 3-1 on page 28.

   For example:

   If you are changing the language to German, you would type

   `LANGUAGE 7`

   This command points the NLM programs to the correct directory for non-English message files on the server.

3 Add the line to load the correct character set for the new language to `startup.ncf`:

   Edit `c:\newserver\startup.ncf` and add the applicable `CHARSET CPxxx` command at the end, below the `LANGUAGE xx` command.

   For example:

   If you are changing the language to German, you would type

   `CHARSET CP850`

   This line specifies the character set for the server console's video display; CP850 is good for most languages. See the charset commands in Table 3-1 on page 28.

Table 3-1 *Lconfig Filenames, Language Numbers, and Code Page Numbers*

Language Name	Lconfig Filename	Language Command	Charset Command
French	LC_850.033	LANGUAGE 6	CHARSET CP850
Italian	LC_850.039	LANGUAGE 8	CHARSET CP850
German	LC_850.049	LANGUAGE 7	CHARSET CP850
Portuguese	LC_850.055	LANGUAGE 12	CHARSET CP850
Spanish	LC_850.054	LANGUAGE 14	CHARSET CP850
Russian	LC_866.007	LANGUAGE 13	CHARSET CP866

4 Reboot the server.

5 Verify that the changes in place are correct:

   5a When the server is back up, enter LANGUAGE at the System Console prompt.

      Two lines are displayed:

```
Current NLM language is (the_new_language_number) and language_name
```

```
Current DOS code page is (new_code_page_number, matching the LC_xxx
part of the lconfig filename).
```

   5b Load a translated utility at the server console, such as NWCONFIG, to verify that the language is active and the character display is correct.

```
load nwconfig
```

      If the translated utility displays, this confirms that the CHARSET setting is correct.

6 (Conditional) If you need to change the server keyboard type, use the KEYB utility.

   6a At the System Console prompt, enter

```
unload keyb
```

      Even though typing this command won't do anything, we recommend doing this step so that you can use the up-arrow key to recall this command later, if needed, for a suddenly unfamiliar keyboard mapping.

   6b Display a list of options to the Logger screen by entering the following at the System Console prompt:

```
keyb
```

   6c Switch to the Logger screen to find the keyboard type that matches the one you are using.

   6d Change the keyboard type to match your keyboard by entering the following at the System Console prompt:

```
[load] keyb keyboard_type
```

      For example:

```
[load] keyb germany
```

6e If you need to return to the server's previous keyboard type, enter the following at the System Console prompt:

```
unload keyb
```

For more information, see "KEYB" in the *NW 6.5 SP8: Utilities Reference*.

3.4 Setting Up, Enabling, and Managing PCI Hot Plug

PCI Hot Plug technology allows industry-standard PCI network boards to be added or removed without disrupting the operation of the NetWare server. This reduces unplanned down time for maintaining or adding disk or LAN network boards. To use hot plug technology, your server hardware must be hot-plug capable.

Features of industry-standard, PCI Hot Plug technology include the following:

- **Uninterrupted service:** You can add or replace network or other I/O controller boards while a system is operating through hot insertion or hot removal.

  Hot insertion: The process of physically plugging a network board into a PCI slot without stopping power to the server.

  Hot removal: The process of physically pulling a network board from a PCI slot without stopping power to the server.

- **Compatibility:** Multiple system providers, operating system suppliers, and network board vendors can implement Hot Plug, which is compatible with existing PCI standards.

- **Backward compatibility:** You can use a mix of Hot Plug and non-Hot-Plug components in the same system. This allows for some slots to be Hot Plug capable while others might not be capable of Hot Plug.

For a general description of Hot Plug architecture and components, see "PCI Hot Plug Architecture" on page 29.

To learn how to enable PCI Hot Plug, see "Enabling PCI Hot Plug" on page 31.

To learn how to use the Novell Configuration Manager to manage Hot Plug devices, see "Managing Hot Plug" on page 31.

3.4.1 PCI Hot Plug Architecture

The PCI Hot Plug architecture is modular, which minimizes the changes required of third-party network board software. The system relies on a central component, the Novell Event Bus (NEB), which facilitates communication among different software modules.

The NEB is an integral part of the PCI Hot Plug architecture. NEB facilitates communication between the PCI Hot Plug software modules, management agents, and device drivers.

The following figure provides a graphical representation of the Novell NetWare Hot Plug Architecture.

Figure 3-1   *Novell NetWare Hot Plug Architecture*

System Hot Plug Hardware
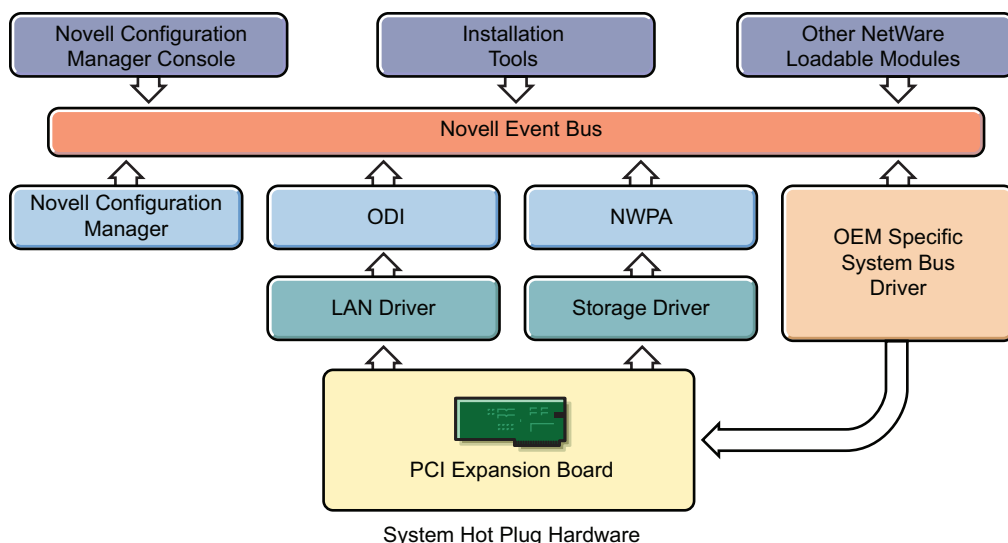
Novell Configuration Manager (ncm.nlm)

For PCI Hot Plug servers, the Novell Configuration Manager manages the Hot Plug system and ensures proper system behavior.

The primary function of the Configuration Manager is to sequence Hot Plug operations by shutting down the network board's device driver before turning off power to the slot. This ensures the stability of the system.

The Configuration Manager also maps hardware resources to device driver software.

System Bus Driver

The system bus driver provides access to the hardware platform-specific implementation of PCI Hot Plug. This driver controls the system hardware necessary to perform Hot Plug functions and is responsible for the following:

- ◆ Enabling or removing power from a Hot Plug slot upon request.
- ◆ Configuring PCI network boards in Hot Plug slots by assigning such things as memory, IO space, and interrupts.

NetWare allows multiple system bus driver modules to exist simultaneously. The controller manufacturer provides the system bus driver specific to the PCI Hot Plug hardware. Some system bus drivers are included with NetWare.

Novell Configuration Manager Console (ncmcon.nlm)

The Novell Configuration Manager console provides the interface for controlling all PCI Hot Plug operations. In addition, it displays slot configuration details, including network board driver information and status.

The Configuration Manager console consists of three screens: the Main Menu, Slot Options, and Slot Detailed Information.

The Novell Configuration Manager Console is described in detail in "Novell Configuration Manager Console" on page 32.

3.4.2 Enabling PCI Hot Plug

The following Hot Plug PCI modules are installed when you install NetWare on Hot Plug-capable hardware:

* `Ncm.nlm`—The Novell Configuration Manager, which manages the Hot Plug system.
* `Ncmcon.nlm`—The Hot Plug user interface, called the Novell Configuration Manager Console.
* `Odineb.nlm`—A module combining the Open Data-Link Interface and the Novell Event Bus (NEB) that enables the NEB to control device drivers.
* Specific System bus drivers—The `cpqsbd.nlm` for Compaq, `ibmsbd.nlm` for IBM platforms, and `phpsbd.nlm` for Intel platforms are included. To support other hardware platforms, you need to provide a different driver.

If the NetWare installation process determines that your server supports Hot Plug and has the appropriate driver, the installation process adds the following two load commands to the `autoexec.ncf` file:

* `load driver_name (for example, cpqsbd.nlm)`

  This command loads the system bus driver. After this command is executed, NetWare autoloads `ncm.nlm`.

* `;load sys:\system\ncmcon.nlm`

  This command loads the Novell Configuration Manager Console, which, in turn, loads the `odineb.nlm`.

  This command is commented out. If you want NetWare to load the Novell Configuration Manager Console every time the `autoexec.ncf` file is executed, remove the semicolon (;) from the command.

To enable PCI Hot Plug technology, execute the `autoexec.ncf` file by restarting the server. You can also execute the load commands for the driver and enter `ncmcon` at the System Console prompt.

3.4.3 Managing Hot Plug

After you have enabled PCI Hot Plug Technology on your server, you can use NCMCON (the Novell Configuration Manager console) to manage your hardware.

For a general introduction to the Novell Configuration Manager console, see "Novell Configuration Manager Console" on page 32.

For general information about how to use the NCMCON interface, see "Navigating NCMCON Menus" on page 35.

For step-by-step instructions for managing your hardware network boards, see "Adding a Network Board" on page 36 and "Removing a Network Board" on page 35.

Novell Configuration Manager Console

The Novell Configuration Manager console (`ncmcon.nlm`) lets you view status information on PCI slots and to remove and add PCI Hot Plug network boards.

The NCMCON interface constantly monitors and displays the status of all slots. If there are any errors, the appropriate error message is displayed.
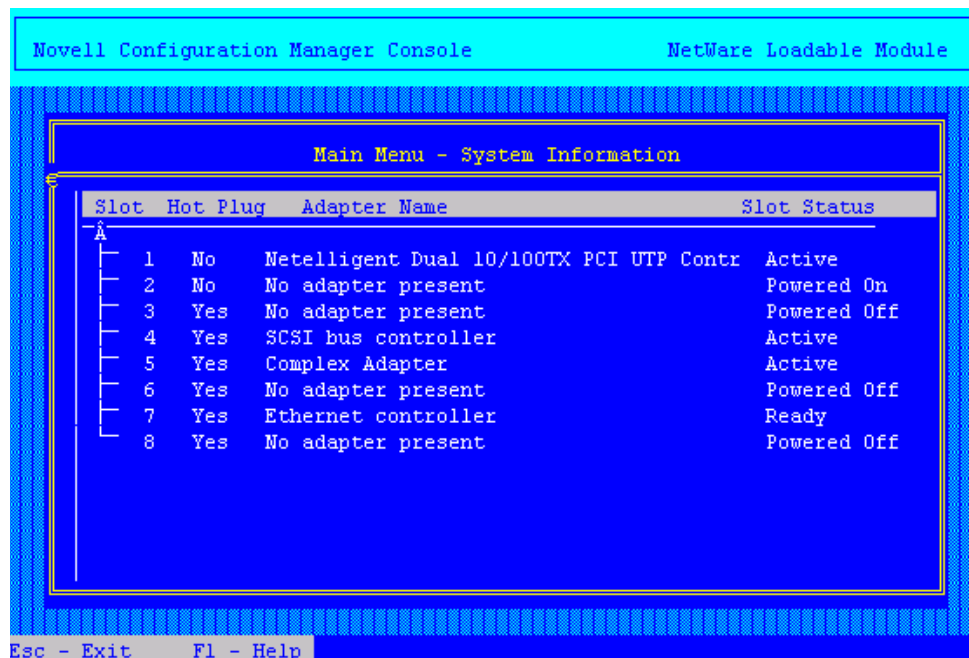
In the NCMCON interface, the following three screens are used:

Main Menu

The Main Menu displays a list of all PCI slots in the system.

Figure 3-2 *Novell Configuration Management Console, Main Menu System Information Screen*

For each slot, the Main Menu displays the following information:

- The system board slot number
- Whether or not the slot is hot-pluggable
- A network board description field or name
- The status of the slot/network board, which might include the following:
  - **Powered Off:** Power to the slot is turned off.
  - **Powered On:** The lever has been closed, power to the slot is turned on, and the slot is empty (this is different from Ready because there is no card in the slot).

◆ **Ready:** A network board is in the slot and ready to be used but there is currently no driver loaded for it.

◆ **Active:** A loaded driver is using this network board and the board is believed to be working.

◆ **Failed:** The driver for the network board or Hot Plug driver indicated some type of device failure. The network board can be removed and a new one added at this time.

◆ **Degraded:** A device on the multi-device network board has failed, but other devices on the network board continue to function.

◆ **Processing:** An action is being performed on a slot/network board.

Pressing Enter on a selected slot of the Main Menu displays either the Slot Options or the Slot Detailed Information screen. Online, context-sensitive help is available to guide you through PCI Hot Plug actions.

Slot Options Menu

The Slot Options menu lists the options available for the highlighted Hot Plug slot (selection of a non-Hot Plug slot automatically displays the Slot Detailed Information screen).

Figure 3-3 *Slot Options Menu*
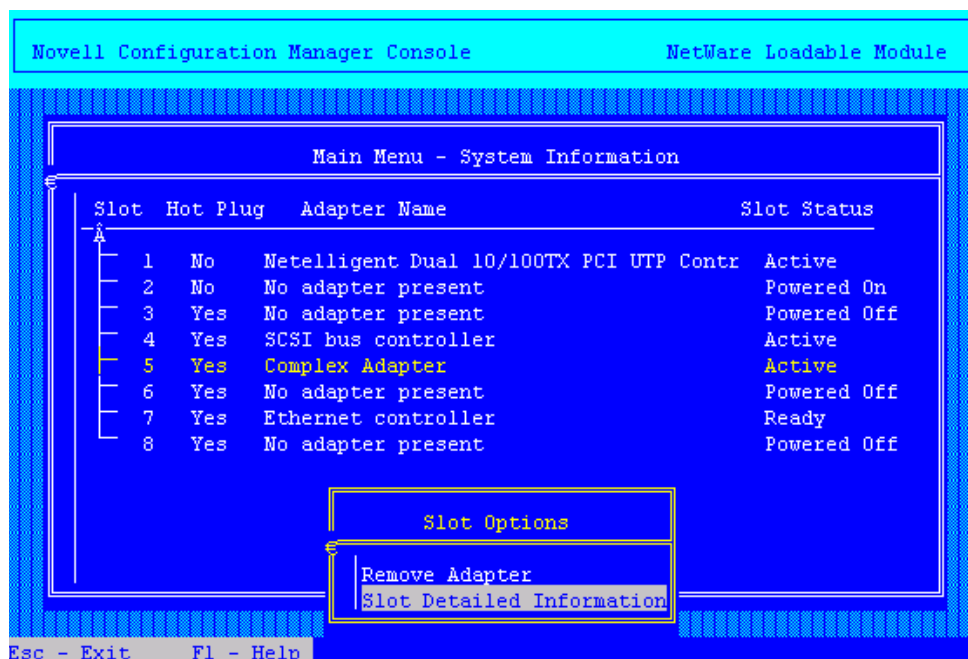
Depending on the driver, the state of the slot or network board, and the capabilities of the system, different options appear on the menu.

The interlock mechanism is one feature that can influence what appears on the Slot Options menu. The interlock is a safety mechanism that shuts off power to a slot if the slot is opened while the power is still on. Not all hardware manufacturers provide an interlock mechanism, and not all interlock mechanisms work the same way. For more information, refer to your hardware documentation.

The following table describes the options on the Slot Options menu and the conditions under which they appear.

Table 3-2 *Slot Menu Options*

Menu Item	Conditions
Add Adapter	There is no power to the slot, the interlock mechanism is closed, and the driver supports Add functionality. (Add functionality means that a network board can be added to an empty slot or an existing network board can be replaced with a different board.)
Remove Adapter	The slot is powered on and a network board is in the slot.
Replace Adapter	There is no power to the slot, the driver supports only Replace functionality, and the interlock mechanism is either closed or not supported. (Replace functionality means that an existing network board can be replaced only with an identical board.)
Power Off Slot	The slot is powered on and no network board is present in the slot.
Power On Slot	There is no power to the slot, the driver doesn't support the interlock mechanism, and the driver supports Add functionality. (Add functionality means that a network board can be added to an empty slot or an existing board can be replaced with a different board.)
Slot Detailed Information	All conditions.

Slot Detailed Information Screen

The Slot Detailed Information screen displays information about a specific slot and the network board in that slot.

Figure 3-4 *Slot Detailed Information Screen*


```
Novell Configuration Manager Console          NetWare Loadable Module

   Main Chassis, Bus 2, Slot 5, Complex Adapter

 Bus Operation:   PCI/33 MHz
 Bus Capability: PCI/33 MHz, 32 Bit
 Hot Plug?       Yes, Hot Add/Expansion Supported
 Slot Status:    Active

                Device and Driver Information

    HIN:        Registered Driver:              Driver Status:

    10017       No Driver                       Inactive
    501         AHA2940.HAM                      Active
    502         AHA2940.HAM                      Active

Esc - Main Menu   F1 - Help   F2 - Slot Options
```

Items on the screen include the following:

* Slot number
* Description of network board in slot
* The bus type (PCI, EISA, or EMBEDDED)
* The bus number of the slot
* The operating speed of the bus and its capabilities
* Whether or not the network board is hot-pluggable
* The status of the slot/network board
* The NetWare Hardware Instance Number (HIN) of each device
* Device driver name and status for each HIN

  Status possibilities include the following:

  * **Active:** Driver is loaded for the device.
  * **Inactive:** No driver is loaded for the device.
  * **Failed:** The device has failed.
  * **Suspended:** The driver is loaded but activity is suspended while the network board is being added.

Pressing F2 activates the Slot Options menu, which allows you to take actions such as removing the card from a particular slot.

Navigating NCMCON Menus

To navigate NCMCON menus, follow these guidelines:

* In the Main menu, use the arrow keys to move up and down the list of slots.

  If you select a hot-plug-capable slot, the Slot Options menu is displayed.

  If you select a non-hot-plug-capable slot, the Slot Detailed Information screen is displayed.
* From the Slot Options menu, select the desired option.
* At the Slot Detailed Information screen, select a slot and press F2 to open the Slot Options menu.
* To return to the Main menu, press Esc.
* For online help, press F1.

Removing a Network Board

1 From the NCMCON *Main* menu, select the slot with the network board you want to remove.

   The *Slot Options* menu is displayed.

2 Select *Remove Adapter*.

   NCMCON processes the remove request.

3 After the slot has a status of Powered Off and the slot's green LED is no longer lit, open the lever and take the network board out of the slot.

   NCMCON then updates the status of the slot on the screen.

Adding a Network Board

1 If the slot already contains a network board, remove the board from the slot.

See "Removing a Network Board" on page 35.

2 Insert the new network board in the slot and close the lever.

The new network board is detected automatically and you are prompted to apply power to the slot.

3 Respond to the prompt to apply power.

If you respond Yes: The slot's green LED is illuminated and you are reminded to attach cables. The system then attempts to autodetect and load drivers for the network board. Follow any prompts that appear on the screen.

If you respond No: The console status does not change. Go to Step 4 when you are ready to apply power to the slot.

4 When you are ready to apply power to the slot, select the slot and network board from the Main menu.

5 From the *Slot Options* menu, select *Add Adapter* or *Power On Slot* (whichever is displayed).

The Novell Configuration Manager attempts to autodetect and load drivers for the network board. Follow any prompts that appear on the screen.

3.5 What's Next

After setting up your network server, you might want or need to do one or more of the following tasks:

- Make specific changes to optimize it. For more information, see "Optimizing the NetWare Server" on page 37.
- Use specific procedures to manage it. "Managing the NetWare Server" on page 47.
- Find solutions to specific problems you might be experiencing. "Troubleshooting the NetWare Server" on page 113.

Optimizing the NetWare Server

4

Optimizing the NetWare® server requires staying up-to-date with Novell® Support (http://support.novell.com/index.html?sourceid=suplnav_suphome) and performing one or more of the following tasks:

Table 4-1 *Tasks for Optimizing the Server*

To	See
Learn how to obtain the most recent operating system updates and then patch your server before you optimize	"Applying Patches" on page 37
Isolate and resolve bottlenecks by making sure that your hardware components are well matched for power and potential performance	"Matching Performance Capabilities" on page 37
Identify where you can adjust the value of a server parameter and tune your server for its particular processing load	"Setting the Load Balancing Threshold" on page 39
Learn how to improve the performance of your server by changing Set parameters	"Setting Server Parameter Values" on page 40
Reduce network traffic by managing the protocols on your server	"Minimizing Replication Traffic" on page 45

4.1 Applying Patches

Novell makes every attempt to solve problems in the NetWare operating system software by periodically releasing updates that 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 in the update lists on the Novell Support Web site (http://support.novell.com/patches.html).

For information about installing NetWare patches, see "Upgrading to NetWare 6.5 SP8" in the *NW65 SP8: Installation Guide* and read the Readme file associated with the patch.

4.2 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 well-designed system with matched components.

Figure 4-1 *A Well-Designed System*

Lower
Performance

Higher
Performance

a b cde

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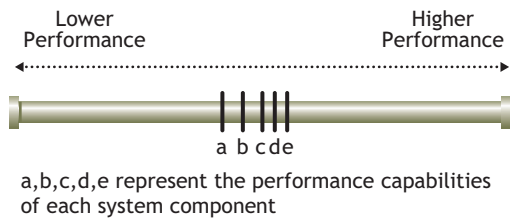
Note that all components in a well-designed system are within the same range of performance. But in this case, a less than optimum component is cost effective. The components are so closely matched that upgrading the lower-end component *a* would not increase performance enough to make it worth the cost.

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

Figure 4-2 *A Poorly Designed System*

Lower
Performance

Higher
Performance

f   g   h i j

f,g,h,i,j represent the performance capabilities
of each system component
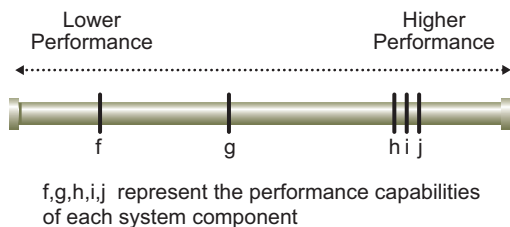
In this system, components *f* and *g* have performance characteristics that are considerably inferior to components *h*, *i*, and *j*. With component *f* as the bottleneck, components *h*, *i*, *j*, and even *g* are constrained by *f* so that they run much more slowly than their designs would otherwise 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 might have cost more than the well designed system. But it cannot perform as well because of the greater disparity between its low- and high-performance components.

The next figure shows an unbalanced system. This system 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*, all additional performance characteristics in *f* would be lost because the bottleneck would move to component *g*.

Figure 4-3 *Unbalanced System*

Lower
Performance

Higher
Performance

f   g   h i j

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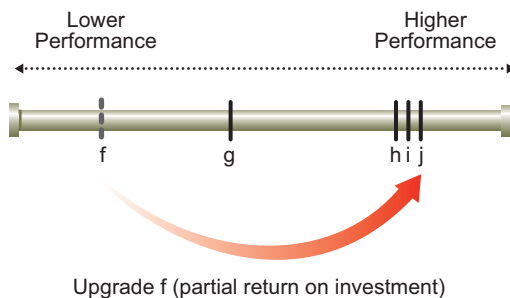
Thus you derive only a partial return on your investment in the upgrade. To accomplish more than moving the bottleneck, both components must be upgraded to the level of *h* before a full return on investment in *h*, *i*, and *j* can be reached.

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 might 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://support.novell.com/techcenter/articles/ana19960104.html).

4.3 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.

IMPORTANT: 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.

To set the load balancing threshold:

1 In Novell Remote Manager, click the *Set Parameters* link under the *Manage Server* heading in the navigation frame and then click the *Multiprocessor* link.

2 Click the *value* link for the System Threshold parameter.

The page displays the current setting and the range of valid values. The default value is 1536.

3 To change the threshold setting, type a new value in the field and click *OK*.

For more information about the value ranges and default setting, see "Multiprocessor Parameters" in the *NW 6.5 SP8: Utilities Reference* or the online help for the parameter in Novell Remote Manager.

