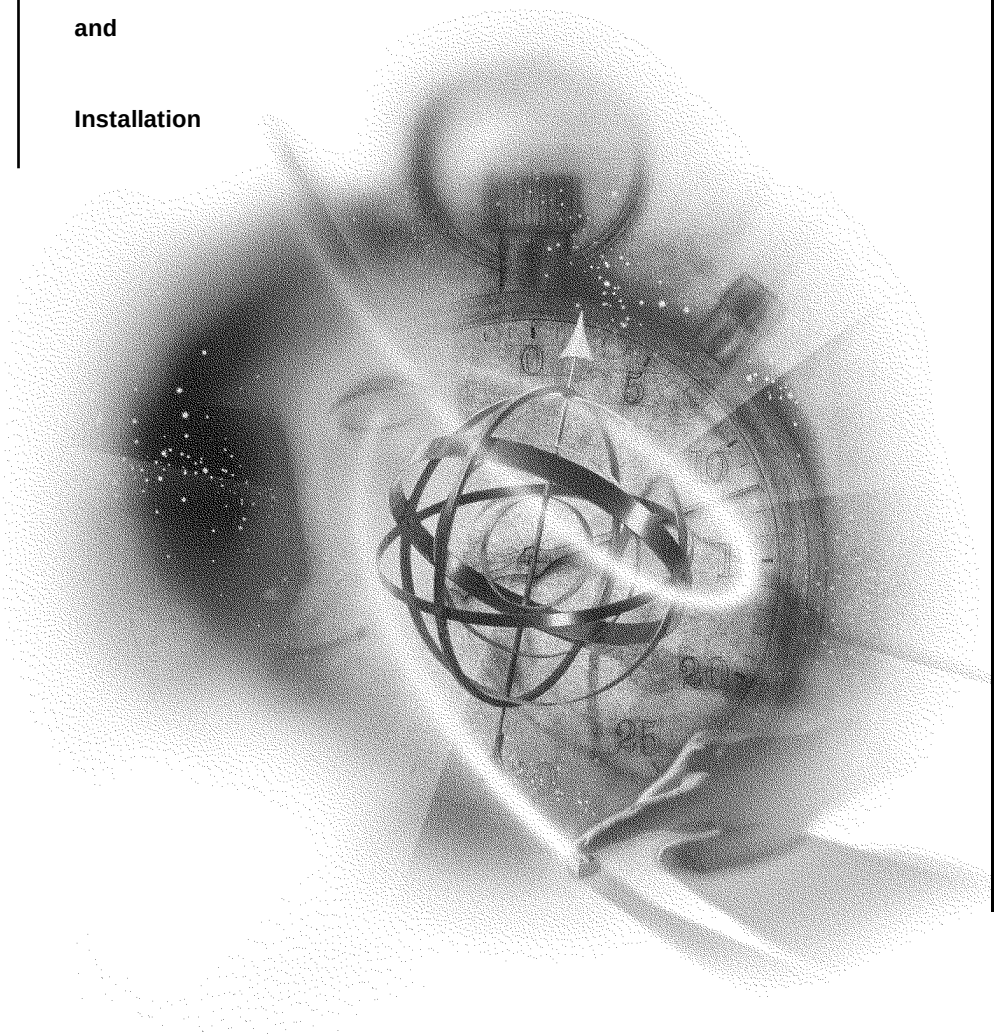
VERSION 5

# Overview and Installation



NetWare® 5™

NETWORK SOFTWARE

Novell®

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**Novell, Inc.**
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**U.S.A.**