To view CPU utilization by an NLM™ program in Novell Remote Manager, click the *Profile/Debug* link under the Diagnose Server heading in the navigation frame, then click the *Profile CPU Execution by NLM* link on the Profiling and Debug Information page.

4.4 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 them, we recommend that you first read the topics listed here.

4.4.1 Understanding Server Defaults

NetWare 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, three utilities are available to check or set server parameter values:

◆ Novell Remote Manager (`portal.nlm`) is a Web-based utility that you run from a workstation. You can use Novell Remote Manager to navigate to quickly a specific parameter by clicking *Set Parameters* under the *Manage Server* heading in the navigation frame, then selecting the *category* and *value* you want to change, and then changing or resetting the values to the default. For more information, see "Viewing or Changing Set Parameters" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

◆ Monitor is a character-based utility that you must use at the server console or access through Novell Remote Manager. 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. For more information, see "MONITOR" in the *NW 6.5 SP8: Utilities Reference*.

◆ SET is a command line utility executed at the System Console prompt. If you are familiar with the names of the server parameters, you might find that using Set commands at the System Console prompt is faster for routine tuning. For more information, see "SET" in the *NW 6.5 SP8: Utilities Reference*.

Most Set parameter values are persistent and are stored in a the NetWare Registry. A NetWare 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.

To ensure that explicit Set parameter changes are preserved, you can add the command for each change to the `startup.ncf` or `autoexec.ncf` file. For procedures on editing these files, see "Using NWCONFIG to Create and Edit Startup Batch Files" on page 63.

4.4.2 Finding Current Parameter Values

Locating the Set parameter values to check or set them is different is a little different in each utility (Novell Remote Manager, Monitor or SET).

In Novell Remote Manager

1 Access Novell Remote Manager.

2 Click the *Set Parameters* link under the *Manage Server* heading in the navigation frame.

3 Click a parameter category.

A list of parameters in that category that can be changed is displayed.

If you want to view a description of a parameter, click the *Info* icon next to the value.

If you are not sure what category a Set parameter is in, you can view and search the Server Configuration report in using Novell Remote Manager. The Configuration report lists all the Set parameters by category with their current settings.

4 Click the value for the parameter you want to change.

The current setting for the parameter and its range of valid values is displayed.

5 Type the new value in the current value field and click *OK*.

In Monitor

1 At the System Console prompt, enter

```
monitor
```

2 From the *Available Options* menu, select *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 pop-up 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.

Using Set Commands

1 At the System Console prompt, enter

```
set
```

A numbered list of server parameter categories is displayed.

2 Enter the number associated with the category you want to view.

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 Esc to exit the category.

3 To select another category, repeat the previous steps.

4.4.3 Printing Current Parameter Values to a File

Most settings for NetWare server parameters are now persistent, whether you set them using Novell Remote Manager, Monitor, or Set commands. Nevertheless, you should record your optimum server configuration as part of documenting your network.

To write current values of settable parameters to a file and print it, complete the following:

1 Access Novell Remote Manager.

2 Click the *Set Parameters* link under the Manage Server heading in the navigation frame.

3 In the *Save Settings to a File on Volume Sys:* field, accept the default filename (`settings.txt`) or enter a different filename.

4 Click the *Save* button to the right of the *Save Settings to a File on Volume Sys:* field.

5 Browse to the file on the server and print it.

4.4.4 Checking Current Parameter Values with DISPLAY ENVIRONMENT

You can also check parameter values by using two other 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 System 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 command displays *only* the server parameters that have values modified from the defaults.

At the System 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 the *NW 6.5 SP8: Utilities Reference*.

4.4.5 When to Modify Defaults

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

Before modifying defaults, you should track and log performance statistics. You can do this using Novell Remote Manager for NetWare or "MONITOR". You will also find the server log files useful in assessing the server's performance. See "Checking Server Error Logs" on page 107.

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 37.

4.4.6 When Not to Modify Defaults

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

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.

4.4.7 Restoring Default Values with Reset Environment Command

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 System 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 the *NW 6.5 SP8: Utilities Reference*.

4.4.8 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 97.

Novell Remote Manager and ConsoleOne® are other utilities that allow you to monitor server performance.

4.4.9 Using Optional Commands in Startup Files

During initialization, NetWare executes two server boot files that are created by the installation process:

- **Startup.ncf** . Executes first and loads the server's disk drivers, name spaces, and some Set parameters. This file resides in the startup directory, `c:\nwserver`.

- **Autoexec.ncf** . Stores the server name and IPX™ internal network number (if IPX is installed), loads the LAN drivers and settings for the network boards, binds the protocol to the installed drivers, and loads other NLM programs. This file resides in sys:\system.

  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. 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 64.

4.4.10 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`, see the detailed information for the parameter in Novell Remote Manager.

If a Set command is nonpersistent and you want its setting to remain when the server is restarted, then add the Set command for any nonpersistent parameters to the `startup.ncf` file.

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. To modify server batch files, you can use NWCONFIG or Editor at the server console or edit and upload the file using Novell Remote Manager. When the server is rebooted, any parameter values set by commands in the `autoexec.ncf` file override previous values for those parameters.

4.5 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 Novell eDirectory™, see "Designing the eDirectory Tree" or "Managing Partitions and Replicas" in the *Novell eDirectory 8.8 Administration Guide*.

Managing the NetWare Server

<div style="text-align: right; font-size: 3em">5</div>

This section contains information to assist you in completing the following tasks when managing you NetWare® server.

5.1 Starting and Stopping the Server

This section contains information and procedures for

5.1.1 Starting the Server

The server can be started manually from the server startup directory after it has been stopped and powered down, or you can place the command to execute `server.exe` in the DOS `autoexec.bat` or `config.nw` file.

 If you installed the server using the NetWare boot loader, then insert the execute commands go in the `config.nw` file.

Then, whenever the server computer is powered up, the server starts automatically.

To start the server after it has been stopped:

1 Change to the startup directory (usually `c:\nwserver`).

2 Enter `server` at the server's DOS prompt.

When you start the server, the X Server--Graphical Console is started and 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.

The following information is also covered:

- "Maintenance Mode" on page 48
- "Resolving Hangs That Occur during Server Startup" on page 48
- "Seeing Modules Load" on page 49
- "Viewing Loaded Modules" on page 50

Maintenance Mode

We have added the option to press the F8 key during the server load process to enter the server maintenance mode. During this maintenance mode, you have the following options:

- Confirm the loading of modules loaded during the server boot process by pressing any key at each prompt
- Abort the loading of the operating system by pressing Esc

  When the server is starting up there is a several-second window in which you can press Esc to exit to DOS indicated by the Press Esc to Abort OS boot prompt. This is especially helpful when you have a command in the DOS `autoexec.bat` file to execute `server.exe`.

- Continue loading the server without further pausing by pressing the C key.

Resolving Hangs That Occur during Server Startup

If the server appears to be hung during the first stages when the drivers from the `startup.ncf` file are loading, check the System Console for the following messages on the most recent screen:

```
Queuing error message for later.
```

or

```
Processing stage 1 loading of NLMs.
```

Several of the following actions or problems could cause the hang and the messages to occur:

- You have made changes in the `startup.ncf` file that removed a necessary storage driver or Custom Device Module (CDM) drivers; specified incorrect slot numbers; or changed the loading order of PSM, CDM, or HAM storage drivers.
- You have changed hardware and not changed the `startup.ncf` to reflect the changes.
- The storage adapter or drives experienced a hardware failure.

If you suspect that the hang was caused by any of these actions or problems, enter the following command at an alternate console prompt (press Ctrl+Alt+Esc and enter 3 to spawn a new command line process).

```
LFVOLUMES RESET STATUS
```

The status shows the drive letters (local volumes) that the system is trying to access via real mode interfaces. If any drives are listed, then the hang condition encountered might be the result of the system waiting for a NetWare driver to report the availability of that local volume and, for some reason, that event isn't happening.

To resolve this hang:

1 At the alternate console prompt, enter

```
LFVOLUMES RESET
```

This informs the operating system that for this boot instance it is allowed to continue accessing local volumes using the real mode interfaces instead of waiting for access through a NetWare driver.

2 When the System Console prompt is available, try to discover why the storage drivers did not load or initialize correctly.

Possible options include:

- ◆ Reviewing the Logger screen for errors reported while loading drivers
- ◆ Running HDETECT to ensure the contents of the `startup.ncf` file is correct
- ◆ Ensuring that the system's disk subsystems are configured correctly

3 Correct the suspected problem and restart the server to ensure that it will run without startup errors.

Seeing Modules Load

When you start the server, you can see a list of modules as they load by making sure the System Console screen or Logger screen is displayed.

You can access these screens by pressing Alt+Esc keys, then tapping Esc until the System Console screen or Logger 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 as shown in the following table:

Table 5-1   *Colors Indicating How a Module Was Loaded*

Color	Module Loaded
Cyan (light blue)	By `server.exe`
Red	From the startup directory
White	From `autoexec.ncf`
Purple	By other modules

Viewing Loaded Modules

After the server is running, you can view which modules are loaded in a few ways.

From the System Console Prompt

After the server is running, you can display a list of all loaded modules by entering the following command at the System 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 the *NW 6.5 SP8: Utilities Reference*.

From Novell Remote Manager

You can view a list of modules running from Novell Remote Manager by clicking the *List Modules* link under the Manage Applications heading in the navigation frame. For more information, see "Managing NLM Programs" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

5.1.2 Bringing Down the Server

To ensure the server's data integrity, use the DOWN command at the System Console prompt 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 down the server immediately without a prompt, use the DOWN command with the -f command-line switch. This -f switch works with the RESTART SERVER and RESET SERVER commands as well. For example:

```
DOWN -f
```

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.

You can also use the RESTART SERVER command at the System Console prompt with the following command line switch options:

Table 5-2   *Command Line Switch Options for Restarting the Server*

To	Use this option
Restart the server without using the `startup.ncf` file.	-ns
Restart the server without using the `autoexec.ncf` file.	-na
Force the server down without prompting.	-f
Break into the server's internal debugger	-d

If you want to bring down the server and then warm boot the computer, use the `RESET SERVER` command.

To make the server load automatically after a `RESET SERVER` command, enter a line to run `server.exe` in the DOS `autoexec.bat` file on the server computer.

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

You can also use the `DOWN`, `RESTART SERVER`, or `RESET SERVER` commands from a workstation using the options on the *Down/Restart* page in Novell Remote Manager.

This section also includes the following information:

- "Down Command Powers Off Server on Most Pentium 4 Machines" on page 51
- "Informing Users About Bringing Down the Server" on page 51
- "Unloading Modules Before Shutting Down the Server" on page 52

Down Command Powers Off Server on Most Pentium 4 Machines

On newer server hardware that provides ACPI (Advanced Configuration and Power Interface) support, NetWare 6.5 auto-detects and loads the `acpidrv.psm` module that supports HyperThreading, if present, and advanced Power Management features.

With the ACPI power management drivers loaded (which they are by default if the hardware support is detected), pressing the server's power button executes the `DOWN` command (bringing down the server with a 30-second default delay and a message) and then powers the server off.

Actually executing the `DOWN` command at the System Console prompt or from Novell Remote Manager, also shuts down the server and powers off the system.

The `RESTART SERVER` command includes a power cycle on these same machines with ACPI support, equivalent to the `RESET SERVER` console command.

Some machines can return to DOS even with ACPI drivers loaded. To disable the power off functionality for the `DOWN` command, use the following command at the System Console prompt:

```
SET server power down options=off
```

This lets you execute the `DOWN` or `RESTART SERVER` commands without powering off the server.

For more information about the Power Management options, see the console command help for SET > Power Management category.

Informing Users About Bringing Down the Server

Before you bring the server down, you should inform all users to close files and log out of the server. You can do this using the *Broadcast Message to Everyone* field on the Connections page in Novell Remote Manager or by using the Connections, Compose a Message (F4) option in Monitor.

To send a message and shut down the server from the server console:

1 At the System Console prompt, enter `LOAD MONITOR`.

2 From the Available Options menu, select *Connections*.

3 Select each connection you want to inform and press F5 to mark it.

4 Press F4 to display a Message Text window.

5 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.
```

6 Enter one of the following commands at the System Console prompt:

To	Command	Comments
To bring down the server and exit to the local operating system	DOWN	You can now shut off power to the system, if necessary.
To reboot the server without exiting to DOS	RESTART SERVER	
To bring down the server and then warm boot the machine	RESET SERVER	

Unloading Modules Before Shutting Down the Server

Although most modules, including those in protected address spaces, unload automatically when you bring 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 in the sys:system directory and place the unload commands in it. If you create shutdown.ncf, it is executed automatically whenever you bring down, restart, or reset the server.

For more information, see "Using EDIT to Create and Edit Text and Batch Files" on page 62 and "UNLOAD", "Down", and "Restart Server" in the *NW 6.5 SP8: Utilities Reference*.

5.2 Viewing and Accessing Server Console Screens

After you start the server, the System Console screen and the Logger screen are available at the server console by default. Several other screens might be available depending on your server setup, such as the NetWare GUI screen or screens for utilities that are running at the server console.

Some NLM™ programs have console screens associated with them. If you load one of these NLM programs, then the console screen associated with it is automatically activated and available at the server console.

The following table shows what to do to view or access the available console screens.

Table 5-3 *Viewing or Accessing Server Console Screens*

To	Action
View a list of screens that are running at the server console	Press Ctrl+Esc on the server keyboard.
View a specific screen	Press Ctrl+Esc to view the *Current Screens* list, then enter the number for the screen you want to view.
	Or, press Alt+Esc on the server keyboard, and then continue to hold Alt down and tap Esc until the screen you want to access is displayed.
	Use the title bar at the top of the screen for navigation.
	When the X Server--Graphical Console (Server GUI) is displayed, you must release the keys and start over.
Hide a specific screen	Press Ctrl+Esc to view the *Current Screens* list and learn the screen name for the screen you want to hide.
	Enter the `HIDESCREEN` *screen_name* command at the System Console prompt.
	NOTE: The hidden screens are indicated by an asterisk before screen name in the Current Screens list.
Restore a hidden screen	Press Ctrl+Esc to view the *Current Screens* list, then enter the number for the screen name you want to restore.
	NOTE: The hidden screens are indicated by an asterisk before screen name in the *Current Screens* list.
	You can also restore a screen by entering the `SHOWSCREEN` *screen_name* command at the System Console prompt.

This section also includes the following information:

5.2.1 System Console Screen

The System Console screen is item 1 in the *Current Screen* list. From this screen, you can view the current messages sent to the server. At the System Console prompt, you can

- Enter commands to load or unload any NLM programs to the server.
- Execute console commands.
- Change Set parameter values.

- View the history of messages sent to this screen.
- Save the contents of this screen to a file.

To view the functionality of this screen, press F1 for the online help.

Scrolling

The System Console screen is scrollable and you can navigate it using the following keys:

Table 5-4   *Navigating the System Console Screen*

Key	Moves the Cursor
Ctrl+Down-arrow	One line down on the screen.
Ctrl+Up-arrow	One line up on the screen.
End	To the last entry on the screen.
Home	To the first entry on the screen.
PgDn	One page down on the screen.
PgUp	One page up on the screen.

To disable this functionality, enter the `SERVER -CS` command when you start the server or add it to the `autoexec.bat` file to disable scrolling permanently.

Executing Console Commands

To execute a command at the System Console screen, type the command and its parameters and then press Enter.

The System Console retains a history or buffer of the commands that you have entered at the System Console screen. Therefore, if you have recently entered a command, you can press the Up-arrow key or Down-arrow key to recall the command and execute it again by pressing Enter when the command appears at the System Console prompt.

The amount of commands retained in the command history buffer varies and depends on the length of the commands entered. The command history buffer is flushed when you restart the server or disable the history.

To disable the command history buffer, press the F10 key while viewing the System Console screen. When the commands are not recallable, the System Console prompt changes from a colon (:) to a special character (≡).

To resume saving the console command history, press F10 again while viewing the System Console screen. The command prompt returns to a colon (:).

Saving the Console Screen History to a File

The messages that are displayed on the System Console screen are normally saved to the conlog file. However, the information that is displayed during the boot process is not captured in the conlog file.

If you want to save this information to a file, you can save it by pressing the F2 key while viewing the System Console screen. The information is saved to the `console.txt` file in the server startup directory.

If you want to save the file to a different location, you can specify a different location using the `Loggerpath` command. For more information on using this command, see "Loggerpath" in *NW 6.5 SP8: Utilities Reference*.

You can also save the information to the file using the `consolesave` command. Using this method can be useful if you want to schedule the saving of this file on a regular basis by using cron or the Schedule Task feature in Novell Remote Manager. See "Scheduling Tasks to Run at the Server" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

For more information on the consolesave command, type `help consolesave` at the System Console prompt.

5.2.2 Logger Screen

The Logger screen is item 2 in the *Current Screen* list. Most messages and alerts are sent to the Logger screen. This screen is scrollable, searchable, and its contents can be saved to a file.

To access a list of commands for scrolling, saving the buffer to a file, and searching content in the buffer, press F1 while viewing the Logger screen.

To clear the contents of the buffer, press F5 while viewing the Logger screen.

- "Searching the Logger Screen Buffer for Information" on page 55
- "Saving the Contents of the Logger Buffer Screen" on page 56
- "Changing the Default Size of the Logger Screen Buffer" on page 57

Searching the Logger Screen Buffer for Information

The Logger screen maintains a buffer or log of the messages sent to the server console. You can search this buffer of information in two ways:

- Using the lss command from the System Console prompt
- Using View History Buffer link in Novell Remote Manager.

Using the LSS Command from the System Console Prompt

To search the Logger screen buffer:

1 At the System Console prompt, enter `LSS`.

2 Type the information you want to search for, such as *LAN* or *a message string*.

If the text is found, the console switches to the Logger screen and positions the line containing the search string in the middle of the screen unless it is at the bottom of the buffer.

If the text is not found, a message is returned containing the text searched for.

3 (Optional) Press F3 to find the next occurrence of the text searched without returning to the server console screen.

4 (Optional) Return to the System Console prompt to enter a new string.

Using View History Buffer Link Novell Remote Manager

To search the Logger screen buffer:

1 In Novell Remote Manager, click *Console Screens* under the *Manage Server* heading in the navigation frame > *View History Buffer*.

2 Using the search or find feature of your browser, enter the information you want to search, such as LAN or *a message string*.

Saving the Contents of the Logger Buffer Screen

You can save the contents of the logger screen to the `logger.txt` file using several methods:

Method 1

At the System Console prompt, enter `loggersave`.

Method 2

While viewing the logger screen at the server console, press F2 on the console keyboard.

The `logger.txt` file is saved by default to the server startup directory (`c:\nwserver`).

You can change where this file is saved by using the `loggerpath = pathname` command. If the path does not exist, it is created. You can change the path to any directory on volume `sys:` or the boot drive.

For example: `loggerpath = sys:\loggerscreen`

Method 3

You can also save the file using the tool in the Server GUI console:

1 View the file in the Server GUI.

    1a Click the *Console Log* icon.

    1b Click *Screens > Logger*.

2 Click *File > Save As*.

3 Browse to the directory where you want to save the file.

4 Enter a filename, such as `logger.txt`, and click *Save*.

If you want to append the file to a previously existing file, you can also do this using the Server GUI:

1 View the file in the Server GUI.

    1a Click the *Console Log* icon.

    1b Click *Screens > Logger*.

2 Click *File > Append*.

3 Browse to the file that you want to append the information to, then click *Save*.

Changing the Default Size of the Logger Screen Buffer

The default size of the logger screen buffer is 240 KB. This represents about 55 screens full of data. You can decrease or increase the size of the buffer anywhere from 192 KB to 1024 KB.

To change the size of the buffer from the default, enter the following command when loading the server: `server -ls ` *`desired_size`*

For example, `server -ls 1024`

IMPORTANT: This setting is not stored in the NetWare registry.

If you want this buffer size every time the server comes up, edit the load line in the c: `autoexec.bat` or `config.nw` file to add these parameters to the server load line.

For example:

```
c: cd \nwserver server -ls1024
```

NOTE: When entering the command to change the buffer screen size, you can use either -ls1024 or -ls 1024.

5.2.3 X Server--Graphical Console

The default screen that is shown when the server is started is the X Server--Graphical screen unless you have disabled it.

The X Server--Graphical Console, also known as the server GUI lets you access and run the Java applications listed.To access the list, click *Novell* on the Graphical Console.

Table 5-5 *Tasks and Procedures for the X Server Graphical Console*

To	Action
Load this screen if you have disabled it	At the System Console prompt, enter `startx`
Close this screen from the GUI menu	Click *Exit*
Close this screen using the server keyboard keys	Press Ctrl+Alt+Backspace

5.2.4 Emergency Console

The Emergency Console can be useful when the server console seems to hang.

From this console, you can:

- Shut down the file server and exit to DOS
- Abort a volume mount
- Open a new console screen to issue the necessary commands, such as unloading modules.

Table 5-6 *Tasks and Procedures for the Emergency Console*

To	Action
Access this screen	On the server keyboard, press Ctrl+Alt+Esc
Exit this screen	On the server keyboard, press Esc
Close additional screens opened by the Emergency Console	At the Emergency Console prompt of each screen, enter `BYE`

5.3 Starting and Stopping Processors

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

When the Platform Support Module (PSM) is loaded in the `startup.ncf` file and the Auto Start Processors Set parameter value (Multiprocessor category) is set to On, NetWare can start the secondary processors automatically.

NOTE: 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 or display information about secondary processors at any time while the server is running using the following procedures.

5.3.1 Displaying Processor Information

Before starting or stopping a process, you should display the processor information to determine the status of the processor. The following utilities are available to display processor information.

Using Novell Remote Manager

1 Click the *Processors* link under the *Manage Hardware* heading in the navigation frame.

2 View the information on the Processor Information page.

From this page you can view whether the processor is online or offline, start or stop a processor, and view the following information about each processor:

- Speed, family, model, and stepping
- Feature flags and CPUID
- L1 and L2 cache
- The amount of TLB Instruction and Data entries

Using Server Console Commands

The following table specifies the commands to use at the System Console prompt to determine processor status.

Table 5-7   Determining Processor Status by Using Commands at the System Console Prompt

To	Enter
Determine which processors are currently online	`display processors`

Determine processor speed and other generic information	`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" and "CPUCHECK" in *NW 6.5 SP8: Utilities Reference*.

Using Monitor

Per-processor statistics are also available from Monitor. From the Available Options menu, select *Kernel > Processors*.

5.3.2 Stopping Processors

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

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

You can stop processors using Novell Remote Manager or server console commands at the System Console prompt.

-
-

Using Novell Remote Manager

To bring a secondary processor offline in Novell Remote Manager:

1 Click the *Processors* link under the Manage Hardware heading in the navigation frame.

2 Click the *Stop Processor* link for the applicable processor that you want to stop.

Using Server Console Commands

The following table specifies the commands to use at the System Console to take a processor offline.

Table 5-8 *Stopping Processors by Using Commands at the System Console Prompt*

To	Enter
Identify which processors are currently online and to obtain their ID numbers	`DISPLAY PROCESSORS`
Take a secondary processor offline	`STOP PROCESSORS `*n* *n*=processor number
Take two or more (but not all) secondary processors offline	`STOP PROCESSORS `*n n* *n*=processor number
Take all secondary processors offline	`STOP PROCESSORS`

For more information, see "DISPLAY PROCESSORS" and "STOP PROCESSORS" in the *NW 6.5 SP8: Utilities Reference*.

5.3.3 Starting Processors

The NetWare default is to start secondary processors automatically when the server boots. If a secondary processor is offline, you can bring in online by using Novell Remote Manager or server console commands at the System Console prompt.

- "Using Novell Remote Manager" on page 60
- "Using Server Console Commands" on page 60

Using Novell Remote Manager

To bring a processor online in Novell Remote Manager:

1 Click the *Processors* link under the Manage Hardware heading in the navigation frame.

2 Click the *Start Processor* link for the applicable processor that you want to start.

Using Server Console Commands

The following table specifies the commands to use at the System Console to bring a processor online.

Table 5-9 *Starting Processors by Using Commands at the System Console Prompt*

To	Enter
Bring a specific secondary processor online	`START PROCESSORS `*n* *n*=processor number
Bring two or more (but not all) secondary processors online	`START PROCESSORS `*n n* *n*=processor number
Bring all secondary processors online	`START PROCESSORS`

For more information, see "START PROCESSORS" in the *NW 6.5 SP8: Utilities Reference*.

5.4 Managing Server Processes

In NetWare 6.5, the following changes were made in the way that the server processes work:

* Eliminated the New Service Process Wait Time parameter.
* Allowed the kernel to allocate up to the Maximum Service Processes when they are needed without waiting.
* Freed worker threads that haven't been used for five minutes and retained Minimum Service Processes.
* Server process names won't be reused, so higher numbers than the current number of worker threads are available.

These changes enable you to configure the Maximum Service Processes to a higher level without worrying that memory will be wasted by unused server processes.

A good rule is to have your Maximum Service Processes set to a server process for each remote client that will be logged in to the server.

You can configure Maximum and Minimum Service Processes in Novell Remote Manager. On the Set Parameters page, click *Miscellaneous*, then click either *Maximum Service Processes* or *Minimum Service Processes*.

You can see if you are near the configured maximum for either pool in Monitor, which now reports both the current MP server processes and legacy UP server processes.

To see if you are having packet receive buffer problems:

* In Novell Remote Manager, on the LSL Statistical Information page, look at the Get ECB Fails statistic.

   Click *View Statistics* under the *Manage Server* heading in the navigation frame > *LSL Statistical Information*.
* In Monitor, on the LAN Statistics screen look at Receive Discarded, No Available Buffers statistic.

If you are running out of packet receive buffers, you might not have enough of them or you might need more server processes. First, increase the number of packet receive buffers. If that doesn't resolve the problem, increase the number of server processes.

Packet receive buffers are usually 4 KB in size and each server process requires slightly more than 32 KB of memory.

5.5 Using Server Batch Files

This section explains how to use `.ncf` batch files to load modules, execute System Console commands, and configure subsystems. For procedures, see the following:

* "Using EDIT to Create and Edit Text and Batch Files" on page 62
* "Using NWCONFIG to Create and Edit Startup Batch Files" on page 63
* "Making a Command Optional in a Server Batch (.Ncf) File" on page 64

A server batch file is an executable file containing server console commands. You execute the file by entering its name at the System 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. This file resides in the server's startup directory, `c:\nwserver`.
* **Autoexec.ncf:** This file is executed after `startup.ncf` and after volume `sys:` is mounted. 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. This file resides in the `sys:system` directory.

In addition, you can create a batch file called `shutdown.ncf` in `sys:system` to execute commands whenever you shut down the server. The `DOWN` command executes `shutdown.ncf` automatically whenever the server is shut down, so you should never include the `DOWN` command in the `shutdown.ncf` file.

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 that you want them executed.

5.5.1 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 System Console prompt, enter

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

If you specify a path, include both the directory and filename. 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 filename) 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 filename 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, select 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, select the filename and press Enter.

2 Create or edit the file as needed.

To get a description of the keystrokes to use while using EDIT, press F1.

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

The system redisplays the pathname prompt.

4 To edit or create another file, enter the file pathname. To redisplay the System Console prompt, press Esc.

For more information, see "EDIT" in the *NW 6.5 SP8: Utilities Reference*.

5.5.2 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 System Console prompt, enter

`[LOAD] NWCONFIG`

2 Select *NCF Files Options*.

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

3 Select 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. Changes to the file take effect after you reboot the server.

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`.

For more information, see "NWCONFIG" in the *NW 6.5 SP8: Utilities Reference*.

5.5.3 Making a Command Optional in a Server Batch (.Ncf) File

By default, a `.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 (Miscellaneous category) to either *On* or *Off*. On means the default response is `Y` for Yes; Off means the default response is N for No.

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 (Miscellaneous category) parameter to a time in seconds. The default value is 10 seconds.

5.5.4 Checking the Execution of .ncf Files

If you want to check the functionality of each line in a `.ncf` file, you can use run the `KF8 ON` command at the System Console prompt. This lets you lets you pause the execution after each command of a `.ncf` file.

When you are finished, execute the `KF8 OFF` command to turn off this functionality.

5.5.5 Changing the Server Name and 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 Novell eDirectory Server objects. You must use ConsoleOne® to rename eDirectory Server objects.

IMPORTANT: Be sure to use ConsoleOne to update any references to the former server name in the eDirectory tree and in the `timesync.cfg` file.

The server's 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 internal network number in the `autoexec.ncf` file, use NWCONFIG or EDIT at the System Console prompt, then reboot the server.

To use NWCONFIG to change the settings, see "Using NWCONFIG to Create and Edit Startup Batch Files" on page 63. To use EDIT, see "Using EDIT to Create and Edit Text and Batch Files" on page 62.

5.6 Using Server Utilities and Console Commands

This section 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 at the System Console.

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 System Console prompt.

When you enter a command at the System 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.

NOTE: The amount of commands stored varies based on the length of the commands enter

You can also disable the storing of console commands by pressing the F10 key at the System Console prompt. For more information, see "Executing Console Commands" on page 54.

You can also use the "RECORD" and "REPLAY" commands to enter commands that you enter frequently at the System Console.

For more information, see the following topics:

- "How to Access Help for Utilities and Console Commands" on page 66
- "Using NetWare Loadable Modules" on page 66
- "Loading and Unloading NetWare Loadable Modules" on page 67

- "Accessing Monitor" on page 96
- "RECORD" and "REPLAY" in the *NW 6.5 SP8: Utilities Reference*

5.6.1 How to Access Help for Utilities and Console Commands

For a list of utilities and console commands, with descriptions, syntax, and examples, see *NW 6.5 SP8: Utilities Reference*.

The following table shows the information that you can get online at the System Console.

Table 5-10   *Displaying Help for System Console Commands and Utilities*

To display	Enter the following command at the System Console Prompt
A list of console commands on the server console	HELP
Help for a specific console command	HELP *command_name*
A description for all valid console commands	HELP ALL
Help for an NLM that has a console menu, such as Monitor	LOAD *NLM_name* Then press F1 at the subsequent menus, lists, and information windows.

To display a list of all the console commands in Novell Remote Manager, click the *Console Commands* link under the *Manage Server* heading in the navigation frame. For help on a specific command, click the *Info* icon next to the command.

5.6.2 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 and .exe extensions) let you monitor and change configuration options.

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

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

- **Name space support** (`.nam` extension) lets non-DOS naming conventions 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 NLM programs, 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:

- The `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 the *NW 6.5 SP8: Utilities Reference*.

5.6.3 Loading and Unloading NetWare Loadable Modules

- "Loading" on page 67
- "Unloading" on page 68
- "More Information" on page 68

Loading

To load a NetWare Loadable Module (NLM), enter the following at the System 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 the *NW 6.5 SP8: Utilities Reference*.
- If you want the NLM to be loaded whenever the server boots, add the command to `autoexec.ncf`.
- If you want the NLM program to be displayed in a language other than English, see "Changing the Language NetWare Uses" on page 26.

NOTE: In most cases you can load an NLM program by entering just the name of the NLM at the System 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 directs the server to load the NLM instead of executing the file of the same name. For information about the LOAD command, see "LOAD" in the *NW 6.5 SP8: Utilities Reference*.

When a module is loaded, a message is sent to the Logger screen showing information about the module including the load time.

Unloading

To unload an NLM program, enter the following at the System Console prompt:

```
UNLOAD NLM_name
```

To unload an NLM program from a protected address space, enter the following at the System Console prompt:

```
UNLOAD ADDRESS SPACE = space_name module_name
```

More Information

You can also load and unload NLM programs from the server using Novell Remote Manager. For more information, see "Managing NLM Programs" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

For more information about loading and unloading modules, see "LOAD" and "UNLOAD" in the *NW 6.5 SP8: Utilities Reference*.

For more information about unloading modules from protected address spaces, see "Unloading Protected Address Spaces" in the *NW 6.5 SP8: Server Memory Administration Guide*.

5.7 Using the Novell JVM (NJVM) for NetWare on the Server

This section explains the types of administrative tasks that you can do with NJVM.

Additional information you might need about the JVM for NetWare can be located in the Novell JVM for NetWare documentation (http://www.novell.com/documentation/lg/jvm142/index.html).

For information about using and managing Java-based components on the NetWare server, see:

- Section 5.7.1, "Font.properties File," on page 69
- Section 5.7.2, "Loading and Unloading NJVM," on page 69
- Section 5.7.3, "NetWare GUI Tasks," on page 69
- Section 5.7.4, "Applet and Application Tasks," on page 75
- Section 5.7.5, "Using the File Browser," on page 77
- Section 5.7.6, "Viewing and Setting Environment Variables," on page 78
- Section 5.7.7, "Performance Tuning," on page 81
- Section 5.7.8, "Java Configuration Files," on page 81

5.7.1 Font.properties File

The `java\lib\font.properties` file for NJVM controls the Java font to native font mapping. The `font.properties` file is nearly identical to the Solaris* implementation. For a description, see the `font.properties` documentation on the Sun Web Site (http://java.sun.com/j2se/1.4.2/docs/guide/intl/fontprop.html).

5.7.2 Loading and Unloading NJVM

This section explains how to load and unload NJVM.

Loading NJVM

To load NJVM (`java.nlm`), enter `load java` at the system console.

This loads NJVM into memory and allows the command interpreter to recognize when a Java application or applet is launched. For information about different loading options, see "JVM Client and Server Versions" on page 82.

Unloading NJVM

You can unload NJVM (`java.nlm`) from memory by entering the following command at the system console:

```
java -exit
```

This calls any registered shutdown hooks, closes all of your Java applications, and unloads Java.

5.7.3 NetWare GUI Tasks

This section contains the following procedures:

- "Selecting a Background Pattern" on page 73
- "Using the NetWare GUI without a Mouse" on page 73
- "Keystroke Actions for Java Text Areas and Text Fields" on page 74
- "Closing the NetWare GUI" on page 75

Starting the NetWare GUI

To start the NetWare GUI, enter `startx` at the system console.

When the *Novell* button appears on the taskbar in the lower left corner, the startup process is complete.

Server Console Utility

The NetWare GUI's Server Console utility is C-based and does not require Java to be loaded. Multiple instances of the Server Console utility can be loaded. This lets you view multiple server screens simultaneously in the NetWare GUI. For example, you can view the Logger screen, Edit screen, and the Console screen from three different windows.

To start the Server Console utility, click the *Server Console* icon on the Server GUI taskbar, or click *Novell > Utilities*, *Server Console*.

NOTE: Some screens have limited functionality and update only when they are the active screen. You need to view these screens from within a system console that follows the active screen.

The first instance of the Server Console utility you launch follows the active screen. This means that it immediately reflects changes made on the active screen. For all other instances, following the active screen is not the default setting; you can manually select this option by clicking *View > Follow Active Screen*.

All instances following the active screen have an asterisk in front of the screen name.

Toggling between the NetWare GUI and the System Console

- To toggle to the next screen, press Alt+Esc.
- To toggle to the NetWare screen selection list, press Ctrl+Esc.

Activating the Taskbar

There are three methods to activate the taskbar:

- Click *Novell* in the lower left corner of the Server GUI screen
- Press the Windows meta key
- Right-click on the NetWare GUI background

Configuring the Taskbar

The taskbar consists of items that are either menus or commands.

Menus

Menus consist of the following items:

- Default name
- International name (optional)

If you specify an international name, it appears in the taskbar; otherwise, the default name appears.

Internationalized names are stored in files with the `.properties` extension.

Commands

Commands consist of the following items:

- Default name
- International name
- The command to execute

> **IMPORTANT:** We recommend that you specify a `.ncf` file that contains the actual commands to execute.

Creating a Menu

1 Click *Novell* in the NetWare GUI, select *Settings*, then select *Menu Editor*.
2 Right-click the location where you want to install the menu item.
3 Click either *New Command* or *New Menu*.
4 Type the information in the Edit panel.
5 On the taskbar, click *File*, then click *Save*.

Modifying a Menu

1 Click *Novell* in the NetWare GUI, select *Settings*, then select *Menu Editor*.
2 Click the menu you want to change.
3 Modify the command information in the Edit panel.
4 On the taskbar, click *File*, then click *Save*.

Deleting a Menu

1 Click *Novell* in the NetWare GUI, select *Settings*, then select *Menu Editor*.
2 Right-click the menu you want to remove.
3 Select *Remove*.
4 On the taskbar, click *File*, then click *Save*.

Moving a Menu

1 Click *Novell* in the NetWare GUI, select *Settings*, then select *Menu Editor*.
2 Right-click the menu you want to move.

3 Click either *Move Up* or *Move Down*.

4 On the taskbar, click *File*, then click *Save*.

If a target menu is open, the selected menu moves into that menu; otherwise, the selected menu moves past the target menu.

Using International Names

The Menu Editor contains two sections for names:

- Default Name: The name that displays for the menu item's text if no international name is specified.

- Optional International Name: The name that displays if an international name is specified. The text for the international name is specified in the properties file.

Properties Files

A properties file is a text file that contains key=value entries. For example, PROGRAMS=programs or UTILITIES=utilities.

The key on the left should contain only ASCII characters. The value on the right can contain characters or specifiers for Unicode encoding. For example, you can specify the value Run using any of the following:

- RUNITEM=Run

- RUNITEM=\u0052\u0075\u006e

- RUNITEM=R\u0075\n

The naming convention is to specify a file with a base name and an extension of `.properties`. For example, *MyApp*`.properties`

To use a properties file, you must first place it in the `sys:\java\lib\taskbar` directory. Then, in the Optional Internationalized Name section of the Menu Editor, click *Browse* to select your properties file. When you select this file, the items in the file display in a list of names. You choose the name you want to use from this list.

IMPORTANT: Do not add your own name entries to the `NWMenu.properties` file. This file is overwritten when you install a newer version of NJVM.

The values you retrieve from a properties file can correspond to the language of the server. If you provide the product for an international audience, you might want to ship properties files for each of the locales supported by the server. To do this, create a file whose name will be used as the base name. Then create files with filenames that contain the base name plus a language (and optionally locale) specifier that corresponds to the language of the values in the properties file. This follows the naming convention used by Java properties files.

For example, the following are some of the file names in the `sys:\java\lib\taskbar`:

- `NWMenu.properties` contains values for English text.

- `NWMenu_de.properties` contains values for German text.

- `NWMenu_fr.properties` contains values for French text.

- `NWMenu_ru.properties` contains values for Russian text.

When you specify the properties file, you specify the default properties file such as NWMenu.properties. The actual properties file that is used to retrieve the names depends on the language and locale of the server. For example, if the NWMenu.properties file is specified, the server language is set to use German, and there is a NWMenu_de.properties file, then the NWMenu_de.properties file is searched first for the entry. If the entry is not found in this file, then the NWMenu.properties file is searched. If the entry is not found in either file, then the default name is used.

Configuring X Server Using the NetWare GUI Environment Utility

You use the NetWare GUI Environment utility to configure X Servers on NetWare. This utility lets you select the video board, keyboard, mouse, and monitor from a set of predefined hardware devices supported by the NetWare GUI environment utility.

1 In the NetWare GUI, click *Novell*, select *Settings*, then select *GUI Environment*.

See the NetWare GUI Environment online help for further documentation on using this utility.

Selecting a Background Pattern

1 In the NetWare GUI, click *Novell*, select *Tools*, then select *Backgrounds*.

All files in the sys:\java\nwgfx\pixmaps directory display. The supported graphics formats are xpm, jpeg, gif, and bmp. If you have background patterns (in the supported formats) that you want to use, place them in the sys:\java\nwgfx\pixmaps directory.

2 Select the desired background pattern and click *Test*.

3 Click *OK*.

Using the NetWare GUI without a Mouse

If you start the NetWare GUI without a mouse attached to a PS/2 or USB port, the NetWare GUI will start in mouseless mode.

When the NetWare GUI is operating in mouseless mode, use the keypad keys for mouse movement and button clicks.

IMPORTANT: NUMLOCK must be activated to enable keypad mouse movements.

Table 5-11 Keystrokes for Using the NetWare GUI without a Mouse

Keypad Key	Function
Arrows	Move the mouse pointer.
Shift+arrows	Accelerate pointer movement.
5	Behaves like the default pointer button.
0	Locks the default pointer button down (for easy dragging).
. (decimal)	Unlocks the default pointer button (releases a drag).
+ (plus)	Double-clicks the default pointer button.
Alt+Tab	Switches to the next program.

Keypad Key	Function
Alt+Shift+Tab	Switches to the previous program.

Keystroke Actions for Java Text Areas and Text Fields

The following table shows the keystroke actions for Java text areas and text fields as implemented for NJVM.

Table 5-12 *Keystroke actions*

Action	Text Area	Text Field
Navigate out forward	Ctrl+Tab	Tab
Navigate out backward	Ctrl+Shift+Tab	Shift+Tab
Move up/down one line	Up-arrow, Down-arrow	N/A
Move to previous/next character	Left-arrow, Right-arrow	Left, Right
Move to previous/next word	Ctrl+Left-arrow, Ctrl+Right-arrow	Ctrl+Left, Ctrl+Right
Move to start/end of line	Home, End	Home/End
Move to start/end of text area	Ctrl+Home, Ctrl+End	N/A
Move up/down a page	PgUp, PgDn	N/A
Select all	Ctrl+/	Ctrl+/
Deselect all	Ctrl+\	Ctrl+\
Extend selection up/down	Shift+Up-arrow, Shift+Down-arrow	N/A
Extend selection left/right	Shift+Left-arrow, Shift+Right-arrow	Shift+Left, Shift+Right
Extend selection to start/end of line	Shift+Home, Shift+End	Shift+Home, Shift+End
Extend selection to previous/next word	Ctrl+Shift+Left-arrow, Ctrl+Shift+Right-arrow	Ctrl+Shift+Left, Ctrl+Shift+Right
Extend selection to start/end of text area	Ctrl+Shift+Home, Ctrl+Shift+End	N/A
Extend up a page	Shift+PgUp	N/A
Extend down a page	Shift+PgDn	N/A
Copy selection	Ctrl+C	Ctrl+C
Cut selection	Ctrl+X	Ctrl+X
Paste	Ctrl+V	Ctrl+V
Delete next character	Delete	Delete
Delete previous character	Backspace	Backspace

Action	Text Area	Text Field
Insert tab	Tab	N/A
Toggle Insert/Replace mode	Insert	Insert
Insert line break	Enter	N/A
Submit entry	N/A	Enter

Closing the NetWare GUI

There are three ways to shut down the NetWare GUI:

* In the NetWare GUI, click *Novell*, select *Close GUI*, then click *Yes*.
* Press Ctrl+Alt+Backspace.
* Run `stopx` from the System Console prompt.

5.7.4 Applet and Application Tasks

This section contains the following processes:

Running an Applet

* To run an applet, enter

  ```
  appletviewer html_filename or URL
  ```

* To run an applet sending any console output to a new screen, enter

  ```
  applet -J-ns html_filename or URL
  ```

For example, assume that an applet called MYAPP and its corresponding HTML file are found in `sys:\myapps\`. To run this applet, you would enter

```
appletviewer sys:\myapps\myapp.html
```

Running an Application

* To run an application, enter

  ```
  java application_name
  ```

* To run the application in a new screen, enter

  ```
  java -ns application_name
  ```

NJVM assigns a screen to the application, then executes the application. If the application requires a graphical interface, NJVM loads the NetWare GUI and displays the application.

IMPORTANT: If the application requires console keyboard input, the -ns option must be used.

While the application is running, you can use the Server Console utility to view any output on the console screens. For instructions on using the Server Console utility, see .

All GUI applications appear in the same GUI screen.

Binding an Application to a Specific Processor

To force an application to run on a specific processor, use the -mp flag. The processor number should follow -mp. For example, to assign a JVM specifically to processor 3, enter the following at the System Console prompt:

```
java -mp3 application_name
```

To assign a JVM to processor 0, enter the following at the System Console prompt:

```
java -mp0 application_name
```

NOTE: Using the -mp0 flag is equivalent to disabling multiprocessor support. This flag should be used only with applications that are considered mp-unsafe.

Listing the Current Java Processes

To display a list of currently running processes and their process IDs, enter the following at the system console:

```
java -show
```

Shutting Down a Running Java Process

1 Get a list of the running Java processes. At the System Console prompt, enter

```
java -show
```

2 At the System Console prompt, enter

```
java -shutdownprocess_ID
```

For example:

```
java -shutdown610
```

610 is the ID of the process to be shut down.

3 To shut down all running processes, enter the following at the System Console prompt:

```
java -shutdownall
```

NOTE: When you use -shutdown, Java calls the application's registered shutdown hooks. This provides a more graceful shutdown than the Java -kill command, which closes the application without calling the application's shutdown hooks. It is the application's responsibility to register its shutdown hooks.

5.7.5 Using the File Browser

You can use the file browser to accomplish the following:

Searching for Files

You can search for files by name or search for specific text within a file. You can start from the file search taskbar, the GUI Start menu, or within the file browser.

After you start the file searching application, do the following to search for files:

1 Right-click the folder you want to search for files in.

2 Specify the initial folder to start the file browser from.

3 Select the Search item from the pop-up menu.

4 When the file searching application displays, type the name of the file or the specific text you are searching for.

You can include the * and ? wildcards.

You can also specify additional search criteria.

The file searching text is not case sensitive.

5 Click *Find*.

Setting File Associations

The file browser supports file associations that specify a default action to occur when a file is selected. You can specify which application to use for opening files that use a specific extension.

The File Associations dialog box contains two columns. One column specifies the file extension. The other column contains the command to execute. When you specify the command to execute, the %1 functions as a placeholder for the full path of the file. When the File Browser runs the associated command, it replaces the %1 with the full pathname of the selected file.

1 In the File Browser menu, click *Options > Associations*.

2 In the File Associations dialog box, add, edit, or delete associations.

For example:

Extension	Command	Explanation
nlm	load %1	Loads the NLM program.
ncf	%1	Runs the .ncf file.
txt	editor %1	Opens the .txt file in the GUI editor.
cfg	editor %1	Opens the .cfg file in the GUI editor.

The extension entries are not case sensitive.

3 Click *Apply*.

5.7.6 Viewing and Setting Environment Variables

This section contains the following processes:

- ◆ "Viewing the Current Values of Environment Variables" on page 78
- ◆ "Setting the DISPLAY Environment Variable" on page 78
- ◆ "Using the Remote Display Feature" on page 79
- ◆ "Setting the CWD Environment Variable" on page 80
- ◆ "Setting the CLASSPATH Environment Variable" on page 80

Viewing the Current Values of Environment Variables

1 Start NJVM by entering the following at the System Console prompt:

```
load java
```

2 At the System Console prompt, enter

```
envset
```

When you unload NJVM (`java.nlm`), the process deletes the environment variables that were set using ENVSET.

Setting the DISPLAY Environment Variable

The DISPLAY environment variable exists in two environments: the environment for Java and the C Library environment. Graphical Java applications use the DISPLAY variable from the environment for Java. All other applications, including the NetWare GUI, use the Display variable from the C Library environment.

It is helpful to understand the UNIX X Window System* before setting up the DISPLAY environment variable.

To set the DISPLAY variable in the environment for Java:

1 Start NJVM by entering the following at the System Console prompt:

```
load java
```

2 At the System Console prompt, enter

```
envset DISPLAY=IP_address:display
```

The default value for *display* is 127.0.0.1:0.0, which is the address of the loopback interface and the default value for the display and screen you want to use.

To set the DISPLAY variable in the C Library environment:

1 At the System Console prompt, enter

```
env DISPLAY=IP_address:display
```

When the NJVM loads, the environment for Java inherits the value of the DISPLAY variable in the C Library environment.

The default value for *IP_address:display* is 127.0.0.1:0.0. This is the address of the loopback interface, which displays the output to the local server.

To make the application always open to the NetWare GUI screen, enter the following at the System Console prompt,

```
envset display=IP_address_of_local_X_server:0.0
```

All Java GUI applications now display on the remote client workstation on the NetWare GUI screen. If you do not want the application to always open to the NetWare GUI screen, remove the ".0" from the end of the IP address.

The local System Console screen does not automatically switch to the NetWare GUI screen when a GUI application is opened from a remote server or from foreign IP addresses. You must manually switch to the NetWare GUI on your local server to see the display being exported from the remote server.

Using the Remote Display Feature

The remote display feature lets you display the output of any X client programs to any machine on the network running an X server. Because the NetWare GUI is X-based, all Java GUI applications and applets are considered X clients and are able to use the remote display feature.

This section describes how to use the remote display feature when both the X client and the X server are NetWare servers. This procedure is similar for other platforms; however, you need to refer to the platform-specific documentation for setup instructions.

The two machines used for the remote display feature are called the remote server and the local server The remoter server is the X client machine. The local server is the X server that displays the application that is running on the X client.

Allowing Remote Access to a Server

You must configure your local X server to allow remote access. There are two methods to authorize access of a remote X client to a local X server:

- Method 1:

  Edit the `java\nwfgx\bin\xservrc` file to change the `load Xvesa` command to `load Xvesa -ac`

  This turns off access control and lets any other client access the server. Be cautious with this method. It lets anyone who can connect to your X server run programs on your display.

- Method 2:

  Start X server, then run `xhost +IP_address_of_Xclent` on the local system.

  For example, `xhost +10.0.0.3`

  This lets you add hosts to the list of X client workstations that you allow to access your X server. It also lets you delete workstations from this list.

Displaying a Java Applet or Application on a Local X Server

1 Allow the remote NetWare system to access the local X server.

See

2 Start X server at the local system.

3 At the local system, start RCONJ and log in to the NetWare server.

4 Do the following in the RCONJ window:

    4a Start NJVM by entering the following at the System Console prompt:

```
load java
```

    4b Enter the following:

```
envset display=ip_address_of_local_X_server:0
```

    4c Start the Java applet or application.

5 (Optional) To make the application always open to the NetWare GUI screen, enter the following at the command line of the NetWare server:

```
envset display=ip_address_of_local_X_server:0.0
```

All Java GUI applications now display on the remote client workstation on the NetWare GUI screen. If you do not want the application to always open to the NetWare GUI screen, remove the ".0" from the end of the IP address.

NOTE: The local System Console screen does not automatically switch to the NetWare GUI screen when a GUI application is opened from a remote server or from foreign IP addresses. You must manually switch to the NetWare GUI on your local server to see the display being exported from the remote server.

Setting the CWD Environment Variable

NJVM uses an environment variable to simulate a current working directory. This variable, CWD, lets you run an application in any directory as if it is the current working directory. By default, this variable is set to the root (\) when Java is loaded. In NetWare, Java's root is `sys:\`.

The preferred method of using CWD is to set it for only the current application by using the `-env` option. For example:

```
java -envCWD=sys:\myfiles myapp
```

To set the CWD for all applications:

1 Start NJVM by entering the following at the System Console prompt:

```
load java
```

2 Set the variable by entering:

```
envset CWD=pathname
```

For example:

```
envset CWD=sys:\myjava\myapp
```

Setting the CWD does not change the CWD of applications that are currently running.

Setting the CLASSPATH Environment Variable

A default CLASSPATH variable is set when Java loads. If the CLASSPATH variable is set incorrectly, your Java applications might not run. A lengthy CLASSPATH variable might decrease the performance of your Java applications.

The preferred method of changing the CLASSPATH is to set it for only the current application by using the `-classpath` option.