**Overview and Installation**
**July 1998**
**100-004245-001**

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# Welcome to NetWare 5

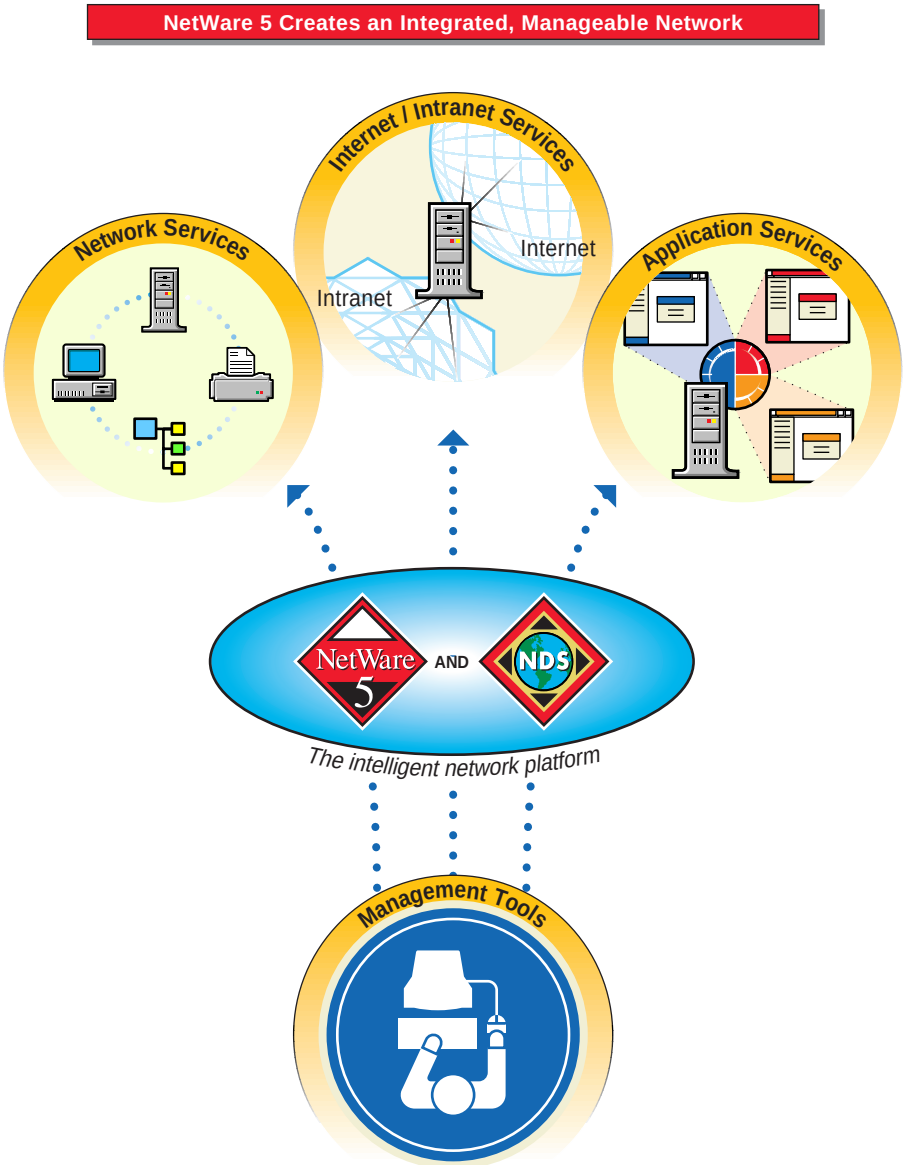
NetWare® 5 is the #1 network for Internet-enabled businesses.

NetWare 5™ turns a server-class PC into a high-performance network server, providing connectivity among personal computers, printers, mass storage devices, and other networks such as the Internet.

We have designed and created NetWare 5 to give you superior management and control of your entire heterogeneous network, and have included

- The industry's leading directory-based (NDS™) management tools that let you control everything from your workstation with the click of a mouse.
- The world's fastest, safest, and most efficient Internet/intranet access services.
- Robust and scalable application support, including the industry's top-performing Java* application development and deployment environment.
- Next generation, scalable, proven networking services.