```
java -classpath=$CLASSPATH;sys:\myclasses myapp
```

To change the CLASSPATH for all applications:

1 Start NJVM by entering the following at the System Console prompt:

```
load java
```

2 Enter the following at the System Console prompt:

```
envset CLASSPATH=$CLASSPATH;path_to_append
```

For example, to append the path `sys:\myclasses` to the current CLASSPATH, enter

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

The $ symbol in $CLASSPATH allows the substitution of the current value of the CLASSPATH environment variable.

NOTE: The default CLASSPATH variable includes (.), which means to look in the current working directory (CWD) for the application. If the CWD variable is not set correctly, the application might not run. For more information, see .

5.7.7 Performance Tuning

The default native (C) stack size for Java threads on NetWare is 160 KB. For applications that create many threads and do not require such a large stack size, the -Xss Java command options can be used to specify the stack size. For an explanation of the Java command options, refer to the JavaSoft documentation for the Java Interpreter.

To specify the amount of virtual memory available to Java applications for non-heap allocations, use the -vm Java command option. The default is 64 MB for NetWare 6 and 100 MB for NetWare 6.5. The -vm Java command option is unique to NetWare and is not supported by JavaSoft. The following is the syntax for this option:

```
java -vmsize MyClass
```

For example,

```
java -vm128m MyClass
```

5.7.8 Java Configuration Files

This section explains the following components:

- `java.cfg` configuration file
- `autoexec.ncf`

Java.cfg Configuration File

The `java.cfg` file is an optional configuration file that can be used to set Environment variables. It is located in the `sys:\etc` directory and is read when `java.nlm` is loaded.

Autoexec.ncf

The following lines are added to the `sys:system\autoexec.ncf` file during the installation. If they are not added, you can add them manually right after the "mount all" command in the file.

```
SEARCH ADD SYS:\JAVA\BIN

SEARCH ADD SYS:\JAVA\NWGFX\BIN

STARTX
```

TIP: The STARTX line is optional and should go at the end of the `autoexec.ncf` file. It causes the NetWare GUI to begin running at server startup. You should delete any other instances of these lines in the `autoexec.ncf` file.

5.7.9 Internationalization

This section explains the following NJVM internationalization issues.

AWT Limitations

Dead keys are not supported in AWT components.

AWT components can display characters only from the current locale.

AWT components cannot display Japanese, Chinese, or Korean characters.

Keyboard entry of Russian characters in AWT components is available only if the current server language is Russian (language 13).

Adding Fonts with Font.properties.allfonts

The `font.properties` file with no extension is the default file for Latin character languages. Files with country-specific extensions are provided for Russian, Japanese, Chinese, and Korean servers. For example, `font.properties.ru` corresponds to the Russian `font.properties` file. No configuration is necessary beyond setting the server language during installation because NJVM automatically selects the appropriate `font.properties` file for the language setting. However, some servers might require systems or other resources located on different language platforms. To enable full character support, back up the `font.properties` file, then rename the provided file `font.properties.allfonts` to `font.properties`.

NOTE: Renaming `font.properties.allfonts` to `font.properties` slows the startup of the first application because of the additional characters that need to load.

5.7.10 JVM Client and Server Versions

NJVM 1.4.2 includes two implementations of the HotSpot virtual machine (VM). This section explains the applications for each version.

Client VM

The Client VM is the default version of the HotSpot runtime compiler. It is specifically tuned to reduce application startup time and memory footprint.

The Client VM is located in `sys:\java\bin\client\jvm.nlm`

Server VM

The Server VM is specifically tuned to maximize peak operating speed. It is intended for long running server applications. The server version requires a larger memory footprint to execute a Java application than that of the client version. You might use this version when operating speed is more important than startup time.

The Server VM is located in `sys:\java\bin\server\jvm.nlm`.

Switching JVM Versions

On NetWare you can run applications with either the Client VM or the Server VM. However, you cannot use both simultaneously. The command-line flags used to specify which VM to load are `-client` and `-server`. You cannot switch VMs while Java applications are running. If you attempt to start an application using one of these flags and the VM version requested is different than what is already being used, then that Java application will fail to load.

To determine which version of the VM is running, enter the following command at the System Console prompt after an application has been started:

```
modules jvm
```

If the `jvm.nlm` program was loaded from `sys:\java\bin\client`, the Client VM is running. If the `jvm.nlm` program was loaded from `sys:\java\bin\server`, the server version is running.

The default version of the JVM is the Client VM. To change the default VM to server, add the following line to the `sys:\etc\java.cfg` file:

```
JAVA_COMPILER=server
```

Running an application with the Server VM might require more heap space than with the Client VM. To increase the heap size, use the `-Xmxheapsizem` flag. For example, you might have a Java application that requires 128 MB of heap to run with the client JVM. Changing to the server might require more heap space, so you could set the heap size flag to -Xmx256m.

5.8 Securing the Server Console

The first principle of securing your server console is physical security. If you don't provide physical security, nothing else you do matters very much.

The processing unit should be locked in a place where no one can remove it or reboot it. Some network administrators remove both the keyboard and the monitor and manage the server remotely by using Novell Remote Manager or RCONSOLEJ. We suggest that you also consider using a power-on password whether you manage at the console or use RCONSOLEJ at a workstation.

Two features that provide additional security at the console are the following:

- The SECURE CONSOLE command. For more information:
  - "Why Should I Use SECURE CONSOLE?" on page 84
  - "Using the SECURE CONSOLE Command" on page 84
- The screen saver console-lock feature. For more information:
  - "Using SCRSAVER to Lock the Server Console" on page 85
  - "Unlocking the Server Console" on page 85

5.8.1 Why Should I Use SECURE CONSOLE?

After you have provided physical security for your server, you can use the SECURE CONSOLE command line utility to provide the following security features, while still allowing you to use the console:

- Prevent NetWare Loadable Module programs from being loaded from any directory other than `sys:system` or `c:\nwserver`. This means that no one can load an invasive NLM program from a server's diskette drive or boot partition unless it is already in a search path.
- Prevent keyboard entry into the operating system debugger. This restricts the ability to alter the operating system.
- Prevent anyone from changing the date and time. Some security and accounting features depend on date and time for their enforcement.
- When you issue the `SECURE CONSOLE` command, the server must be taken down and rebooted to unsecure the console. Now that server parameter settings are persistent in NetWare, you can shut down the server without losing the settings you made to optimize and tune your server.
- When you use SECURE CONSOLE with the Novell Remote Manager or RCONSOLEJ, access is subject to the protections provided by SECURE CONSOLE.
- SECURE CONSOLE does not lock the server console. You can lock the console by using `SCRSAVER` command. If the console is locked using the console-locking feature, an intruder can still access the console from a remote workstation; however, the intruder must still be authenticated to eDirectory through the SCRSAVER console lock.

TIP: To protect the server console by encrypting the RCONSOLEJ password in the `autoexec.ncf` file, see "Loading the RConsoleJ Agent at Startup" in the *NW 6.5 SP8: Remote Server Management Administration Guide*.

5.8.2 Using the SECURE CONSOLE Command

To secure the server console, enter the following command at the System Console prompt:

```
SECURE CONSOLE
```

To secure the server console whenever the server is booted, add the SECURE CONSOLE command to the server's `autoexec.ncf` file. If the `autoexec.ncf` file loads modules from any directory other than `sys:system` or `c:\nwserver`, then in the `.ncf` file the SECURE CONSOLE command must follow the `LOAD` commands for these modules.

IMPORTANT: To disable SECURE CONSOLE, you must first shut down the NetWare server and reboot it. If the `SECURE CONSOLE` command is in the `autoexec.ncf` file, use EDIT or any text editor to remove it before you shut down the server and reboot it.

For more information on using SECURE CONSOLE, see "SECURE CONSOLE" in the *NW 6.5 SP8: Utilities Reference*.

5.8.3 Using SCRSAVER to Lock the Server Console

The console-locking feature in the `scrsaver.nlm` allows you to require a password before gaining access to the server console prompt. If a key is pressed when the console lock is enabled, a dialog box appears. You must then supply an eDirectory username and password. For more information, see "Unlocking the Server Console" on page 85.

When the screen saver is activated, it displays a moving snake for each processor on the server. Each snake is a different color: the first one is red, the second is blue, etc. The speed of each snake and the length of its tail are directly proportional to the processor's utilization.

If the console is unlocked, press any key to activate the console. The snake screen will disappear.

1 To display command options for SCRSAVER, enter the following at the System Console prompt:

```
SCRSAVER HELP
```

Command options allow you to enable and disable locking, check the status of the lock options, and change the length of time the console is allowed to be inactive before the screen saver is activated. The default is 600 seconds (10 minutes).

2 For more information about a command option, enter the following at the System Console prompt:

```
SCRSAVER HELP command_option
```

3 To load the SCRSAVER module, enter the following at the System Console prompt:

```
SCRSAVER [option; option...]
```

When you load the screen saver, the default is to enable the console-locking feature and to require a password for access.

For more information, see "SCRSAVER" in the *NW 6.5 SP8: Utilities Reference*.

5.8.4 Unlocking the Server Console

To unlock the server console after locking it using `scrsaver.nlm`, complete the following:

1 While the screen-saver snake is displayed, press any key on the server console keyboard.

2 (Conditional) At the Login dialog box, press Enter to select the *Username* field.

The login box appears only if the console is locked.

3 Enter an eDirectory username.

The eDirectory user must be either of the following:

- ◆ A trustee of the Server object having the Write right to the access control list (ACL) property of the Server object.

- ◆ A Console operator or a member of a group assigned as console operator with the user or group being a trustee of the Server object with at least the Read right to the [All Attributes Rights] property of the Server object.

4 Press Enter again to select the *Password* field.

5 Type the password for the username and press Enter twice.

The screen-saver snake disappears and the server console screen appears.

5.9 Using NCP Packet Signature

NetWare includes a feature called NCP Packet Signature that protects servers and clients by using the NetWare Core Protocol™ (NCP™) services.

NCP Packet Signature prevents packet forgery by requiring the server and the client to sign each NCP packet. The packet signature changes with every packet.

Without NCP Packet Signature installed, a user could pose as a more privileged user and send a forged NCP request to a NetWare server. By forging the proper NCP request packet, an intruder could gain the Supervisor right to the Server object and access to all network resources.

NCP packets with incorrect signatures are discarded without breaking the client's connection with the server. However, an alert message about the invalid packet is sent to the error log, the affected client, and the server console. The alert message contains the login name and the station address of the affected client.

If NCP Packet Signature is installed on the server and all of its workstations, it is virtually impossible to forge a valid NCP packet.

For additional information about packet signature, see the following:

- ◆ "Why Should I Use Packet Signatures?" on page 86
- ◆ "NCP Packet Signature Options" on page 87
- ◆ "Effective Packet Signature" on page 87
- ◆ "Recommended Signature Levels" on page 88

To implement packet signature, see "Implementing NCP Packet Signature" on page 88.

5.9.1 Why Should I Use Packet Signatures?

We recommend using NCP Packet Signatures for security risks such as the following:

- ◆ You have an untrustworthy user at a workstation on the network
- ◆ Easy physical access to your network cabling system exists
- ◆ You have an unattended, publicly accessible workstation on the network

NCP Packet Signature is not necessary for every server installation. You might choose not to use NCP Packet Signature if you can tolerate security risks in situations such as the following:

- Only executable programs reside on the server
- You know and trust all network users
- Data on the NetWare server is not sensitive and loss or corruption of this data would not affect operations

5.9.2 NCP Packet Signature Options

Because the packet signature process consumes CPU resources and slows performance both for the client and the NetWare server, NCP Packet Signature is optional.

Several signature options are available, ranging from never signing NCP packets to always signing NCP packets. NetWare servers and Novell clients each have four settable signature levels.

The signature options for servers and clients combine to determine the level of NCP Packet Signature on the network.

You can choose the packet signature level that best meets both your system performance needs and network security requirements.

NOTE: Some combinations of server and client packet signature levels can slow performance. However, low-CPU-demand systems might not show any performance degradation.

5.9.3 Effective Packet Signature

The NCP Packet Signature levels for the server and the client interact to create the effective packet signature for the network. Some combinations of server and client levels do not allow logging in.

The following figure shows the interactive relationship between the server packet signature levels and the client signature levels.

Figure 5-1 *Effective Packet Signature for a Server and Client*

If	Server = 0	Server = 1	Server = 2	Server = 3
Client = 0	○	○	○	⊘
Client = 1	○	○	●	●
Client = 2	○	●	●	●
Client = 3	⊘	●	●	●

● Packet signature
○ No packet signature
⊘ No logging in

5.9.4 Recommended Signature Levels

The default NCP Packet Signature level is 1 for clients and 1 for servers. In general, this setting provides the most flexibility while still offering protection from forged packets. Following are some examples of situations requiring different signature levels.

Table 5-13   *NCP Packet Signature Level Recommendations*

Situation	Example	Recommendation
All information on the server is sensitive.	If an intruder gains access to **any** information on the NetWare server, it could damage the company.	Set the server to level 3 and all clients to level 3 for maximum protection.
Sensitive and nonsensitive information reside on the same server.	The NetWare server has a directory for executable programs and a separate directory for corporate finances (such as Accounts Receivable).	Set the server to level 2 and the clients that need access to Accounts Receivable to level 3. All other clients remain at the default, level 1.
Users often change locations and workstations.	You are uncertain which employees will be using which workstations and the NetWare server contains some sensitive data.	Set the server to level 3. Clients remain at the default, level 1.
A workstation is publicly accessible.	An unattended workstation is set up for public access to nonsensitive information, but another server on the network contains sensitive information.	Set the sensitive server to level 3 and the unattended client to level 0.

For information on implementing NCP Packet Signature, see "Implementing NCP Packet Signature" on page 88.

5.9.5 Implementing NCP Packet Signature

To implement NCP Packet Signature, complete the following procedures:

- "Setting Server Signature Levels" on page 88
- "Setting Client Signature Levels" on page 89
- "Changing the Signature Level for an NLM" on page 90
- "Setting Packet Signature for Job Servers" on page 90

Setting Server Signature Levels

- To determine the server's current signature level, enter the following command at the System Console prompt or view the setting using Novell Remote Manager:

  ```
  SET NCP Packet Signature Option
  ```

- To set a server's packet signature level, enter the following command at the System Console prompt or change the setting using Novell Remote Manager:

  ```
  SET NCP Packet Signature Option = number
  ```

Replace *number* with 0, 1, 2, or 3. The default is 1.

For example:

```
SET NCP Packet Signature Option = 2
```

Table 5-14   *Server NCP Packet Signature Options and Explanations*

Number	Explanation
0	The server does not sign packets (regardless of the client level).
1	The server signs packets **only** if the client requests it (client level is 2 or higher).
2	The server signs packets if the client is capable of signing (client level is 1 or higher).
3	The server signs packets and requires all clients to sign packets or logging in will fail.

To ensure that the signature level is set each time the server is brought up, you can add this Set parameter command to your `startup.ncf` file

You can also use the Set parameter command to change the signature level from a lower to a higher level or use Novell Remote Manager.

You cannot change from a higher to a lower level unless you first reboot the server. For example, if the current signature level is 2, you can't set the signature level to 1 by using the Set command at the console.

To change the signature level from 2 to 1, you must add the Set command to the `startup.ncf` file and then restart the server.

Setting Client Signature Levels

Set client signature levels to 0, 1, 2, or 3. The default is 1. Increasing the value increases security, but decreases performance.

Table 5-15   *Client NCP Packet Signature Options and Explanations*

Number	Explanation
0	Disabled. The Client does not sign packets.
1	Enabled, but not preferred. The Client signs packets **only** if the server requests it (server level is 2 or higher).
2	Preferred. The Client signs packets if the server is capable of signing (server level is 1 or higher).
3	Required. The Client signs packets and requires the server to sign packets or logging in will fail.

To set DOS or MS Windows client signature levels, add the following parameter to the workstation's `net.cfg` file:

```
signature level = number
```

To set the Windows 95 or Windows NT client signature level for an individual workstation, change the parameter setting with the Advanced Settings tab of Novell NetWare Client Properties, as follows:

1 In the system tray, right-click *N*.

2 Click *Novell Client Properties > Advanced Settings*.

3 Select *Signature Level* from the scrollable list.

You can set the signature level for multiple clients at once by adding the signature level to the configuration file when you install the clients. For information about configuring Windows clients, see the Novell Client online documentation (http://www.novell.com/documentation/lg/noclienu/index.html).

Changing the Signature Level for an NLM

NLM programs that use the Novell Runtime Libraries are assigned a default NCP Packet Signature level that corresponds to the current signature level of the server.

To change the packet signature level for a single NLM, use the following command syntax when you load the NLM:

```
[LOAD] NLM [CLIB_OPT]/L number
```

Replace *number* with 0, 1, 2, or 3.

Setting Packet Signature for Job Servers

A job server is a server that performs a task and then returns the completed task. Most job servers are third-party products.

You should be aware that some job servers do not support NCP Packet Signature. A job server might produce unsigned sessions if one of the following occurs:

- It does not operate on top of DOS
- It does not use standard Novell clients
- It is not an NLM
- It uses its own implementation of the NCP engine (such as embedded print servers in printers)

Minimizing Risks

To minimize security risks associated with job servers:

- Install queues only on servers with signature level 3.
- Do not allow privileged users to put jobs in queues on servers with signature levels below 3.
- Make sure the job server's account is unprivileged.
- Disable the job server's ability to change to client rights.

Disabling Change to Client Rights

To prevent a job server from assuming the rights of a client, add the following SET command to the server's `startup.ncf` file:

```
SET Allow Change to Client Rights = OFF
```

The default is On, because certain job servers and third-party applications cannot function without changing to client rights. To determine whether the job server can function without client rights, refer to the documentation that comes with the job server.

5.10 Using the Transaction Tracking System

NetWare includes a transaction-monitoring feature called the Transaction Tracking System™ (TTS™). If you flag a file as transactional, TTS can prevent corruption of records in the file by backing out incomplete transactions and keeping a record of backed-out data.

NOTE: A file flagged as transactional cannot be deleted or renamed.

TTS can also back out file truncations or extensions and multiple changes to the same data area during a single transaction. TTS can even back out interrupted backouts if the NetWare server fails in the middle of backing out transactions.

TTS can protect against these types of failures for any type of application that issues record-locking calls and stores information in records, including traditional databases, some electronic mail applications, and some workgroup appointment schedulers.

Files that aren't organized into discrete records (such as word processing files) aren't protected by TTS.

Transactions on a network can be saved improperly in any of the following situations:

- Power to a server or a workstation is interrupted during a transaction
- Server or workstation hardware fails during a transaction (for example, a parity error on a network board)
- A server or workstation hangs (a software failure) during a transaction
- A network transmission component (such as a hub, a repeater, or a cable) fails during a transaction

If the server fails and the file has been flagged transactional, TTS backs out the transaction when the server comes up again. If a workstation or network transmission component fails, TTS backs out the transaction immediately.

5.10.1 How TTS Works

The Transaction Tracking System (TTS) can prevent data corruption by backing out incomplete transactions and keeping a record of backed-out data.

TTS guarantees that all changes to a database file are either wholly completed or not made at all. TTS follows these steps to track transactions:

1. When the application allocates a physical or logical record lock, TTS infers that the application is making a transaction. At this point, if you have flagged the file as transactional, TTS begins tracking the transaction so that the transaction can be backed out if a failure occurs.

2. TTS makes a copy of the original data so the data can be restored if the transaction fails. A copy of the data is placed in a file external to the database. This external file contains all transaction backout information; only the operating system uses it.

3. After the copy of the original data has been written to the backout file, TTS writes the changed data to the database file.

4. TTS repeats Steps 2 and 3 for additional changes (a single transaction can consist of a sequence of changes).

5. When all changed data has been written to disk, and the database application releases physical and logical record locks, TTS infers that the application has completed the transaction. TTS writes a record to the backout file, indicating that the transaction is complete, and stops tracking the transaction.

To learn how to enable and activate TTS, see .

Can I Move the TTS File from one Volume to Another?

The easy answer is no; the TTS file cannot be moved from one volume to the other without redoing your entire volume strategy. The TTS file is an internal system-based file that cannot be moved around. In previous versions of NetWare, volume sys: was always a Traditional volume; therefore, the TTS file was always on volume sys:. Since NetWare 6, a new install defaults volume sys: to be a Novell Storage Services (NSS) volume, so the first Traditional volume that you create after creating volume sys: is where the TTS file is created and kept until that volume is destroyed. Theoretically, it is possible to have the TTS file created on the volume of your choice, but you would need to create and mount that Traditional volume before any other Traditional volume, and this depends on whether volume sys: is an NSS volume.

5.10.2 Enabling and Activating TTS

TTS has three possible states:

- Disabled
- Enabled but inactive
- Active

The disabled and inactive states are similar in that TTS operations have no effect. Only in the active state, do TTS operations have an effect.

Only one file system can have an active TTS. Therefore, if your server is using both the Novell Storage Service (NSS) file system and the Traditional file system, note the following:

- TTS might be enabled on both file systems but it will only be active for one of them.
- By default, the Traditional file system has TTS always enabled.
- NSS determines if the Traditional file system has TTS enabled and if this is the case, it automatically makes TTS inactive on the NSS file system. Therefore, if any Traditional volumes are on your server, TTS on the NSS file system is automatically disabled or inactive.
- If TTS is disabled on the Traditional file system by using the `DISABLE TTS` console command, then TTS automatically becomes active on the NSS file system if it is enabled.

  Because the `DISABLE TTS` command is not persistent, the only way to persistently allow TTS to be active when it is enabled on NSS volumes is to put the `DISABLE TTS` console command in the `autoexec.ncf` file.

- By definition, if you have Traditional and NSS volumes on the same server, then it is impossible for TTS to be available on all volumes.

- If you only have Traditional volumes on your server, then TTS is available on all volumes.

- If you only have NSS volumes on your server, you can enable TTS on all volumes, but it will not, by default, be enabled on all volumes. To do so would result in a 4 MB tax on every volume.

- You can enable TTS manually for any NSS volume by entering the following command at the System Console prompt:

  ```
  NSS /Transaction=Volume_Name
  ```

The NetWare server automatically disables TTS if one of the following happens:

- Volume `sys:` becomes full

  Volume sys: is the TTS backout volume.

- The NetWare server has insufficient memory to operate TTS

If TTS has been disabled and you have solved the problems that led to its disabling, enter one of the following at the System Console prompt to enable it again:

- On a server with Traditional volumes: `ENABLE TTS`

- On NSS volume: `NSS /Transaction=Volume_Name`

To enable and manage transaction tracking for individual files on Traditional volumes, use the commands and parameters in the following table.

Table 5-16 *Tasks and Actions for Enabling and Managing Transaction Tracking for Individual Files*

To	Do the following
Enable transaction tracking for a file on a Traditional volume.	Use Novell Remote Manager to flag the file as transactional. For more information, see "Viewing Individual Files" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*. (Files flagged as transactional cannot be deleted or renamed.)
Enable TTS to back out transactions without displaying confirmation prompts on a Traditional volume.	Place the following command into the `startup.ncf` file and restart the server: `SET AUTO TTS BACKOUT FLAG = ON` If this parameter is set to On (default), the backouts happen automatically. If this parameter is set to Off, you will be prompted to confirm file backouts. You can also set the parameter with Novell Remote Manager > *Set Parameters* > *Traditional File System*.

To	Do the following
Log backed out data to the `sys:tts$log.err` file on a Traditional volume.	Execute the following command at the System Console prompt:
	`SET TTS ABORT DUMP FLAG = ON`
	If this parameter is set to On, the transactions are stored in `sys:tts$log.err`.
	If this parameter is set to Off, the transactions are backed out, but the server does not provide you with a record of the backouts.
	You can also set the parameter with Novell Remote Manager > *Set Parameters* > *Traditional File System*.

5.11 Using an Uninterruptible Power Supply

An uninterruptible power supply (UPS) is a backup power unit that supplies uninterrupted power if a power outage occurs. A UPS is an indispensable part of your network. Not only does it help prevent damage to your computers from power surges and brownouts, but it also prevents data loss during power outages.

Both online and offline UPS systems are available:

* **Online UPS** actively modifies the power as it moves through the unit. If a power outage occurs, the unit is already active and continues to provide power.

  An online UPS is usually more expensive than an offline UPS, but provides a nearly constant source of energy during power outages.
* **Offline UPS** monitors the power line. When power drops, the UPS is activated.

  The drawback to this method is the slight lag before the offline UPS becomes active. However, most offline UPS systems are fast enough to offset this lag.

Because UPS systems can be expensive, most companies attach them only to the most critical devices, such as NetWare servers, routers, and hard disk subsystems.

Attaching a UPS to a server enables the server to properly close files and rewrite the system directory to disk.

Unfortunately, most programs run on the workstation and data stored in RAM is not saved during a power outage unless each station has its own UPS.

If the UPS doesn't have its own form of surge protection, install a surge protector to protect the UPS.

5.12 Tracking Potential Security Risks

Using Novell Remote Manager, you can run a security report that shows general and specific security information about your server, helping you track the following security information:

* Trustee information for the root of each mounted volume
* Trustee information for common folders on volume `sys:`
* Security information for each protocol loaded on the server

For example, for the IP protocol, you will see the IP addresses for the server, the DNS name, and a list of open ports on the server and NLM programs that use those ports.

For NetWare Core Protocol (NCP) information, you will see the protocols bound to the server and the addresses they use as well as connection information for each connection to the server.

- A list of users that have security equivalence to user Admin

- A list of users and a list of several parameters related to security that you might want to track (such as password required, unique password, minimum length, expiration information and grace login limit and remaining settings)

For more information about the report and how to run it, see "Security Report" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

5.13 Preventing Virus Infection

Keep viruses off the network by educating users about virus dangers and by enforcing procedures that reduce virus risks, such as the following:

- Back up data frequently.

- Maintain layers of archived backups so you can retrieve a backup from a preinfected file.

- Keep a write-protected, bootable diskette with the latest virus scan and removal software for all servers and workstations.

- Keep a backup of executable files and flag them Execute Only.

- Educate yourself about the infection techniques of the latest viruses.

- Educate network users about how to detect viruses.

- Warn users of the dangers of viruses. Discourage them from using diskettes and files that have been in computers away from work.

- Teach users to power down their workstations immediately upon encountering a virus.

- Restrict access to a server's diskette drives by locking the server in a secure room. Put tape over the drive openings to remind you not to use them unnecessarily.

- Avoid using the Admin account when possible. The fewer privileges your login account has, the less power a virus has to destroy data and to spread.

5.14 Monitoring the NetWare Server

Monitoring the server allows you to do the following:

- Isolate performance bottlenecks

- Optimize server performance

- Troubleshoot and resolve server problems

This section discusses several key tools included with NetWare that you can use to monitor the NetWare server.

- Section 5.14.1, "Novell Remote Manager," on page 96

- Section 5.14.2, "Health Command," on page 96

- Section 5.14.3, "Monitor," on page 96

5.14.1 Novell Remote Manager

Novell Remote Manager is a tool for debugging and monitoring the server from a Web browser at your workstation. You can also access a Java version of this tool from the server GUI. For more information, see "Accessing Novell Remote Manager for NetWare", "Diagnosing Server Problems", and "Troubleshooting Specific Problems" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

5.14.2 Health Command

The `Health` command can be used at the server console to view the overall health of the server. If the overall health status for the server is something other than Good, you might want to use the All option with the `Health` command to view the health status of the specific component that might be causing the abnormal health status.

To use this command, the `portal.nlm` must be loaded on the server.

For more information, see "Health" in the *NW 6.5 SP8: Utilities Reference*.

5.14.3 Monitor

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

This section includes the following information:

- "Accessing Monitor" on page 96
- "What to Monitor and Why" on page 97
  - "Monitor's General Information" on page 97
  - "Monitoring Allocated Services" on page 99
  - "Other Information and Statistics to Monitor" on page 100

Accessing Monitor

- To load Monitor at the System 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.
  - Press Ctrl+Esc. To display a numbered list of available console screens, then enter the number for the NetWare 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 System Console prompt.

To immediately bring up the Exit confirmation box, press Alt+F10, then press Enter to return to the System Console prompt.

What to Monitor and Why

A monitoring utility can be overwhelming in the volume of information and statistics it provides.

To simplify your access to key parameters, Monitor's General Information screen includes most of them on one screen, including performance indicators that pertain to disk I/O and memory utilization.

For an explanation of the interaction of three types of configurable parameters that control dynamically allocated services, see "Monitoring Allocated Services" on page 99. The guidelines allow you to be proactive in maintaining the level of service your users require.

"Other Information and Statistics to Monitor" on page 100 includes error logs, available free disk space, and user 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 that 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 General Information screen in Monitor. The following screen is displayed when you load Monitor.

Figure 5-2   *General Information Screen in Monitor*

```
NetWare Console Monitor                          NetWare Loadable Module
Server name: 'SERVER1' in Directory tree 'EXAMPLE'
Product: Novell Open Enterprise Server, NetWare 6.5

                         General Information

             Utilization:                           2%
             Server up time:                  2:02:40:56
             Online processors:                       8
             Original cache buffers:            965,792
             Total cache buffers:               220,362
             Dirty cache buffers:                     0
             Long term cache hits:                  86%
             Current disk requests:                   0
             Packet receive buffers:              2,000
             Directory cache buffers:                 4
             Maximum service processes:             750
             Current service processes:               8
             Current MP service processes:          101
             Current connections:                     1
             Open files:                            123

                      Disk cache utilization

Tab=Next window    Alt+F10=Exit                              F1=Help
```

The following information describes the onscreen performance indicators.

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

  Use this information to 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.** 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.** 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.** The amount of 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.

- ◆ **Dirty Cache Buffers.** The amount of 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 Traditional file system.

- **Long Term Cache Hits.** The cumulative percentage of requests for disk blocks that were already in cache for the Traditional file system. (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 you are using the Traditional file system. If this value falls below 90%, the disk thrashes and server performance degrades. The solution is to install more physical memory (RAM).

- **Current Disk Requests.** The amount of 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.** The amount of memory that is 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.** The amount of 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 number of service processes to ensure that it does not reach this value.

- **Current Service Processes.** The amount of task handlers that 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 (Communications category) parameter must be increased.

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

- **Open Files.** 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 eDirectory.

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.

- **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 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) after 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 the following:

- "Checking Server Error Logs" on page 107
- "Checking Disk Drives" on page 108
- "Reviewing Server Cache Statistics" on page 108
- "Checking Free Space on Server Disks and Volumes" on page 108
- "Reviewing User Accounts" on page 108
- "Testing the Uninterruptible Power Supply" on page 109

5.15 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. By default, whenever an alert is received, a bell also sounds.

To turn the bell sound off, set the following server parameter in the Miscellaneous category:

```
Sound Bell for Alerts = OFF
```

Available alert parameters are described in the following table.

Table 5-17 *Available Alert Parameter Descriptions*

Condition That Generates Alert	Relevant Parameters
Spurious interrupts are detected	Display Spurious Interrupt Alerts
	Spurious Interrupt Alert Threshold
	(See SET > "Miscellaneous Parameters" in the *NW 6.5 SP8: Utilities Reference*.)

Condition That Generates Alert	Relevant Parameters
Lost interrupts are detected	Display Lost Interrupt Alerts
	Lost Interrupt Alert Threshold
	(See SET > "Miscellaneous Parameters" in the *NW 6.5 SP8: Utilities Reference*.)
NLM programs fail to relinquish control of processor	Display Relinquish Control Alerts
	CPU Hog Timeout Amount
	(See SET > "Miscellaneous Parameters" in *NW 6.5 SP8: Utilities Reference*.)
Incomplete IPX packets are received	Display Incomplete IPX Packet Alerts
	(See SET, "Display Incomplete IPX Packet Alerts value" in the *NW 6.5 SP8: Utilities Reference*.)
Available file cache buffers are nearing minimum	Minimum File Cache Report Threshold
	(See SET > "File Caching Parameters for the Traditional File System" in the *NW 6.5 SP8: Utilities Reference*.)
A volume is becoming full	Volume Low Warn All Users
	Volume Low Warning Threshold
	Volume Low Warning Reset Threshold
	(See SET > "File Caching Parameters for the Traditional File System" in the *NW 6.5 SP8: 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. See "ALERT" in the *NW 6.5 SP8: Utilities Reference*.

5.16 Managing Workstation Connections

This section explains how to use utilities and commands for disabling logins, clearing connections, controlling resource allocation, sending messages, and working with watchdog packets. See the following:

- Section 5.16.1, "Performing Connection Management Tasks," on page 102
- Section 5.16.2, "Monitoring Workstation Connections to the Server," on page 102
- Section 5.16.3, "Sending Console Messages to Workstations," on page 103
- Section 5.16.4, "Clearing a Workstation Connection," on page 104
- Section 5.16.5, "Disabling and Enabling Logins," on page 105
- Section 5.16.6, "Clearing a Connection That Uses Auto Reconnect," on page 105
- Section 5.16.7, "Controlling Resource Allocation with Locks," on page 106

5.16.1 Performing Connection Management Tasks

The tasks for which you can use Novell Remote Manager or Monitor include the following:

- Viewing a list of active workstation connections on the server
- Determining which users are logged in
- Viewing information about a connection
- Configuring a watchdog to monitor connections for activity
- Viewing a list of files that the connection has open
- Terminating one or more workstation connections

    You can also use CLEAR STATION *n* or CLEAR STATION ALL at the System Console prompt. For more information about these commands, see "CLEAR STATION" in the *NW 6.5 SP8: Utilities Reference*.

- Sending a message to one or more workstations

5.16.2 Monitoring Workstation Connections to the Server

The most effective tool for monitoring workstation connections to the server is Novell Remote Manager. For information about monitoring workstation connections to the server using Novell Remote Manager, see "Managing Connections to the Server" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

To monitor connections to the server from utilities at the server console, see the procedures in the following table.

Table 5-18   *Task and Actions for Monitoring Connections to the Server*

To	Do the following
View a list of active server connections. Determine which users are logged in.	1. In Monitor, from the *Available Options* menu, select *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 eDirectory but are not logged in.

To	Do the following

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
  ◆ Supervisory rights
	1. In Monitor, from the *Available Options* menu, select *Connections* to display the list of Active Connections.
	
	2. Select 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.

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. In Monitor, from the *Available Options* menu, select *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.
Terminate one or more connections. Use this procedure to clear the connection when a workstation has crashed and left open files on the server. **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.	See "Clearing a Workstation Connection" on page 104.
Send a message to one or more workstations. Use this procedure when you need to warn users to log out before you down the server.	See "Sending Console Messages to Workstations" on page 103.

5.16.3 Sending Console Messages to Workstations

To send a message from the server console to all workstations or to a single user using Novell Remote Manager, see "Sending Messages to Users" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

To send a message from the server console to all workstations or to a single user using Monitor, complete the following:

1 From the *Available Options* menu, select *Connections*.

2 Press F8 to display more options on the taskbar.

3 In the list of Active Connections, select the connection for the user you want to send a message to. (Use F5 to mark additional recipients.)

In the *Active Connections* list, items *without* an asterisk (*) represent logged-in users.

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 the *NW 6.5 SP8: Utilities Reference*. For information about receiving and clearing messages at the workstation, see the documentation for your NetWare client.

5.16.4 Clearing a Workstation Connection

To clear a client connection when the workstation has crashed and left open files on the server, use one of following procedures:

- "Clearing Specific Connections" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*
- "Clearing a Connection Using Monitor" on page 104
- "Clearing a Connection Using CLEAR STATION" on page 104.

IMPORTANT: 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.

Clearing a Connection Using Monitor

1 In Monitor, from the *Available Options* menu, select *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.

- To clear one connection, select the connection and press Delete. At the *Clear Connection?* prompt, select *Yes*.
- To delete multiple connections, select 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.

For more information, see "MONITOR" in the *NW 6.5 SP8: Utilities Reference*.

Clearing a Connection Using CLEAR STATION

If you know the connection number, you can terminate a specific connection by entering the following at the System Console prompt:

```
CLEAR STATION n
```

Replace *n* with the connection number of the workstation.

To clear all connections, enter the following at the System Console prompt:

```
CLEAR STATION ALL
```

IMPORTANT: The `CLEAR STATION ALL` command clears all not-logged-in connections including connections by NLM programs. You should be careful in clearing NLM-based connections because some backup NLM programs establish a connection during the server initialization process and maintain a not-logged-in connection to the server until it is time to log in and run the process. These type of NLM-based connections will not be able to re-establish a connection to the server unless the NLM is unloaded and reloaded at the server.

For more information, see "CLEAR STATION" in the *NW 6.5 SP8: Utilities Reference*.

5.16.5 Disabling and Enabling Logins

If you need to make repairs to the server, you can prevent users from logging in by entering the following command at the System 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 System 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.

For more information, see "DISABLE LOGIN" and "ENABLE LOGIN" in the *NW 6.5 SP8: Utilities Reference*.

5.16.6 Clearing a Connection That Uses Auto Reconnect

Novell Client™ has automatic reconnection capabilities that make a complete restoration of the user environment after a network failure possible. 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.

Novell Client also supports file caching on the client side, which allows files to be cached as they are read from and written to the server. With the default settings for the Auto Reconnect Level and the File Cache Level parameters, Novell Client 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 use a combination of the console commands to prevent clients from reconnecting long enough to complete your work on the server.

1. To warn users, see "Sending Console Messages to Workstations" on page 103.

2. To prevent auto-reconnect users from reattaching to the server while you are working on it, enter DISABLE LOGIN at the System Console prompt before you clear the connections. See "Disabling and Enabling Logins" on page 105.

3. Then use CLEAR STATION to terminate the connection as discussed in "Clearing a Connection Using CLEAR STATION" on page 104. 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.)

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

TIP: 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.

5.16.7 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 the following Set parameters (Traditional File System category) to limit the number of locks for the server and for each connection.

- Maximum Record Locks Per Connection = *value*
- Maximum File Locks Per Connection = *value*
- Maximum Record Locks = *value*
- Maximum File Locks = *value*

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.

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

- Maximum File Locks
- Maximum Record Locks

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

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

Increasing File Record Locks

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 Increase the values of the following (Traditional File System category) 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.

2 Increase the values of the following (Traditional File System category) 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.

5.17 Performing Common Maintenance Tasks

This section includes information about the following tasks:

5.17.1 Backing Up Server Data

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

For information about the backup software included with NetWare, see the *NW 6.5 SP8: Storage Management Services Administration Guide*.

5.17.2 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 (command line) or Editor (GUI) at the server console or with a text editor from a workstation.

When needed, NetWare creates the following error logs 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.

5.17.3 Checking Disk Drives

Once a week check the Storage Devices statistics to make sure that the operating status of each disk is active. You can do this in Monitor or in Novell Remote Manager by clicking the *View Statistics* link under the *Manage Server* heading in the navigation frame and then selecting the applicable drives you want to view.

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.

5.17.4 Reviewing Server Cache Statistics

For more information about monitoring and optimizing server memory, see "Optimizing Server Memory" in the *NW 6.5 SP8: Server Memory Administration Guide*.

For server's using Novell Storage Management, see "Setting the Cache Balance" in the *NW 6.5 SP8: NSS File System Administration Guide*.

For servers using the traditional file system:

1 Review the traditional file server cache statistics weekly.

   These statistics are found on the *File System Cache Statistics* page in Novell Remote Manager.

2 See the recommendations in the online help on this page for monitoring memory usage.

5.17.5 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 volume `sys:` and at least 10% free space on other volumes. If volume `sys:` 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 REBUILD on NSS logical volumes and VREPAIR on Traditional volumes. See "VREPAIR" or "REBUILD" in the *NW 6.5 SP8: Utilities Reference*.

5.17.6 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.

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

5.17.7 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 in to the network.

1 Bring 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.

5.17.8 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 also need much of this information if you ever need to call Novell Support. You might want to keep documentation in a notebook or online in a database.

IMPORTANT: Whether you store your network documentation in a notebook 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.

Your network documentation should include 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 3.1*x* clients) or the registry (for Windows 95/98 and Windows NT/2000).

  Any standard directory structures.

- Configuration information for server

  In Novell Remote Manager, click *Run Config Report* link under the Diagnose Server heading in the navigation frame. Click the *View Report* button. Then print and save the report. This report contains the following:

  - Contents of all `.ncf`, `.bat`, `.cfg`, `.bat`, `abend.logs`
  - A file list of the `c:` directory
  - A file list of the `sys:system` directory
  - A list of all Set parameters and current settings
  - A list of all the modules currently running on the server
  - A list of LAN driver configurations
  - Storage device configuration information
  - Volume statistics for volume `sys:` and `_admin`

You should also gather the following information:

- ◆ Services provided by each server, such as file and print, databases, etc.
- ◆ General directory structure of each volume.

◆ Configuration information for printers

Map of printer locations, the version of NLM programs, and the dates and versions of print drivers.

◆ eDirectory tree structure

Print out the eDirectory structure from ConsoleOne or iMonitor. 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 and special menus.

◆ Software and hardware repairs and service calls

Repair records and receipts, service calls log, and 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.

Any updates to the network or its components.

5.18 Performing Preventive Maintenance Tasks

To avoid common server problems, review the following:

- ◆ "Preventing Memory Problems" on page 110
- ◆ "Preventing Power Supply Errors" on page 111
- ◆ "Preventing Static Electricity Problems" on page 111
- ◆ "Monitoring the NetWare Server" on page 95
- ◆ "Matching Performance Capabilities" on page 37
- ◆ "Documenting the Network" on page 109
- ◆ "Preventing Cabling Problems" in the *NW 6.5 SP8: Novell Server Communications Administration Guide*

5.18.1 Preventing Memory Problems

- ◆ Make sure you have adequate memory installed on the system.

- 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 .

5.18.2 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 might 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 power goes out. Then you can bring down the NetWare server in an orderly manner 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.

5.18.3 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.

We recommend that 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 might 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 pinholes 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.

Troubleshooting the NetWare Server

6

This section contains the following information for troubleshooting your NetWare® server:

6.1 Using a Troubleshooting Methodology

Novell® Support recommends 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 those that any Novell Support representative would ask you to perform if you called Support. By following these steps on your own, you might be able to resolve problems without assistance. Then, if you still need to call Support, you already have the information prepared for the representatives to solve your technical problems more quickly.

You can find additional tips in TID 2938836, "Before Calling Support for OS Issues" at the Novell Support Web site (http://support.novell.com/docs/Tids/InfoDocument/2938836.html).

6.1.1 Keeping Your Servers Patched

Many problems that might occur on your server 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.

Novell provides regular Support Packs that contain patches for the complete operating system and associated products.

To locate the latest patches for your network and for server.nlm and for other NLM™ programs, see the Patches & Security page on the Novell Support Web site (http://support.novell.com/patches.html).

Copy updated NLM programs to the server's startup directory where they will overwrite the previous versions.

In addition, be sure you use up-to-date drivers for the version of NetWare that you are using. Use drivers that ship with the product; drivers that are tested, certified, and made available on the Patches & Security page on the Novell Support Web site (http://support.novell.com/patches.html); or certified drivers released by hardware vendors. Check product certification bulletins on the DeveloperNet® Web site at YES CERTIFIED Bulletin Search (http://developer.novell.com/yessearch/Search.jsp).

ODI™ 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 uses 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) that wrote the driver.

To verify the compatibility of the ODI modules with the LAN drivers on your server, download and run `drvspc.exe`. To get the driver, see TID: 2911341: ODI Driver Specification Utility (http://support.novell.com/docs/Readmes/InfoDocument/2911341.html).

NetWare 6 or later drivers for storage devices and host bus adapters are written to the NWPA (NetWare Peripheral Architecture™) specification.

6.1.2 Eliminating Obvious Causes

Be sure to eliminate any obvious causes for network problems, such as making sure that everything is plugged in and that the power is on. Consider the following:

- Check the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1) for known problems with software and hardware.
- Inventory the hardware and cabling systems to make sure that everything is plugged in, connected, and terminated properly.
- Check for user errors.
- Make sure that all hardware is Novell certified. Check the Novell DeveloperNet Web site (http://developer.novell.com/devnet/yes/) for a list of hardware and software products certified to run with NetWare.
- Make sure that there are no rights problems. Insufficient rights prevent you or your users from accessing volumes, directories, and files and from performing file operations.

6.1.3 Gathering Information

Start gathering information about the context of the problem. Ask 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? 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, did you install new software?

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

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

- What do configuration and log files reveal? If you need to call Novell 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.

  To get this information, you can run, view, and send a configuration report on your server using Novell Remote Manager. For procedures, see "Configuration Report" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

- If you suspect problems with Novell eDirectory™, 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 eDirectory on pertinent servers

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

6.1.4 Simplifying 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` or `startup.ncf` file. You can comment out the commands in the `.ncf` files, or you can execute `SERVER` command with the `-na` or `-ns` option. (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 the *NW 6.5 SP8: Utilities Reference*.

- Unload all NLM programs. Remove all nonessential products, including virus scanners and server metering modules, until the server software is in a basic or default configuration.
- Remove or disconnect peripheral devices.
- Remove extra network boards or LAN adapters.

When you have simplified the server as much as possible, note whether the problem happens again. To determine whether the operating system is the source of the problem, restore each component of the system, one at a time, checking to see whether the addition of the component generates the problem.

6.1.5 Using Troubleshooting Resources

Novell and other vendors provide research tools you can use to resolve problems.

For example:

Table 6-1 *Troubleshooting Resources*

Resource	What It Provides
The Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1).	This site contains Technical Information Documents (TIDs), solutions, 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.
Novell Support Discussion Forums (http://support.novell.com/forums).	Here 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.
The Novell YES Certified Program (http://developer.novell.com/devnet/yes/).	This site contains information about third-party products certified to run with NetWare. You can use a search facility that is form-based to locate tested and approved bulletins by category.
Novell user groups, located in most cities and countries. Novell Users International (NUI) offers NetWare support forums on the World Wide Web (http://www.nuinet.com).	Novell Users International is the association for Novell professionals where you can get IT information from professionals who have mastered Novell and Novell partner products.
Vendor Web sites	These sites provide information and updated software to download.
NetWare utilities, such as Novell Remote Manager or Monitor.	Novell Remote Manager can be used from a workstation through a Web browser. From this utility, you can track down high users of server memory, server CPU, server processes, server disk space, etc. For more information about using this utility, see the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.
	The Monitor utility can provide important clues to the source of server or network performance problems. For more information about using this utility, see "MONITOR" in the *NW 6.5 SP8: Utilities Reference*.

6.1.6 Developing Hypotheses and Performing Tests

After you have gathered information, eliminated obvious causes, or simplified your system, you can 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, etc. Base your hypotheses on the data you have gathered and on your own experience with the system.

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

- Decide which hypothesis seems the most likely and test this one first.

  Test the least likely hypothesis 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 down hypotheses 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, boards, or connectors might be the source of the problem and then test each one individually. Test only one component at a time.

- Try replacing components.

  If you suspect a faulty component is causing the problem, replace it with a component that you know is good. Make sure that you replace only one component at a time.

- Simplify the system.

  If you have not already done so, try 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.

6.1.7 Looking for Additional Help

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

Using Novell Authorized Reseller Representatives

Find Service Partners by locality or area. For a list of resellers and distributors worldwide, check the Novell Support Web site > Partner Services (http://support.novell.com/partner_services.html).

Using Novell Support Tools

Novell has additional support tools available. For a list of these tools, see the Novell Support Web site > Support tools (http://support.novell.com/tools).

Determining Support Options

Novell offers many support options. For a list of these option, see the Novell Support Web site > Support Programs (http://support.novell.com/support_options.html?sourceid=suplnav_supportprog).

6.1.8 Documenting the Solution

After 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, workarounds, etc.

6.2 Obtaining an abend.log

An `abend.log` is a text file maintained by the server. When an abend occurs, information is logged that documents the abend that occurred as well as other information that describes the state of the server at the time of the crash, such as processes that were running and NLM programs that were loaded.

Viewing the `abend.log` file might prove helpful, but it is only a basic summary. Serious debugging probably requires a core dump.

6.3 Creating a Core Dump

Novell will probably 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 data file containing 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.

1 Start a core dump in one of these two ways:

   ◆ Select the core dump option when an abend occurs.

   > **NOTE:** After the core dump is completed, the server abend handler restarts or reboots itself, depending on the Auto Restart After Abend parameter setting.

   ◆ Manually start a core dump by entering `.c` while in the NetWare internal debugger.

   You can enter the debugger at any time by typing 386debug or pressing the following keys: Alt+right-Shift+left-Shift+Esc.

   > **TIP:** Press and hold the Alt and right-Shift keys with the right hand, then with the left hand press and hold the left-Shift and press the Esc key last.

   Then enter `.c` at the # prompt and respond to the .

2 When the core dump is finished, do one of the following if you manually started the core dump:

   ◆ Enter `g` to resume the server's execution if possible.

   ◆ Enter `h` to display Help.

   ◆ Enter `q` to exit the debugger.

   If the server was hung when you entered the debugger, it probably will not resume the server's operation.

   If the server abended, it is best not to resume the server's operations.

6.3.1 Core Dump Prompt Options

Whether you selected the core dump option after an abend or are forcing a core dump, you have the following options when responding to the core dump prompts.

Table 6-2   *Core Dump Prompt Options*

Prompt	Option
Reboot server after coredump?	**Y** : Reboots server after the core dump
	N : Leaves the server in the same state after core dump
Lists available local drives and available free space on each	Informs you of local partitions available for the core dump, including USB devices, for the dump.
Coredump Type	**Full** includes all the server memory in the core dump. For some cases, this is the recommended option.
	Full w/o cache includes all server memory except file cache (disk cache). Generally, this is the recommended option. Novell technical support will advise you when to make a full core dump.
Compress Coredump	**Yes** is the recommended option
	No
Where should diagnostic core dump be saved?	**HDISK** writes the file to a local partition. For details, see "Saving a Dump to a Local Partition (HDISK Option)" on page 119.
	NETWORK writes the file to the image host (server or workstation) at the IP address specified.
	This greatly decreases the time that the server must remain in a downed state for diagnostics.
	For details, see "Saving a Dump to a Remote Image Host Device (NETWORK option)" on page 120.

Saving a Dump to a Local Partition (HDISK Option)

After you start the core dump, you are asked to specify the drive letter and file path that the memory image file will be written to.

The drive can be any writable local device that contains enough storage space. This could be the C: drive or another FAT partition (on a USB storage device, for example).

IMPORTANT: If the device is a USB device, you must format it and plug it in to the server so that it has a drive letter assigned to it before the core dump is initiated.

You can plug in a preformatted USB storage device when the server is halted in the debugger (# prompt). The device is recognized and mounted automatically as a FAT partition. Then, when you initiate the core dump with the `.c` option, the USB storage device shows up as one of the local drives with the associated drive letter.

You can also create a logical core dump drive using Novell Remote Manager and write the core dumps to this drive just as you would to the local C: drive or other local FAT partitions. For more information, see "Creating a Logical Volume for Saving Core Dumps" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

When the image is written to a local hard disk on the server, the default name of the image file is `c\:coredump.img`.

To write to a different device, substitute the drive letter and filename. For example, `d:\coredump.img`

After the server is up and running, the image file can be:

- Compressed, backed up to tape, or sent to Novell (if you have opened a support incident).
- Copied to a network drive later.

    You can do this by using Novell Remote Manager (recommended), by using the TBX commands, or by using any other third-party NLM that provides this functionality.

Saving a Dump to a Remote Image Host Device (NETWORK option)

1 Start an image host agent by doing the following:

On a NetWare server, load `imghost.nlm`

or

From a Windows workstation, run `sys:public\imghost.exe`.

When loading the `imghost.nlm` or running the `imghost.exe`, you can specify a directory where you want the image to be sent (the directory must already be created) or accept the default paths.

For example: `load imghost sys:coredump`

The default path for `imghost.nlm` is volume sys:.

The default path for `imghost.exe` is the directory that you run the `.exe` from.

2 At the "`Where should the diagnostics coredump be sent?`" prompt, select the *Network* option.

3 At the "`IP Address of IMGHOST`" prompt, enter the IP address of the server or workstation where you started the image host agent.

The image host agent receives the core dump from server and stores it in a directory based on the server name and the file name based on the date (year, month, day, version) of the core dump with an `.img` extension.

For example, if a file was sent from a server named DASERVER1 on September 17, 2007 to a server running `imghost.nlm`, the `DASERVER1\070917aa.img` directory and file would be created on volume sys:.

6.3.2 Sending the Core Dump to Novell

IMPORTANT: You will be expected to patch the server to the latest Support Pack before Novell requests a core dump. To send a core dump file to Novell, you must first open a support incident, which will be billable. You are not charged until the incident is resolved or closed. If the problem is a Novell bug and no patches were previously available, then there is no charge.

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

6.3.3 Modifying the Defaults of DBNET

The `dbnet6.nlm` controls the network settings for the sending a core dump to the network. The `dbnet6.nlm` is loaded by default on the server and it automatically configure itself by scanning for any network boards bound to TCP/IP. It chooses a board that is on the same network as the default router specified by `tcpip.nlm`. If no default router is present, DBNET chooses the first IP network board found.

The `dbnet6.nlm` can also be used to display statistics that might assist you in debugging problems with your server. For information on the command available from the System Console, see "Using DBNET Console Commands" on page 121.

After `dbnet6.nlm` is loaded, you can manually save its settings to a configuration file (`dbnet.cfg`) in the server's boot directory (typically `c:\nwserver`). This procedures is optional. For procedures, see "Manually Setting the DBNET Configuration (Optional)" on page 122.

Using DBNET Console Commands

The following is a table of console commands that are available when `dbnet6.nlm` is loaded:

Table 6-3 *Console Commands for dbnet6.nlm*

Command	Purpose
dbhelp	Displays DBNET console commands
dbconfig	Displays DBNET configuration
	syntax: [save | config | reset]
	The Save option saves DBNET's settings to the `dbnet.cfg` file on the NetWare DOS partition. After the `dbnet.cfg` file exists, DBNET uses the settings in it and no longer detects new settings.
	The Config option creates a new configuration file using one of the available IP network boards.
	The Reset option deletes the `dbnet.cfg` file and restarts the debug network.

Command	Purpose
dbstat	Displays debug network statistics. This command also work at the debug console.
	syntax: mem | mlid | lsl | arp | ip | udp [conn] | tcp [conn]
	mem: Displays memory statistics
	mlid: Displays MLID statistics
	lss: Displays LSL statistics
	apr: Displays APR statistics
	ip: Displays IP statistics
	udp: Displays UDP statistics
	tcp: Displays TCP statistics
	conn: The Conn option displays the connection statistics for the protocol specified.

6.3.4 Manually Setting the DBNET Configuration (Optional)

IMPORTANT: Setting the DBNET configuration is completely optional and is not recommended unless it is necessary. It is only necessary when you want to use a different adapter than the one automatically chosen or change any of the default settings.

The dbnet6.nlm automatically configures the network configuration. However, you can use the information in this section to create a dbnet.cfg file manually and store it in the server's boot directory.

Creating the Dbnet.cfg File

The following show a list of sections and keywords that are accepted in the dbnet.cfg file. The sections and keywords are case sensitive:

Table 6-4   *Dbnet.cfg File Sections and Keywords Options and Purposes*

Section	Keywords:	Purpose
dbmild	mlid	Debug network module with command line options
dbip	addr	Specify the IP address of debug board
	mask	Specify the IP network board mask
	defr	Specify the default IP router

Section	Keywords:	Purpose
dblst **NOTE:** The dblsl section is not required for most network drivers. By default, DBNET will try to determine the packet size required by the network board. For an Ethernet board, DBNET chooses an initial buffer size of 2048 (a maximum size required by some Ethernet drivers); otherwise, the operating system LSL buffer size is used.	min buffers	Specify the minimum LSL buffers to allocate Default: 128 Range: 128 to 256
	max buffers	Specify the maximum LSL buffers to allocate Default: 256 Range: 128 to 256
	buffer size	Specify the LSL buffer packet size in bytes Default: operating system LSL buffer size Range: 632 to 4280

The following is a sample `dbnet.cfg` configuration file:

```
[dbmlid]mlid=3C59X FRAME=Ethernet_II
SLOT=10005[dbip]addr=192.65.79.47mask=255.255.252.0defr=192.65.79.254
```

6.4 Troubleshooting Hardware and Network Problems

The following sections provide troubleshooting information for resolving errors related to hardware but not to NetWare errors.

6.4.1 Identifying Problems after Installation

If the problem occurred after installation, it might indicate that the network was installed incorrectly.

- Check all network boards for conflicting address and I/O settings.

  Each component should be able to work as a standalone system.
- Make sure that all cables are fastened securely to all network boards and network connectors, and that terminating resistors are installed correctly.

6.4.2 Resolving Hard Disk Access Problems

To diagnose hard disk access problems, determine whether any of the following conditions exist:

- The disk driver has not been loaded.
- A hard disk is not installed or cabled correctly.
- The communication channel between the controller interface board, the disk coprocessor board, and the hard disk is not functioning.
- The hard disk controller board is not terminated or addressed correctly.

To resolve hard disk access problems, perform the following actions:

- Make sure that the disk driver is loaded. In Novell Remote Manager, click the *Disk / LAN Adapters* link under the *Manager Hardware* link in the navigation frame, then click the *Info* icon for each network board in your server.
- Check the cables between the hard disks and the controller boards. Make sure that Pin 1 of each cable is attached to Pin 1 of each connector.
- Check the power cables and make sure that they are seated correctly in the power sockets on the hard disks.
- Check the disk partition and volume information on the hard disk using ConsoleOne® or Novell Remote Manager.

6.4.3 Making Computer Memory Available for Network Drivers

To increase the amount of workstation memory available for network drivers, do any or all of the following:

- Add more memory.
- Unload unneeded terminate-and-stay-resident (TSR) programs (DOS clients only).
- Modify the `net.cfg` file to load only necessary drivers.
- Modify the `config.sys` file to load only necessary drivers.

6.5 Troubleshooting the NetWare Server

This section provides troubleshooting suggestions for typical NetWare server problems such as the following:

- Abends
- Insufficient Packet Receive Buffer, No ECB Available Count Errors
- Slow Response
- Console Hangs
- High Utilization Statistics
- General Server Disk I/O Errors
- Disk Space Problems
- Memory Problems
- Locked Device Errors

- Event Control Block Allocation Errors
- Console Command Problems
- Keyboard Locking Problems when Copying Files from CD

6.5.1 Resolving Abends

The NetWare operating system is very resilient, but errors can occur. 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 the NetWare fault handler. NetWare uses abends to ensure the integrity of operating system data.

When a server abends, users might not be able to log in to the server, workstations might not be to read from or write to the server, and an abend message usually appears on the System Console or Logger screen of the server console. If the NetWare auto-recovery mechanism is enabled (default), NetWare might restart the server automatically or suspend the offending process, depending on the nature of the abend.

If there is no abend message on the console, no `abend.log` file in sys:system, and no number in brackets within the System Console prompt, but users still can't access the server, see "Monitoring and Resolving Communication Problems" on page 147. If there is no abend message but the console is frozen so that you cannot enter commands, see "Server Console Hangs" on page 131.

Understanding What Happens When You Get an Abend

When the server abends, it displays an abend message similar to the following:

```
ABEND: SERVER-5.xx-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 drive c:. as soon as the server is restarted, the `abend.log` file is moved to sys:system.

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.

IMPORTANT: Sometimes an abend (or a faulty NLM program) can cause the server console to stop functioning. In this case, the abend message is not displayed and you cannot enter commands at the console prompt.

After a server failure, we recommend turning the power off of the computer and restarting it rather than just exiting to the DOS prompt, `c:\nwserver`, and entering `server` again.

Responding to the Abend Manually

The default method of responding to an abend is automatic. (See .)

To respond manually to abends, change the following Set parameter (*Error Handling* category) to the value shown:

```
AUTO RESTART AFTER ABEND = 0
```

This Set parameter controls what the server does after an abend. See the online help for a description of each value.

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 could 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 the network operating system. 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 sends a message to users that the server is going down and advising them to save their files and log out. The server then stops 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 Set parameter AUTO RESTART AFTER ABEND DELAY TIME. You can set this value from 2 to 60 minutes. The default is 2 minutes.

  You can send the abend.log file to the a Novell Support provider to help you troubleshoot the abend or you can log the information to the Novell Support Discussion Forums (http://support.novell.com/forums/). You can also download the ABENDLogFilter utility (http://www.novell.com/coolsolutions/tools/19435.html) to convert the abend.log into a more readable and useful format.

- ◆ R=Resume the running process, update ABEND.LOG, and attempt to down the server

  This option appears if the abend has detected a hardware problem. Shut down the server, fix the hardware, run diagnostics, and contact the hardware manufacturer for additional assistance.

  When you execute this option, the server sends a message to the users that the server is going down and 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 Set parameter AUTO RESTART AFTER ABEND DELAY TIME. 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.

These abends include page faults, protection faults, and invalid op codes stack overflows, double faults, etc. When this option is available, the server has determined that it cannot return the process to a safe state, but it does not need to shut down the server immediately to resolve the problem. You might still need to shut down the operating system and restart it at a later time.

When you execute this option, the server suspends the currently running process and updates the `abend.log` file, but does not shut down the computer. Server performance might 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. At a convenient time, shut down the server and restart it. Examine the `abend.log` file for more information about the source of the problem.

You can send the `abend.log` file to the a Novell Support provider to help you troubleshoot the abend or you can log the information to the Novell Support Discussion Forums (http://support.novell.com/forums/).

◆ `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, stack overflows, double faults, etc. 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 server. In most cases, the server completely recovers and no further action is necessary.

◆ `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. For information on core dumps, see "Creating a Core Dump" on page 118.

◆ `X=Restart`

This option appears only if DOS has been removed. Execute this option if you want to restart the server.

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 shut 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 it 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.

When the server restarts, it moves the `abend.log` file from the DOS partition to the `sys:system` directory.

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 Set parameters (*Error Handling* category) 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
```

Because these are the default values of the parameters, the default mode is to respond to abend automatically.

◆ When both of the following Set parameters are set to the value shown, the server responds to the abend by shutting down the server and attempting to restart it.

```
AUTO RESTART AFTER ABEND = 2
DEVELOPER OPTION = OFF
```

Use the following Set 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
```

To set the parameter values, use the SET command or Monitor at the server console or Novell Remote Manager from a workstation.

The Developer Option parameter is in the Miscellaneous category.

The *Auto Restart After Abend* and *Auto Restart After Abend Delay Time* parameters are in the *Error Handling* category.

All parameters can be set in the `startup.ncf` file.

Because the server responds to the abend automatically, you might not know when an abend has occurred. Therefore, you should periodically check the `abend.log` file or the Profiling and Debug Information screen in Novell Remote Manager (look for Suspended by Abend Recovery status).

6.5.2 Insufficient Packet Receive Buffers, No ECB Available Count Errors

The ECB (event control block) counter increments when a device sends a packet to your NetWare server but no packet receive buffer is available. This mean a packet has been dropped by the server.

The server allocates more packet receive buffers after each incident until it reaches its maximum limit (Maximum Packet Receiver Buffer setting).

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.

For procedures on setting the Minimum Packet Receive Buffers and Maximum Packet Receive Buffers parameters, see "SET" > "Communications Parameters" in the *NW 6.5 SP8: Utilities Reference*.

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 (HSM) are incompatible. This value is maintained by the `tsm.nlm` program.

If the ECB count is increasing and all the packet receive buffers are in use, take a core dump (see "Creating a Core Dump" on page 118) and contact Novell Support.

6.5.3 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 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.
- 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:

- 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.

- Check the status of packet receive buffers and service processes. Compare their values to the maximum allowable values.

  To check the health of these values, use Novell Remote Manager. Click the *Health Monitor* link under the Diagnose Server heading in the navigation frame. Click the links for the *Allocated Server Processes*, *Available Server Processes*, and *Packet Receive Buffers* on the Server Health Monitoring page.

  Packet receive buffers are used to transmit and receive packets. If the number of packet receive buffers is increasing, the server operating system will be sluggish. If the number of packet receive buffers reaches the maximum and no ECBs are available, the system will become very sluggish and might not recover.

  If the current service process are approaching the maximum, you should consider increasing the Maximum Services Processes Set parameter value. If you have only a few available server processes, your server is probably very busy. You might consider increasing the Minimum and Maximum Service Process Set Parameter values.

  To change the values for these parameters, access Novell Remote Manager. Click the *Set Parameter* link in the navigation frame. On the Set Parameter Categories page, click the following:

  - *Communications* link > *Current Value* link for Minimum Packet Receive Buffers

- *Communications* link > *Current Value* link for Maximum Packet Receive Buffers

- *Miscellaneous* link > *Current Value* link for Minimum Service Processes

- *Miscellaneous* link > *Current Value* link for Maximum Service Processes

You can also use `Monitor` or the `SET` commands at the server console.

◆ Check the Hot Fix™ status of all hard disks that use the Traditional file system.

To view the status, do the following:

- Access Monitor.

- From the Available Options menu, click *Storage Devices*.

◆ Verify that all mirrored disks are still mirrored by entering the following command at the System Console prompt:

`MIRROR STATUS`

◆ Purge deleted files.

- Access Novell Remote Manager.

- Click the *Volumes* link under the *Manage Server* heading in the navigation frame.

- Click the *Volume Information* icon next the volume you want to delete files on.

- Click the *Purge Deleted Files* button.

You can also set the Purge attribute on files you want to be purged.

◆ Check the LAN driver statistics.

- Access Novell Remote Manager.

- Click the *Disk / LAN Adapters* link under the *Manage Hardware* heading in the navigation frame.

- Click the *Network Adapter Info* link for each network board on the Hardware Adapters page.

If you are using more than one network board in the server, 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.

◆ Check the CPU usage.

- Access Novell Remote Manager.

- Click the *Profile/Debug* link under the *Diagnose Server* heading in the navigation frame.

- Click the *Profile CPU Execution by NLM* link and look for unusually high CPU usage.

◆ 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.

◆ Take a sniffer or LAN trace of the problem and analyze it.

◆ As a last resort, perform a core dump (see "Creating a Core Dump" on page 118) and contact a Novell Support engineer.

6.5.4 Server Console Hangs

If the server console locks up so that you cannot enter commands, but there is no abend message on the System Console or Logger screen, follow these steps to troubleshoot the problem. If there is an abend message on the screen, see "Resolving Abends" on page 125.

1 Verify whether you can toggle among console screens.

If yes, the problem might be caused by high server utilization. See "High Utilization Statistics" on page 131. If no, continue with the following steps.

2 Verify whether the server console hangs when you unload a specific NLM.

If yes, the NLM is probably the source of the problem. Contact the NLM vendor.

3 Make sure you are using the latest disk and LAN drivers, BIOS, and firmware.

If not, update disk and LAN drivers. For information on NetWare drivers, see "Keeping Your Servers Patched" on page 114.

4 Verify whether the server console hangs after you mounted the last volume.

If yes, the network board might not be seated correctly or might not be configured correctly. Check the board and its configuration and correct any problems.

5 Verify whether you can you break into the debugger by pressing Shift+Shift+Alt+Esc on the system console keyboard.

6 If the console is locked, you can't toggle among screens and you can't enter the debugger, contact Novell Support or your computer vendor to learn how to generate a nonmaskable interrupt to shut down the server.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113; search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1); and contact a Novell Support Provider.

6.5.5 High Utilization Statistics

Network performance is a key concern for network administrators and for Novell as well. Unfortunately, sometimes there is 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 CPU Utilization health status in Novell Remote Manager or the Utilization value in Monitor's 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 might 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 might 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 or more, when connections are dropped, or when server performance deteriorates noticeably. High utilization with these conditions indicates a problem. If you're not seeing these conditions, your utilization might 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 to be recalculated.)

What Are the Most Common Solutions?

Before troubleshooting high utilization problems, make sure that you have followed the steps in "Using a Troubleshooting Methodology" on page 113. Check the Novell Support Web site (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1) for NetWare patches or updated NLM programs. Available patches will contain fixes for reported high utilization problems related to the actual code of the operating system and eDirectory.

However, a number of high utilization conditions can still result from problems with configuration, levels of NLM programs, and tuning issues.

One of the first things you might want to do is discover the NLM program and threads that are using the CPU. To do this, complete the following steps:

1 Access Novell Remote Manager.

2 Click the *Profile/Debug* link under the Diagnose Server heading in the navigation frame.

3 Click the *Profile CPU Execution by NLM* link.

4 Note the parent NLM program and threads that are taking the longest execution time.

5 If possible, unload the offending NLM program to see if the problem disappears.

You can also use the following list of issues 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 Support representatives. We recommend that you review each item, using each to carefully analyze your system. Except for problems new to NetWare 6.5, you will be able to resolve the problem on your own in almost every case.

- Operating System Issues
- Storage Device Issues
- Memory Issues
- Novell eDirectory Issues
- Client Issues

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 99.

For the procedure to configure the allocation of packet receive buffers (communication buffers), see "Increasing Maximum and Minimum Packet Receive Buffers" in the *NW 6.5 SP8: Novell Server Communications Administration Guide* and SET > "Communications Parameters" in the *NW 6.5 SP8: Utilities Reference* for parameter descriptions.

For information on controlling the allocation of directory cache, see "Tuning Directory Cache for the Traditional File System" in the *NW 6.5 SP8: Server Memory Administration Guide* and SET > "Directory Caching Parameters for the Traditional File System" in the *NW 6.5 SP8: Utilities Reference*.