Whether your network has a single NetWare 5 server or thousands of NetWare, NT, and UNIX* servers located at sites around the world, NetWare 5 has everything you need to create an integrated, manageable network.


NetWare 5 Creates an Integrated, Manageable Network
Internet / Intranet Services
Internet
Intranet
Network Services
Application Services
NetWare 5
AND
NDS
The intelligent network platform
Management Tools

# NetWare 5 Component Overview

If you already have a network, our goal is to ensure that you can implement NetWare 5 on your existing infrastructure.

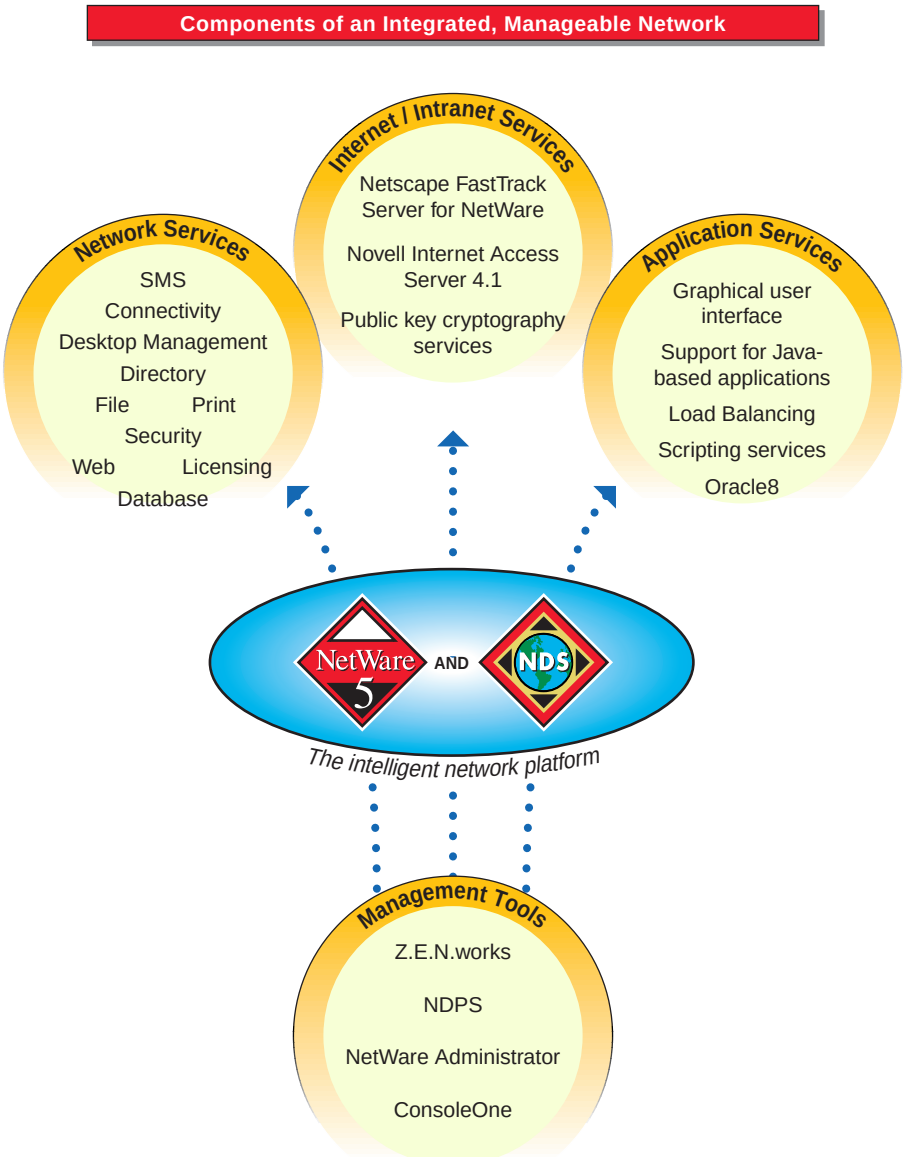
If you are creating a new network, we have provided everything you need.