For setting up and tuning cache buffers in the NSS file system, see "Tuning NSS Performance on NetWare" in the *NW 6.5 SP8: NSS File System Administration Guide*.

For parameter descriptions, see also the service processes parameters in SET > "Miscellaneous Parameters" in the *NW 6.5 SP8: Utilities Reference*.

We suggest that the server parameters in the Table 6-5 on page 133 be set as indicated to avoid running low on server resources. This is especially important if you have 100 or more users. To change the following parameters, you can use Novell Remote Manager at the workstation or SET commands or Monitor at the server console.

In Novell Remote Manager, click the *Set Parameters* link under the *Manage Server* heading in the navigation frame > *Category* > *current value for parameter*. Enter the new value and then click *OK*.

In Monitor, from the Available Options menu, select server *Parameters* > *Category* > *current_value_for_parameter*, then press Enter. Enter the new value, then do the applicable action.

Table 6-5   *Server SET Parameters for Server Resources*

Category	SET Parameter Name and Value
Communications	`Minimum Packet Receive Buffers=`*value* The recommended value is 2 to 3 per connection.
Communications	`Maximum Packet Receive Buffers=4000`
Traditional File System	`Minimum Directory Cache Buffers=`*value* The recommended value is 2 to 3 per connection.
Traditional File System	`Maximum Directory Cache Buffers=4000`

Category	SET Parameter Name and Value
Miscellaneous	`Maximum Service Processes=1000`
Miscellaneous	`New Service Process Wait Time=0.3`

- **Processor hog.** Determine whether one thread is hogging the processor. In Novell Remote Manager, click the *Profile/Debug* link under the *Diagnose Server* heading in the navigation frame. View the data in the *Execution Profile Data by Thread* table.

  In Monitor, from the Available Options menu, select *Kernel Options > Threads*, and then press Enter.

  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 the *NW 6.5 SP8: Utilities Reference*.

  IMPORTANT: Use caution when changing this value. You must understand the impact of what you are changing.

Storage Devices and Adapter Issues

- **Drivers.** See "Keeping Your Servers Patched" on page 114. For a brief explanation of NetWare Peripheral Architecture (NWPA), see "Drivers for Host Adapters and Storage Devices" in the *NW6.5 SP8: Server Disks and Storage Devices*.

- **Free blocks.** When using the Traditional file system, 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, do either of the following:

  - In Novell Remote Manager, click *Volumes* link under the *Manage Server* heading in the navigation frame, then click the *Volume Information* icon.

  - In Monitor, from the *Available Options* menu, select *Volumes > the specific volume*. Press Tab to view the free blocks information on the Volume Information screen.

  If there are not at least 1000 free blocks on the volume, access Novell Remote Manager, click *Volumes* in the navigation frame, click the *Volume Information* icon for the applicable volume, and then click the *Purge Deleted Files* button.

  This removes all deleted files from the directories and subdirectories and increases your free disk space.

  If you have applications that create large numbers of temporary files, you might 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 System Console prompt.

- **Suballocation.** The Traditional file system uses a disk block size of 64 KB. It is very important to monitor the disk space. Novell Support recommends keeping 10% to 20% of the volume space free to avoid suballocation problems. Suballocation does not have any server parameters to adjust.

  To view disk space usage with Novell Remote Manager, click the *Health Monitor* link under the *Diagnose Server* heading in the navigation frame and then the *Available Disk Space* link on the *Server Health Monitor* page. Print the Volume Information page for your records.

- **Compression.** When using compression in the NSS file system, see "Managing Compression on NSS Volumes" in the *NW 6.5 SP8: NSS File System Administration Guide*.

  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. The default SET "File Parameters for the Traditional File System" for compression takes this into consideration.

  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.

  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 might 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 File Compression=Off parameter (Common File System category). This causes files to be queued for compression but the files are not compressed. However, accessing compressed files causes them to be decompressed.

Memory Issues

- **Insufficient RAM.** Memory resources are critical in a server environment.

  To view buffer cache statistics for the NSS file system, enter the following command at the System Console prompt:

  ```
  NSS CACHESTATS
  ```

  The best indicator for assessing server RAM in a Traditional file system is displayed in the following ways:

  - In Novell Remote Manager, click the *View Memory Config* link under the *Manage Server* heading in the navigation frame, then click the *File System Cache* link, and view the *LRU Sitting Time* in the *Traditional File System Cache Statistics* table.

  - In Monitor, from the *Available Options* menu, select *Disk Cache Utilization* and view the *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 might be low. Another good indicator, *Long Term Cache Hits*, is displayed on the same page or screen in either utility.

- Also see "Resolving Server Memory Problems" on page 140.

Novell eDirectory Issues

- **eDirectory partitions.** We recommend having no more than three replicas of each partition in the tree. Efficient tree design is essential to avoid utilization problems. Because Novell eDirectory 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 eDirectory if a database were to become corrupt.

- **eDirectory synchronization.** To test the possibility that eDirectory synchronization is the problem, turn off inbound and outbound synchronization for an hour by setting dstrace=!D60.

  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.

- **eDirectory errors.** To test for other errors, run SET dstrace=On.

Client Issues

- **Hung connections.** Check for them and clear them. See "Clearing a Workstation Connection" on page 104.

- **Client software.** You can identify client problems by changing the NCP Set parameter. For more information, see "NCP Parameters" in the *NW 6.5 SP8: Utilities Reference*.

  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.

  These parameters are in the NCP category:

  - 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 might need to upgrade your cabling, too.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113; review tips in TID 3790791 "Troubleshooting High Utilization On A NetWare Server:" (https://secure-support.novell.com/KanisaPlatform/Publishing/884/3790791_f.SAL_Public.html); search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1) for High Utilization; and contact a Novell Support Provider.

6.5.6 Disk Errors

To resolve disk I/O, disk space, and mirroring problems, see the following sections:

- "Resolving General Server Disk I/O Errors" on page 137
- "Resolving Server Disk Space Problems" on page 137
- "Mirrored Partitions Do Not Remirror Automatically" on page 138
- "Mirroring Takes a Long Time" on page 138
- "Mirroring Stops Just Before It Is Finished" on page 139

Resolving General Server Disk I/O Errors

To resolve a general disk I/O error on the server, try one or more of the following remedies:

- Check the disk subsystems to make sure that the power is on and the cables are correctly connected between the controller and the subsystems.
- Make sure that the subsystem cables are terminated correctly.
- Make sure that the hardware and disks are installed correctly.
- Make sure that the current disk drivers loaded are certified for NetWare 6.5. Many drivers can be found on the *NetWare 6.5 Operating System* CD or on the master diskettes. Updated drivers might also be available from third-party disk driver manufacturers.
- Make sure that the interrupt parameters, I/O port settings, slot settings, etc., for the driver match those for the hardware. Also, make sure that the custom parameters have been set correctly for your hardware.
- Make sure all devices are recognized.
- Make sure that the device is visible and has a valid Hot Fix partition.

If you have tried all the preceding suggestions without success, contact your Novell Support Provider or the drive manufacturer.

Resolving Server Disk Space Problems

To resolve an insufficient disk space error, do one or more of the following:

- Delete unnecessary files and directories from the volume.

- Change the Minimum File Delete Wait Time Set parameter in your server's `autoexec.ncf` file equal to 0 so that files can be removed immediately rather than being retained in a salvageable state on the volume.

- Purge deleted files if they cannot be purged automatically. (The deleted files are using up directory table space.)

- Increase the volume size and/or add more disks to the volume.

- Increase the percentage of disk space that can be used by a directory.

- If the disk or volume does have space available, check the disk drives and disk channel to see if a failure has occurred.

- Delete NLM programs that you no longer use.

- Check and adjust or remove any volume restrictions placed upon users.

- Check the size of error or log files and delete any that are unnecessary.

Mirrored Partitions Do Not Remirror Automatically

When mirrored partitions become unsynchronized, they should resynchronize automatically. If partitions do not resynchronize, complete the following steps:

1 In ConsoleOne, browse and select the tree you want to manage, then click the *Partition Disk Management* icon.

2 Enter the eDirectory tree and context and server information.

3 Click *Properties > Media > Mirror > Resync*.

4 If the partitions still do not resynchronize, you must re-create the mirrored set.

   4a Determine which disk partition has the data you want to save and mirror.

   4b Delete the other disk partitions.

   4c Recreate new partitions in place of the ones you deleted.

   4d Mirror the partition containing data to the new partitions.

     For information about mirroring, see "Managing NSS Software RAID Devices" in the *NW 6.5 SP8: NSS File System Administration Guide*.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

Mirroring Takes a Long Time

If partitions are very large, mirroring can sometimes take several hours to complete; this is normal. The following might help to speed the mirroring process:

- Make sure you are using the latest disk drivers.

- Make sure there are no problems related with the hard disks or drivers you are using.

  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.

- Make sure the Enable Disk Read After Write Verify (Disk category) Set parameter is set to Off.

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 Maximum Concurrent Disk Cache Writes (Traditional File System category) parameter is set at the default value or lower, try increasing the setting.

IMPORTANT: 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 "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

Mirroring Stops Just Before It Is Finished

Sometimes, the mirroring process proceeds without error but stops at 99% completion. To troubleshoot the problem, do the following:

◆ Check whether any faulty disk blocks exist.

 If there are faulty disk blocks, troubleshoot and replace the disk if necessary.

◆ Make sure you are using the latest disk drivers.

◆ Make sure there are no problems related with the hard disks or drivers you are using.

 For known problems with specific hard disks or drivers, contact the drive vendor.

◆ If the Maximum Concurrent Disk Cache Writes (Traditional File System category) parameter is set at its highest value, try reducing the setting.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

Resolving Disk Error Problems When a Traditional Volume Is Mounting

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

◆ The server does not have enough memory to mount the volume.

◆ The operating system is experiencing directory sector mismatching. This mismatching can be caused if the media is defective or if the server is turned off without the DOWN command.

To resolve problems when disk errors while a volume is mounting, do the following:

◆ Load Monitor and check the status of the available cache buffers. If the cache buffers are fewer than 20%, add more memory to your server.

◆ Minor errors usually correct themselves through normal network use. For example, if a FAT entry is wrong, the entry is updated and corrected the next time it is written to. If errors do not correct themselves, run VREPAIR.

◆ Some problems might be corrected automatically by TTS™ (Transaction Tracking System™) software.

6.5.7 Resolving Server Memory Problems

To troubleshoot different kinds of server memory problems, to resolve memory leaks, and to resolve memory problems by freeing memory, see the following sections:

NetWare Doesn't Recognize All the Memory in the Server

Use the following steps to find the source of the problem.

1 Verify whether you are using the NetWare memory manager or an external memory manager. 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 in older computers cannot recognize more than 64 MB of memory. DOS device drivers take memory away from the NetWare memory pool.

Make sure Windows 95 is not being used to boot the server. Windows 95 autoloads memory managers.

2 Make sure the server BIOS is current.

An out-of-date BIOS might be reporting the wrong amount of memory. If a newer version is available, update the BIOS.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

Resolving Server Memory Leaks

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 might 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 then monitor memory statistics (Total Cache Buffers) over time. When traffic hasn't increased and no new applications are installed on the server and the statistics change, use the following steps to find the source of the problem.

1 Load all the latest patches on the server.

Server patches are available from Patch Download Information for All Products (http://support.novell.com/patches.html?sourceid=suplnav3_patches) and other locations. See "Applying Patches" on page 37 for a list of sources.

2 Restart the server to free memory and establish a baseline for memory use.

3 View the memory statistics for the module:

3a Access Novell Remote Manager.

3b Click the *List Modules* link under the *Manage Applications* heading in the navigation frame.

3c Sort the list for memory usage by clicking the *Alloc Memory* button.

3d Click the *value* link for allocated memory for each module name you suspect might be the source of the leak.

Under normal conditions, modules such as `server.nlm`, `nss.nlm` and `ds.nlm` are usually at the top of the list.

3e Print this page and use it as a the baseline as you monitor the module's memory use over time.

4 Repeat Step 3 for each NLM program you suspect might be the source of a memory leak.

5 (Conditional) If the memory error messages occur again, repeat Step 3 to view the memory statistics for each suspected NLM program. 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.

Freeing Server Memory Temporarily

To free server memory temporarily (until you can add more memory to the server), do one or more of the following:

◆ On Traditional volumes, delete unused files and directories and purge them.

◆ Shorten the time period before deleted files are purged.

  ◆ Lower the value of the Minimum File Delete Wait Time Set parameter (Common File System category).

  ◆ Change the setting to On for the Immediate Purge of Deleted Files Set parameter (Common File System category).

◆ Unload any NLM, such as NWCONFIG, Monitor, backup software, virus scanners, that is not currently needed.

◆ Dismount Traditional 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). Therefore, 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. For procedures, see "Copying and Upgrading Legacy Volumes with Volume Copy Upgrade" in the *NW 6.5 SP8: NSS File System Administration Guide*.

- If you are using the Traditional file system, remove 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 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.

- On NSS volumes, monitor and adjust the cache statistics. For more information, see "Tuning NSS Performance on NetWare" in the *NW 6.5 SP8: NSS File System Administration Guide*.

Resolving Memory Errors When a Traditional Volume Is Mounting

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

- Traditional volumes take more memory to mount than they require after being mounted because the mounting process performs consistency checks (for example, the duplicate copies of all the tables are checked).

- Traditional volumes and directory entries grow dynamically. Therefore, if your server is using most of the RAM (file cache buffers are close to 20% of the memory) and you dismount a volume, you might not be able to remount the volume unless additional memory is available.

- Each additional name space support that you add to a Traditional volume increases the size of the FATs and DETs. Adding name space support can cause the tables to grow so large that the server does not have enough RAM to mount the volume.

To resolve problems when memory errors while a volume is mounting, perform the following actions or ensure that the following conditions exist:

- Check the status of the available cache buffers. If the cache buffers are fewer than 20%, add more RAM to your server.

- Free up memory by unloading resources.

- Streamline the directory structure on Traditional volumes. Every subdirectory 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.

- Calculate how much memory you need and add memory to the server.

- Note the Cache Buffers settings in the Server Memory Statistics.

  If the percentage is below 20%, add more memory.

- Remove the recently added name space support.

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

  Have all users log out, and then unload all modules except the server's disk drivers. Dismount any mounted volumes.

  To remove the name space, load VREPAIR, select *Set VRepair Options* and select two options: *Write All Directory and FAT Entries Out to Disk* and *Remove Name Space Support from the Volume*. Then on the volume that would not mount, run VREPAIR, select *Repair a Volume*.

Server Displays Memory Error Messages

Typical memory error messages include the following:

- Cache memory allocator out of available memory

- Cache memory allocator out of available memory, size requested was *x* bites by *NLM_name*.

- Short term memory allocator is out of memory

- Cache memory allocator exceeded the minimum cache buffer limit

If any of these conditions exist, use the following steps to find the source of the problem:

1 Make sure the server is not loading a memory manager or a DOS device 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.

  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 Make sure the server BIOS is current.

An out-of-date BIOS might be reporting the wrong amount of memory. Update the BIOS if a newer version is available.

3 Verify that the setting for the Reserved Buffers Below 16 MB Set parameter (Memory category) is set at 300 or higher.

For older drivers, increase the value to 300 or higher, especially if there is a CD or tape device that needs memory below 16 MB.

4 Make sure memory is being registered automatically.

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 Verify whether memory errors occur when a Traditional volume is mounting.

If yes, the server might be low on memory.

To free memory temporarily, see "Freeing Server Memory Temporarily" on page 141. To solve the problem, add more RAM.

6 Verify whether the LRU Sitting Time (in Novell Remote Manager or Monitor) average is more than 15 minutes during peak work hours.

If no, the server might be low on memory.

To free memory temporarily, see "Freeing Server Memory Temporarily" on page 141. To use the LRU Sitting Time to tune memory, see "Tuning File Cache" in the *NW 6.5 SP8: Server Memory Administration Guide*. To solve the problem, add more RAM.

7 Check for memory leaks.

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 140.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

6.5.8 Resolving Locked Device Errors

To resolve a locked device error, try one or more of the following:

- Wait for a while (sometimes a few hours); the task in process might complete and free the device.
- Retry the action that resulted in the error.
- Delete all user connections and disable logins.
- For a disk device error, unload NLM programs (other than the device driver) that might be using the disk. Dismount all volumes on the disk.

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

6.5.9 Resolving Event Control Block Allocation Errors

Event control block allocation system messages can occur when you first start the server or after the server has been running for some time.

These messages indicate that the server was unable to acquire sufficient packet receive buffers, usually called event control blocks (ECBs). Running out of ECBs is not a fatal condition. However, it can indicate either a LAN or server problem.

Servers that run for several days where high loads occur in peaks might exceed the set maximum number of ECBs, causing the system to generate ECB system messages.

If these situations are caused by occasional peaks in the memory demand, you should probably maintain your current maximum ECB allocation and allow the message to be generated at those times.

Otherwise, if your server memory load is very high and you receive frequent ECB allocation errors, try setting your maximum ECB allocation higher. Use the following SET command in the `startup.ncf` file:

`SET MAXIMUM PACKET RECEIVE BUFFERS=`*`number`*

Memory allocated for ECBs cannot be used for other purposes.

The minimum number of buffers available for the server can also be set in the `startup.ncf` file with the following command:

`SET MINIMUM PACKET RECEIVE BUFFERS=`*`number`*

6.5.10 Resolving Server Console Command Problems

To diagnose server console command problems, identify whether the following conditions exist:

- Some Set parameters can only be set in the `startup.ncf` file.
- You are not at the System Console screen prompt. Press Alt+Esc to toggle through the screens.
- The server has been shut down.
- The server has failed (hung).
- The `server.exe` file is corrupted.
- The network operating system has been configured incorrectly.

To resolve server console command problems, do the following:

- Enter the Set parameter in the `startup.ncf` file and then shut down and restart the server.
- Make sure that all cables are fastened securely to all network boards and network connectors. Make sure that terminating resistors are installed correctly.
- From a backup, or from the *NetWare 6.5 Operating System* CD, copy a new version of `server.exe` to the server boot directory. Have all users close their files and log out.

  Shut down the server, if possible. If not, wait a few minutes after all users have logged out, and then reboot the server.
- Check the hardware configuration on each network board in the server to make sure that the configuration is correct.

- If you recorded network board configurations and they do not agree with the actual hardware configurations, reload the LAN driver with the correct parameters or change the hardware settings to match the LAN driver parameters.

- Check all network board settings for possible interrupt and I/O port conflicts. The server can boot up initially even if the interrupt on a network board is set incorrectly.

  The most common conflict occurs when a network board is set to interrupt 4 and a printer is connected to the server's serial port, which also uses interrupt 4.

- Run a virus scan on the DOS partition.

6.5.11 Resolving Keyboard Locking Problems When Copying Files from CD-ROM

To diagnose keyboard locking problems when copying files from CD-ROM, identify whether the following conditions exist.

If you have a CD device that shares a SCSI bus with a disk subsystem containing volumes that network operating system installation files are copied to (typically volume sys:), your keyboard might lock while loading drivers or copying files to the volume. The following figure shows possible configuration conflicts.

Figure 6-1   *Possible SCSI channel conflicts during a NetWare installation*
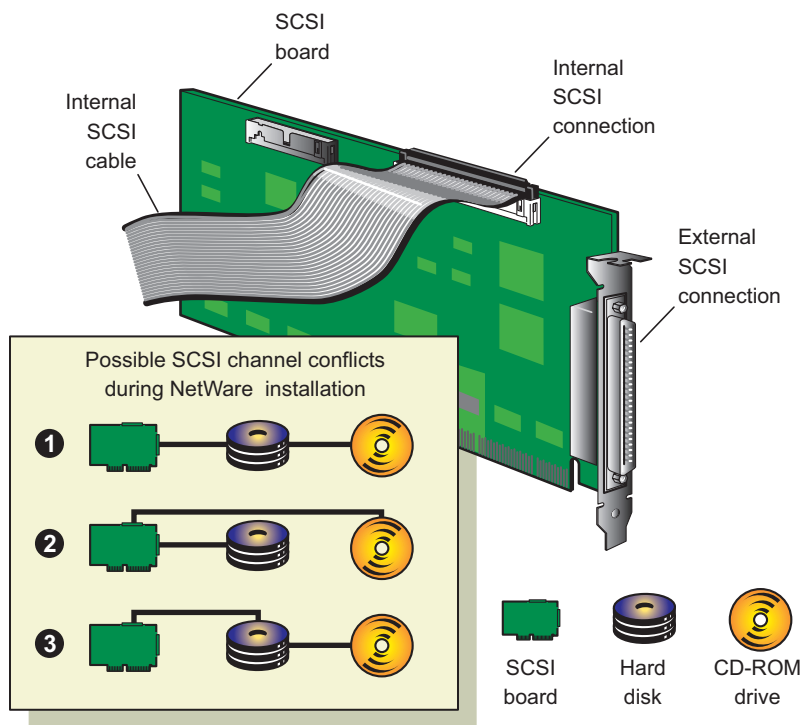
Remove the CD device drivers that you used to set up the CD drive as a DOS device from your `config.sys` file. This will avoid possible conflicts when the *Operating System* CD is mounted as a NetWare volume.

To resolve keyboard locking problems when copying files from the CD, use the following procedure:

1 Press Alt+Esc until you are at the System Console prompt.

2 Enter `DOWN`.

3 Using a text editor, remove the CD device drivers from your `config.sys` file.

4 Save the updated `config.sys` file.

5 Using a text editor, remove any references to the CD drivers from your `autoexec.bat` file.

6 Save the updated `autoexec.bat` file.

7 Reboot the server by pressing Ctrl+Alt+Del.

8 (Conditional) If the server doesn't boot automatically from the `autoexec.bat` file, change to the subdirectory where the `server.exe` file and other boot files are located (the default is c:\nwserver), and enter the following at the DOS prompt:

`SERVER`

9 (Conditional) If you are using ASPI device drivers (for example, for an Adaptec* controller), you need to enter one of the following commands:

`AHAxxxx`

where *xxxx* specifies the Adaptec board number

or

`ASPICD`

or

`CDNASPI`

10 At the System Console prompt, enter

`nwpa`

11 (Optional) At the System Console prompt, enter `cd device list`.

A list appears with numbers associated with all the devices on your network. Determine which number is the volume number.

12 At the System Console prompt, enter

`cddvd.nsscd mount volume_name|number`

13 At the System Console prompt, enter

`nwconfig`

6.6 Monitoring and Resolving Communication Problems

Problems that occur with networking can originate for any of several reasons: corrupted hardware or software, bad links, not enough memory, etc.

The following are tips for solving network communication problems.

- Check all hubs and repeaters to make sure that they are on.
- Check concentrators and look for flashing yellow lights that indicate collisions.

- Make sure that 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 that cables are not running close to sources of interference.

- Make sure that the server network board is seated properly and is initializing.

- Make sure that a protocol is bound to each board and check the configuration of the network boards. Then shut down the server, turn off the power, and check the actual network board settings:

  - Make sure that 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 that 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 network boards do not conflict with other boards, the monitor board, or ports in the server. Make sure that no two pieces of hardware are using the same I/O port, interrupt, or memory address. Avoid interrupts 2, 9, and 15.

- Make sure that the network board works correctly; replace it if it doesn't. Check the lists of certified products at YES CERTIFIED Bulletin Search (http://developer.novell.com/yessearch/Search.jsp). Make sure that drivers are the latest versions.

- Run VOLUMES at the System Console prompt. 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 then turning them back on one at a time.

- Make sure that workstations are using the correct frame type.

- Have a user log in to the network from a workstation. In Novell Remote Manager, click the *Connections* link under the *Manage Server* heading in the navigation frame.

  If the 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 that 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.

6.7 Suspected Multiprocessing Problems

If you suspect a multiprocessing problem, complete the following steps. You can eliminate most probable causes.

1 Make sure the secondary processors are functioning properly.

If the server is already up, stop all processors except Processor 0. In Novell Remote Manager, click the *Processor* link under the *Manage Hardware* setting in the navigation frame. Click the *Stop Processor* link for each processor online except processor 0. (Processor 0 cannot not be taken offline.)

If the server is down, bring up the server and then stop all 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. Then reboot the server; only processor 0 will start.

The `mps14.psm`, `cpqmpk.psm` or `*.psm` in the `startup.ncf` file is the interrupt abstraction layer and communicates with the APIC (Advanced Programmable Interrupt Controller) rather than the PIC for interrupt handing in the machine.

If the problem still occurs, it not a multiprocessing issue.

If the problem no longer occurs, go to Step 3.

3 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 6.5 was released. Whatever is different about the hardware requires a newer PSM to work with the machine.

TIP: 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 Section 6.1, "Using a Troubleshooting Methodology," on page 113. View the `startup.ncf` and `autoexec.ncf` files 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, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

6.8 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.

Use the following steps to troubleshoot server-to-server communication problems.

1 Make sure the server is up and can been seen on the network.

If the server is down, restart it.

If the server has abended, troubleshoot the abend. See "Resolving Abends" on page 125.

2 Make sure the server's time is synchronized to the network.

To see if server time is synchronized to the network, enter TIME at the System Console prompt.

If time is not synchronized, troubleshoot the time synchronization problem. For general information about time synchronization, see the *NW 6.5 SP8: Network Time Synchronization Administration Guide*.

3 Make sure the IPX™ internal network number of the server unique and the IP addresses unique. Make sure 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` > *replica* > `Display Replica Information.`

4 Make sure 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` > *replica* > `Display Replica Information.`

If names are not correct, contact a Novell Support Provider for assistance in renaming servers.

5 If the servers share the same cabling system, make sure addresses are unique for each cable segment.

If addresses are not unique, change addresses as necessary.

6 Make sure all LAN drivers are loaded and protocols are bound. Make sure all LAN adapters and drivers are the latest versions.

Load and bind LAN drivers, if necessary. If drivers are not the latest versions, update the drivers. In addition, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1) for known problems with specific adapters. Replace adapters if necessary.

7 Make sure the LAN is functioning.

Ping the servers to see if the connection is active. View LAN statistics using Novell Remote Manager or Monitor to make sure packets are being sent and received. 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 154.

8 Make sure the routers have enough memory to handle the increase in packets.

If your servers have just been upgraded from NetWare 3, some routers might not have enough memory to buffer the increase in packets from NetWare 3 to NetWare 4, 5, or 6 servers. Make sure the routers have enough memory.

9 Remove routing filters.

If the servers are using IPX and the routers are filtering SAP types 004, 26b, and 278 packets, remove the filters.

10 If you are using IPX, reset the server's internal IPX router.

Use the `RESET ROUTER` command at the System Console prompt to reset the server's internal IPX router. Troubleshoot other routers.

11 Make sure data can transfer over WAN links.

- 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 Make sure server utilization is not high.

Do the affected servers have utilization at or close to 100%?

If yes, take steps to reduce server utilization. See "High Utilization Statistics" on page 131.

13 Make sure the eDirectory database is not locked.

If DSREPAIR is running, the eDirectory 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 modules to finish using the database or shut down the utility or module.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

6.9 Workstations Can't Communicate with Server

To troubleshoot different kinds of workstation to server problems, see the following sections:

- Section 6.9.1, "Errors Reading from and Writing to Network, Server Cannot Be Found Errors," on page 151
- Section 6.9.2, "Connections Dropped Periodically," on page 153
- Section 6.9.3, "Tips for Resolving General Communication Problems," on page 154

6.9.1 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 Make sure other clients can 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 cannot to log in again until the connection is cleared. The server's watchdog process retries the connection a designated number of times, and then the connection times out and the server clears the connection. After the connection is cleared, the user can log in again.

Watchdog processes are controlled by Watchdog (Communications category) Set parameters.

 - 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.

 - Has intruder lockout been activated?

 - Is the workstation LAN cable functioning?

2 Check whether the server has had an abend.

If the server has had an abend, it displays an abend message on the System Console screen. If the abend auto recovery process restarted the server, the message might have scrolled off the screen. Check the `abend.log` log file in `sys:system` to read the message.

To troubleshoot a server abend, see "Resolving Abends" on page 125. For general information about types of server abends, see "Understanding What Happens When You Get an Abend" on page 125. To manage the abend auto recovery process, see "Responding to the Abend Automatically" on page 128.

3 Verify whether the server console has hung.

If you cannot enter commands at the System 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 shut 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. Then reboot the server. See "Server Console Hangs" on page 131 to troubleshoot the problem.

If neither of the commands just described works, the only way to exit the server is to force a nonmaskable interrupt (NMI) error. Contact a Novell Support Provider 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 Verify that volume sys: is mounted.

Enter `VOLUMES` at the System Console prompt 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 Make sure no LAN problems exist.

In Novell Remote Manager, click the *Health Monitor* link under the Diagnose Server heading in the navigation frame, and then click the *LAN Traffic* link in the Description column of the Server Health Monitor page.

View LAN driver statistics to see if packets are being lost or if there are excessive collisions or retries. To do this in Novell Remote Manager, click the *Disk / LAN Adapters* link under the *Manage Hardware* heading in the navigation frame, and then click the name link for each of the network boards in your server.

For tips on troubleshooting communications problems, see "Tips for Resolving General Communication Problems" on page 154

If necessary, use LANalyzer® or a similar product to monitor network traffic and isolate the problem.

6 Make sure server utilization is normal.

Check utilization statistics. For help in responding to high utilization, see "High Utilization Statistics" on page 131.

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 Make sure the server has sufficient resources.

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 128.

8 Make sure the eDirectory database is functioning.

Is the eDirectory database closed or locked by another utility, such as DSREPAIR?

If the eDirectory database is not functioning, the workstation clients will not display the login screen.

9 Check for -625 or other communication errors at the server.

Are servers receiving -625 or other communication errors?

If so, see "Unable to Communicate with Server, -625 Errors" on page 149 or see the online documentation Novell Error Codes (http://www.novell.com/documentation/nwec/index.html) > Novell eDirectory or NDS Error Codes.

If the problem still occurs, follow the troubleshooting steps in "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

6.9.2 Connections Dropped Periodically

Follow these steps to troubleshoot the problem:

1 Make sure server utilization is normal.

Check utilization statistics. For help in responding to high utilization, see "High Utilization Statistics" on page 131.

2 If users are using old versions of the Novell Client, upgrade them to the newest version of the applicable Novell Client.

3 Make sure the node number for each workstation is unique.

4 Make sure all network boards in the server and user's workstations are working properly and are using the latest boards and drivers.

Check Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1) for any known problems with your drivers and boards, update drivers, and replace boards if necessary.

5 Check all cables to make sure they 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 "Using a Troubleshooting Methodology" on page 113, search the Novell Knowledgebase (http://www.novell.com/support/supportcentral/supportcentral.do?id=m1), and contact a Novell Support Provider.

6.9.3 Tips for Resolving General Communication Problems

To resolve general network communication problems, do the following:

- 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. 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. Make sure drivers are the latest versions. Check the lists of certified products at YES CERTIFIED Bulletin Search (http://developer.novell.com/yessearch/Search.jsp). Make sure that drivers are the latest versions.

- Run VOLUMES at the System Console prompt. 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 then turning them back 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. In Novell Remote Manager, click the *Connections* link under the *Manage Server* heading in the navigation frame.

  If the 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.

6.10 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 a Novell Support Provider for assistance.

To avoid losing the Admin account, we recommend 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.

6.11 Preventive Maintenance Tasks

The following sections provide tips for preventing server problems:

- Section 5.14, "Monitoring the NetWare Server," on page 95
- Section 4.2, "Matching Performance Capabilities," on page 37
- "Preventing Memory Problems" on page 110
- "Preventing Power Supply Errors" on page 111
- "Preventing Static Electricity Problems" on page 111
- "Preventing Cabling Problems" in the *NW 6.5 SP8: Novell Server Communications Administration Guide*
- "Documenting the Network" on page 109

Running NetWare in a Virtualized Environment

7

This section applies to the differences that you might experience when running Novell® NetWare® 6.5 SP8 in virtualized environment on a Xen-based virtual machine.

For information on setting up virtualized NetWare, see "Installing and Managing NetWare on a Xen-based VM" in the *OES 2 SP2: Installation Guide*.

This section contains the following information:

7.1 Accessing the FAT Partition

To access the FAT partition beneath the virtualized NetWare, like the `c:\nwserver` directory, you can use TBX for basic commands, or you can load DOSFAT to access the C: drive. For more information on TBX commands, see Appendix B, "Using the TBX NLM Program," on page 171.

You can also view the files on the FAT partition by using Novell Remote Manager. See "Accessing the Server's Local Partitions and Performing Actions on Them" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

7.2 Server Commands

Virtualized NetWare running on a Xen-based virtual machine does not use DOS, nor does it use the NetWare boot loader; it uses the XEN loader to load the operating system.

This section contains the following information:

7.2.1 Restarting the Virtualized NetWare Server After Shutdown

When you issue the `Down` or `Halt` command on a virtualized NetWare server, the Virtual Machine is unavailable to restart. You need to use the following Xen commands at the host console to bring it back up, and then initialize or open the console window.

```
xm new virtual_server_name
```

7.2.2 Set Commands

In the SET controls, you will not find the `Down` commands to cause the machine to drop down to DOS rather than shut off because there is no DOS to drop down to. There is also no ACPI module that controls any alternate behavior of commands like `Down` and `Shutdown` because none of that is present on a Xen-based Virtual Machine.

The Platform Support Module (PSM) module controlling the multiprocessor capabilities is a Xen-specific PSM that is neither MPS14 nor ACPI (although it is closer in functionality to the former than to the latter). Because the SET parameters for `Down` are registered by the ACPI module, and that module is not loaded on the virtualized NetWare server, you do not see those parameters display on the list of SET commands.

7.2.3 Stop Processors

After stopping a processor on a virtualized NetWare server, you cannot restart the processor.

To bring it back up, you must shut down the virtual machine and restart it.

Use the following Xen commands at the host console to shut down the virtual machine, bring it back up, then initialize or open the console window.

```
xm shutdown virtual_server_name
```

```
xm new virtual_server_name
```

7.2.4 Version Command

When you enter the `version` command at the system console prompt of a server running virtualized NetWare, you will see a virtualization indicator (v) added to product version string.

7.3 Starting the Server with Command Line Switches

NetWare virtualized on Xen does not use DOS, nor does it use the NetWare boot loader (`nwloader.sys`). It uses the Xen loader (`xnloader.sys`) to load the operating system. The Xen loader is similar to NetWare boot loader in functionality. It boots NetWare, then passes its commands to Xen as well as providing some of the interfaces between Xen and NetWare.

Therefore, when you want to start the server with specific command line switches, such as -nl or -ns, you should enter these commands at the Xen console when starting the server or put the commands in the `config.nw` file rather than the `autoexec.bat` file.

7.4 Debugger CPU Utilization High During a Core Dump

When performing a core dump on a virtualized NetWare server, the utilization might run higher than usual. This can affect the performance of other virtual machines running on the same host server.

7.5 Creating a Core Dump on a Virtual Machine Running Virtualized NetWare

Novell will probably 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 data file containing 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.

To prepare the environment for a core dump, download the nwcoredumpd utility to a location on the host server. You can get the utility from the Novell Support Web site. See TID 3281847.

NOTE: For this release, nwcoredumpd works for 32-bit Xen host only.

7.5.1 Starting the nwcoredumpd Utility

To write a core dump from a Xen virtual machine to the local Xen host or to a remote ImgHost, the nwcoredump utility must be running on the local Xen virtual machine host. You can start this utility any time before starting the core dump.

1 Log in to the Xen Host server (Dom0) as user `root`.

2 Start the nwcoredumpd utility by entering the following command at the command line prompt:

path `/nwcoredumpd` *coredump_base_path*

Coredump_base_path is the directory where you want the core dump saved or written.This directory must already exist before you start the core dump.

For example,

If the nwcordumpd utility is in the current directory and you want the core dumps written to the same location, enter

`./nwcoredumpd .`

If the `nwcordumpd` file is in a directory named `/opt/novell/` and you want the core dumps written to the `/coredumps` directory that you created, then enter:

`/opt/novell/nwcoredumpd /coredumps`

7.5.2 Starting the Core Dump

Create the core dump as follows:

1 Start a core dump in one of these two ways:

- Select the core dump option when an abend occurs.

  NOTE: After the core dump is completed, the server abend handler restarts or reboots itself depending on the Auto Restart After Abend parameter setting.

- Manually start a core dump by entering `.c` while in the NetWare internal debugger.

  You can enter the debugger at any time by typing 386debug or by pressing these keys: Alt+left-Shift+right-Shift+Esc.

TIP: Press and hold the right-Shift and Alt keys with the right hand, then with the left hand press and hold the left-Shift and press the Esc key last.

Then enter `.c` at the # prompt and respond to the

2 When the core dump is finished, do one of the following if you manually started the core dump:

   ◆ Enter `g` to resume the server's execution if possible.

   ◆ Enter `h` to display Help.

   ◆ Enter `q` to exit the debugger.

If the server was hung when you entered the debugger, it probably will not resume the server's operation.

If the server abended, it is best not to resume the server's operations.

7.5.3 Virtualized NetWare Core Dump Prompt Options

Whether you selected the core dump option after an ABEND or are forcing a core dump, you have the following options when responding to the core dump prompts.

Table 7-1   *Virtualized NetWare Core Dump Prompt Options*

Prompt	Option
Reboot server after coredump?	**Y** : Reboots server after the core dump
	N : Leaves the server in the same state after core dump
Lists available local drives and available free space on each	Informs you of local partitions available for the core dump.
Coredump Type	**Full** includes all the server memory in the core dump. For some cases, this is the recommended option.
	Full w/o cache includes all server memory except file cache (disk cache). Generally, this is the recommended option. Novell technical support will advise you when to make a full core dump.
Compress Coredump	**Yes** is the recommended option
	No

Prompt	Option
Where should diagnostic core dump be saved?	**XENHOST** saves the file to local XEN host machine (DOM 0)
	The virtual machine does not need to be running to obtain the file. For details, see "Saving a Dump to the Xen Host, DOM 0 (XENHOST Option)" on page 161.
	NETWORK saves the core dump file to the remote IMGHost at the IP address specified.
	For details, see "Saving a Core Dump to a Remote IMGHost (NETWORK Option)" on page 161.
	HDISK saves the core dump file to a local FAT partition. The drives that are available were listed when the core dump was started.
	The partition (logical drive) must already exist on the virtual machine. After the core dump completes, you need to reboot the server before the core dump can be accessed or transferred.
	For details, see "Saving a Core Dump to a Local FAT Partition" on page 162.

Saving a Dump to the Xen Host, DOM 0 (XENHOST Option)

1 Log in to the virtual machine server as user `root`.

2 Make sure the nwcoredumpd utility is started. See Section 7.5.1, "Starting the nwcoredumpd Utility," on page 159.

The Xen host agent receives the core dump from the virtualized NetWare server and stores it in a subdirectory based on the virtual server's name and a unique file name with an `.img` extension.

For example, if you sent several core dumps from a server named DASERVER1 and you specified `/coredumps` as the base_coredump_path, you would find a core dump files similar to the following in this directory.

```
/coredumps/daserver1
```

```
070917_001.img
```

```
070918_002.img
```

```
070921_003.img
```

Saving a Core Dump to a Remote IMGHost (NETWORK Option)

1 Log in to the virtual machine server as user `root`.

2 Make sure the nwcoredumpd utility is started. See Section 7.5.1, "Starting the nwcoredumpd Utility," on page 159.

The nwcoredumpd utility in this case automatically routes the core dump on to the remote IMGHost.

3 Make sure a remote image host agent, by doing the following:

On a NetWare server, load `imghost.nlm`

When loading the `imghost.nlm` or running the `imghost.exe`, you can specify a directory where you want the received core dumps to be saved (the directory must already be created) or accept the default paths.

For example: `load imghost sys:coredump`

The default path for `imghost.nlm` is volume sys:.

The default path for `imghost.exe` is the current working directory.

4 At the "`Where should the diagnostics coredump be sent?`" prompt, select the *NETWORK* option.

5 At the "`IP Address of IMGHOST`" prompt, enter the IP address of the server or workstation where you started the image host agent.

The image host agent receives the core dump from server and stores it in a directory based on the server name and assigns a unique filename based on the date (year, month, day, version) of the core dump with an `.img` extension.

For example, if a file was sent from a server named DASERVER1 on September 17, 2007 to a server running `imghost.nlm`, the `DASERVER1\070917aa.img` directory and file would be created on volume sys:.

Saving a Core Dump to a Local FAT Partition

After you start the core dump, you are asked to specify the drive letter and file path that the file will be written to.

The drive can be any writable local device that contains enough storage space. This could be the C: drive or another FAT partition. The partition (logical drive) must already exist on the virtual machine. After the core dump completes, you need to reboot the server before the core dump can be accessed or transferred.

You can also create a logical core dump drive by using Novell Remote Manager and save the core dumps to this drive just as you would to the local C: drive or other local FAT partitions. For more information, see "Creating a Logical Volume for Saving Core Dumps" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

When the image is written to a local hard drive on the server, the default name of the image file is `c\:coredump.img`.

To write to a different device, substitute the drive letter and filename. For example, `d:\cdump2.img`

After the core dump is finished:

◆ Reboot the server.

The core dump cannot be accessed or transferred until this step occurs.

The server does not need to be rebooted if the core dump was saved to a removable, USB drive or device.

◆ The image file can be sent to Novell (if you have opened a support incident).

◆ The image file can also be written to a network drive later. You can do this by using Novell Remote Manager (recommended), by using the TBX commands, or by using any other third-party NLM that provides this functionality.

7.5.4 Sending the Core Dump to Novell

IMPORTANT: You will be expected to patch the server to the latest Support Pack before Novell requests a core dump. To send a core dump file to Novell, you must first open a support incident, which will be billable. You are not charged until the incident is resolved or closed. If the problem is a Novell bug and no patches were previously available, then there is no charge.

Before sending the core dump to Novell, contact a support representative to open a support incident. You will be assigned to a Support Engineer who will help you analyze the core dump file. The Support Engineer will make arrangements to receive the core dump.

Server Console Conditional Commands

A

This section contains conditional commands that can be used at the System Console prompt. Command syntax and usage examples are shown for each command.

These commands can be used in `.ncf` files for performing conditional checks at a basic scripting level.

Practical uses for these commands could be to prevent a Cluster Resource script from completing when an NLM™ program is not loaded. Delaying the script causes the resource load time to time out, which then fails the resource over to a different node. This example could cause a continuous failover.

These commands are normally hidden; if you need help, set the variable to unhide the console command using Novell® Remote Manager. For more information, see "Viewing Hidden Set Parameters, Hidden Console Commands, Hidden Files or Folders, or System Files or Folders" in the *NW 6.5 SP8: Novell Remote Manager Administration Guide*.

The following commands are included:

%do (page 165)

%env (page 166)

%if (page 167)

%reset (page 168)

%while (page 168)

A.1 %do

A.1.1 Syntax

```
%do (action) while (condition)
```

Conditional Logic

```
== != > >= < <=
```

Actions

cmd set env

Conditions

nlminfo set env

Values

numerical: such as decimal (0) or hex (0x...)

text: Make sure the text is surrounded with double quotes. For example,

```
"text"
```

For More Information

Type `help %do condition|action`

A.1.2 Examples

cmd *Action*

```
%do (cmd update.ncf) while (set "allow lip"!="on")%do (cmd delay 5) while (env
major<6)
```

set *Condition\Action*

```
%do (cmd ...) while (env testor!=0)%do (env myname=1) while (env
testif=="false")
```

env *Condition\Action*

nlminfo *Condition*

```
%do (cmdenv %nlm) while (nlminfo *) %do (cmdenv %nlm) while (nlminfo
portal:major > 2)
```

A.2 %env

Global Environmental Variables

Variable definition

```
%env name=value %env name="text"
```

Variable current value

```
%env name
```

Delete variable

```
%env name=
```

A.3 %if

A.3.1 Syntax

```
%if condition then action
```

Conditional logic

```
== != > >= < <=
```

Conditions

loaded set env search nlminfo

Actions

cmd set env

Values

numerical: such as decimal (0) or hex (0x...)

text: Make sure the text is surrounded with double quotes. For example,

```
"text"
```

For More Information

Type `help %if condition|action`

A.3.2 Examples

loaded *Condition*

```
%if !loaded portal then cmd load portal %if loaded nlmName&nlmName then env
iamalive=1 %if loaded !nlmName&nlmName then cmd busy.ncf
```

set *Condition\Action*

```
%if set "allow lip"=="on" then set "allow lip"="off" %if set "alert message
nodes">20 then cmd more.ncf
```

env *Condition\Action*

```
%if env %name=="nlm" then cmd load nlm %if env %name>=5 then set "more
nodes"=50
```

search *Condition*

```
%if !loaded portal then cmd load portal
```

```
%if search * == "c:\dos" then cmd echo c:\dos is an active search path %if
search 1 == "sys:\system" then env my_load_path="sys:\system" %if search 1 !=
"sys:\public" then cmd #search path using bad load are
```

nlminfo *Condition*

```
%if nlminfo nlmname:major==5 then cmd replace nlmname %if nlminfo
nlmname:minor<5 then cmd next.ncf %if nlminfo nlmname:rev>5 then env aok=1 %if
nlminfo nlmname:month>=6 then cmd unload nlmname %if nlminfo nlmname:day<15
then cmd unload nlmname %if nlminfo nlmname:year==2001 then set "my set"=2001
%if nlminfo nlmname:lang!=4 then cmd badlang.ncf %if nlminfo
nlmname:loadpath=="sys:\system" then cmd reload.ncf
```

cmd *Action*

```
%if env %name=="nlm" then cmd load nlm %if env %name>=5 then set "more
nodes"=50
```

```
%if set "allow lip"=="on" then cmd echo allow lip is on %if env major<6 then
cmd down
```

A.4 %reset

Deletes all user defined global environment variables

Syntax

```
%reset
```

A.5 %while

A.5.1 Syntax

```
%while (condition) {action}
```

Conditional logic

```
== != > >= < <=
```

Conditions

loaded env nlminfo set

Actions

cmd set env

Values

numerical: such as decimal (0) or hex (0x...)

text: Make sure the text is surrounded with double quotes. For example,

```
"text"
```

For More Information

Type `help %while` *condition|action*

A.5.2 Examples

loaded *Condition\Action*

```
%while (loaded !portal) {cmd ...} %while (loaded nlmName&nlmName) {env
iamalive=1}
```

env *Condition\Action*

```
%while (env testor!=0) {cmd ...} %while (env testif=="false") {cmd delay 5}
```

nlminfo *Condition\Action*

```
%while (nlminfo *:lang != 4) {cmd env nlm}
```

set *Condition\Action*

```
%while (set "bindery context"==0) {cmd ...} %while (set "application"=="yes")
{cmd delay 5}
```

Using the TBX NLM Program

<div style="text-align: right">**B**</div>

This section documents the TBX NLM™ program and the commands that might be useful when managing a NetWare server.

`TBX.NLM` provides provided various DOS-like commands at the NetWare server console.

When you are using this utility, we recommend loading, using it, and then unloading it because the commands it uses conflict with bash.

To see a list of commands available, load `TBX.NLM` then enter `?`, `tools`, or `man` at the server console to see the following:

Usage: tools *command*

Enter any of the commands at the system console prompt without arguments to see its syntax. For example, entering `cp` displays:

Usage: cp [-r] [-v] *source destination*

The following is a list of common commands that you might use.

Table B-1 *Common TBX Command*

Category	Task	NetWare	Alias
File	Modify the attributes of a file or directory	attrib	chmod
File	Copy a file to a destination	copy	cp
File	Remove a file or directory del	del	rm or rmdir
File	List files to the screen	dir	ls
File	Move or rename a file system entry	move	mv
File	Move or rename a file system entry	ren	mv
File	Display a file in a hexadecimal	dump	od
File	Display a file on the screen type (cat) -	type	cat
Directory	Change the current working directory	cd	chdir
Directory	Create a subdirectory mkdir (md) -	md	md
Directory	Remove a directory	mrdir	rd
Directory	Print current working directory to the screen	pwd	
OS	Sleep for a specified period of time	sleep	
Number	Convert a decimal number to hexadecimal	dtx	
Number	Convert a hexadecimal number to decimal	xtd	