In either case, we know you will discover tremendous value in the exciting new features of NetWare 5, such as

- **The Z.E.N.works™ Starter Pack** to let you configure, update, and maintain network workstations without leaving your desk.
- **NetWare over pure IP** with the most innovative and powerful IP network management tools in the industry.
- **Novell® Storage Services™ (NSS)** to simplify file services and storage administration, to improve file access speed dramatically, and to expand your server storage capacity—both file size and number of files—exponentially.
- **Novell Distributed Print Services™ (NDPS™)** to streamline and simplify network print services administration.

As you read this overview, you will see that these are only a few examples.

The following illustration shows how various NetWare 5 product components and services support the creation of an integrated, manageable network.


Components of an Integrated, Manageable Network
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Load Balancing
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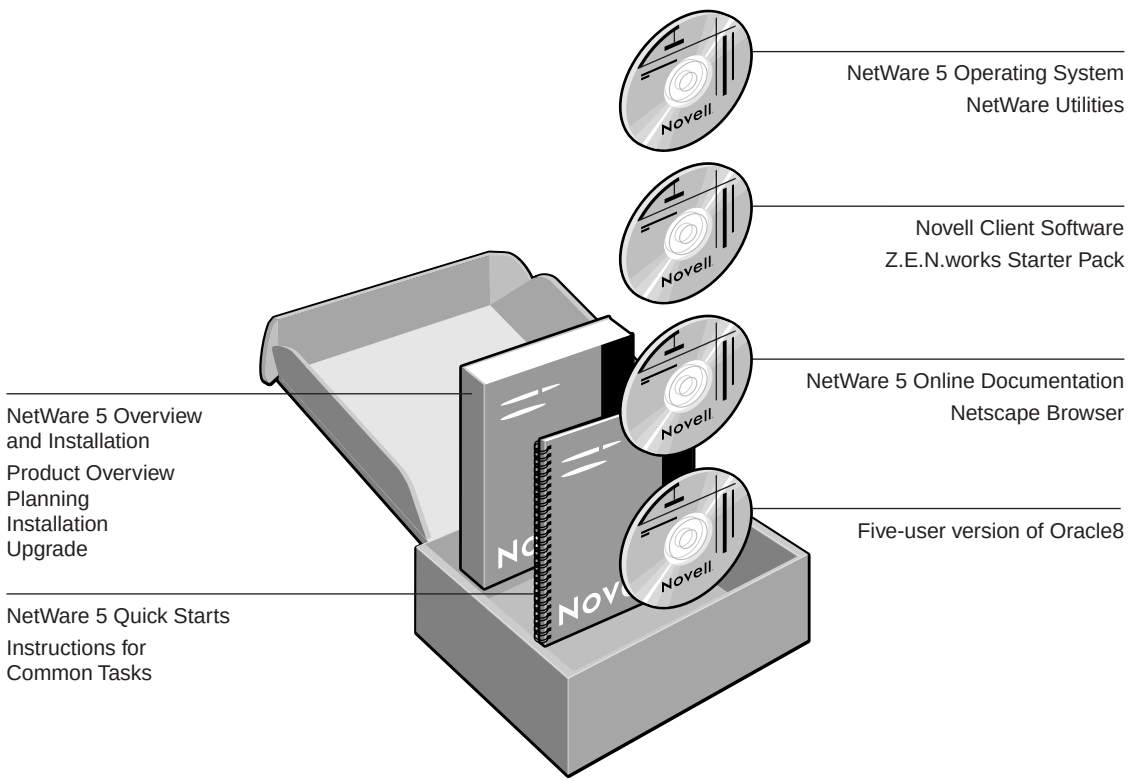
Oracle8
NetWare 5
AND
NDS
The intelligent network platform
Management Tools
Z.E.N.works
NDPS
NetWare Administrator
ConsoleOne

If you are new to NetWare, you will soon understand why it is the network of choice for network professionals world wide. If you are familiar with earlier versions of NetWare, you'll be very pleased with the enhancements and added power in NetWare 5.

As you experience the power and intelligence NetWare 5 brings to your network, we think you will agree with us that NetWare 5 delivers the most benefits at the lowest cost, providing the highest Total Value Networking™ available.

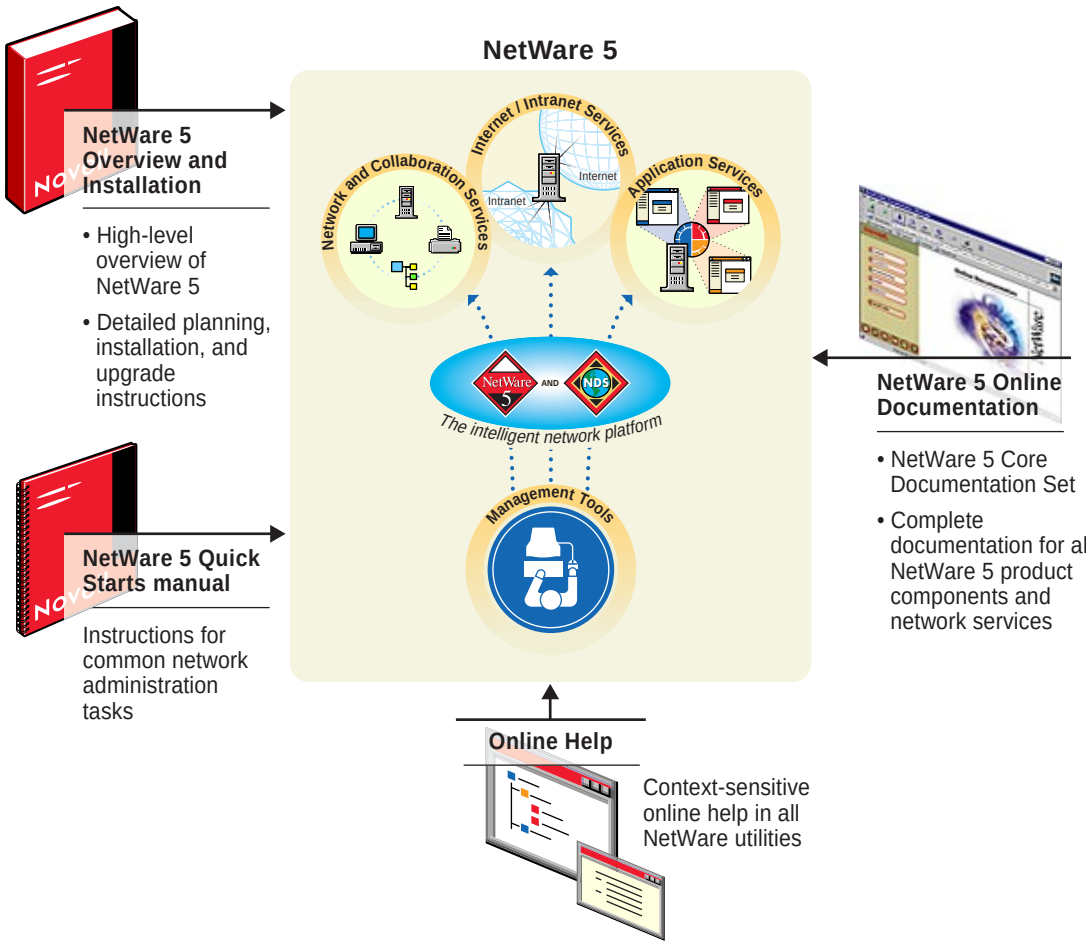
## NetWare 5 Package Components

The NetWare 5 product package contains the following physical components and software. If you like, take a moment to become more familiar with each component before reading on.



# About NetWare 5 Documentation

NetWare 5 includes various types of documentation to support you in your network administration tasks.




NetWare 5 Online Documentation and any relevant corrections or updates are also available at http://www.novell.com/documentation.

If you have specific tasks in mind as you begin to use NetWare 5, refer to the following chart for pointers to relevant documentation.

| If you want to | Refer to |
| --- | --- |
| Get a “big picture” understanding of NetWare 5 and assess how it fits your requirements | Chapters 1 and 2 of this manual. |
| Read about NetWare 5 product details | The Understanding sections in the NetWare 5 online documentation. |
| Plan your NetWare 5 network | Chapter 3, “Server Basics,” on page 73. |
| Install your NetWare 5 network using minimal instructions | The NetWare 5 Quick Starts. |
| Install your NetWare 5 network using detailed instructions | Chapter 4, “Installing a NetWare 5 Server,” on page 103. |
| Plan an upgrade to NetWare 5 | Chapter 3, “Server Basics,” on page 73. |
| Upgrade to NetWare 5 using minimal instructions | The NetWare 5 Quick Starts. |
| Upgrade to NetWare 5 using detailed instructions | Chapter 6, “Upgrading an Existing Server to NetWare 5,” on page 169.<br>Chapter 7, “Moving Bindery Objects and Files to NDS,” on page 197. |
| Install Novell Client™ software | Chapter 8, “Installing Novell Clients,” on page 209. |
| Install and use NetWare 5 online documentation | The NetWare 5 Quick Starts. |
| Set up NetWare 5 network services | The relevant Setting Up sections in the NetWare 5 online documentation. |
| Use NetWare 5 network services | The relevant Managing sections in the NetWare 5 online documentation. |
| Tune or optimize NetWare 5 network services | The relevant Optimizing sections in the NetWare 5 online documentation. |
| Troubleshoot NetWare 5 network services | The Troubleshooting button on the NetWare 5 online documentation home page. |

| If you want to | Refer to |
| --- | --- |
| Learn about a specific command or utility | The Reference button on the NetWare 5 online documentation home page. Click Utilities Reference. |
| Look up definitions for NetWare 5 terms | The Reference button on the NetWare 5 online documentation home page. Click Glossary. |
| Resolve an error code or system message | The Reference button on the NetWare 5 online documentation home page. See links under Error Codes and System Messages. |

# User Comments

We want to hear your comments and suggestions about this manual and the other documentation included with NetWare 5.

Some things we would like to know are

- Does each component fill its purpose as stated in the previous section?
- Is the information complete?
- Is it readable?
- Does the organization and format make sense to you?
- Is the information accurate?
- Are the examples and illustrations helpful?

To contact us, click the envelope button on the lower left of the NetWare 5 online documentation, or send your comments to

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part

# Overview

The following two chapters are written for new network administrators and others who are interested in gaining a high-level understanding of NetWare® 5 and its capabilities.

- Chapter 1, “Network Platforms,” on page 3, contains information about the NetWare 5™ server and the Novell® Client™ software included in the NetWare 5 product package.

- Chapter 2, “Network Services,” on page 17, contains an overview of the network services included in NetWare 5.

Instructions for installing NetWare 5 are contained in Part II and begin with Chapter 3, “Server Basics,” on page 73.

chapter 1

# Network Platforms

Every NetWare® 5 network, whether part of a small business or an international enterprise, consists of at least two fundamental network components:

- NetWare 5™ servers.
- Network workstations running Novell® Client software.

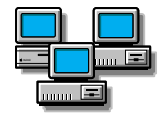
The functions of these components are summarized in the following graphic.

**The NetWare 5 server**

Provides connectivity among personal computers, printers, mass storage devices, and other networks such as the Internet.

Delivers the world's most powerful network services.

**Novell Client software**



Provides network workstations with connectivity to the network and access to NetWare 5 network services.

Lays the foundation for centralized workstation management by network administrators.

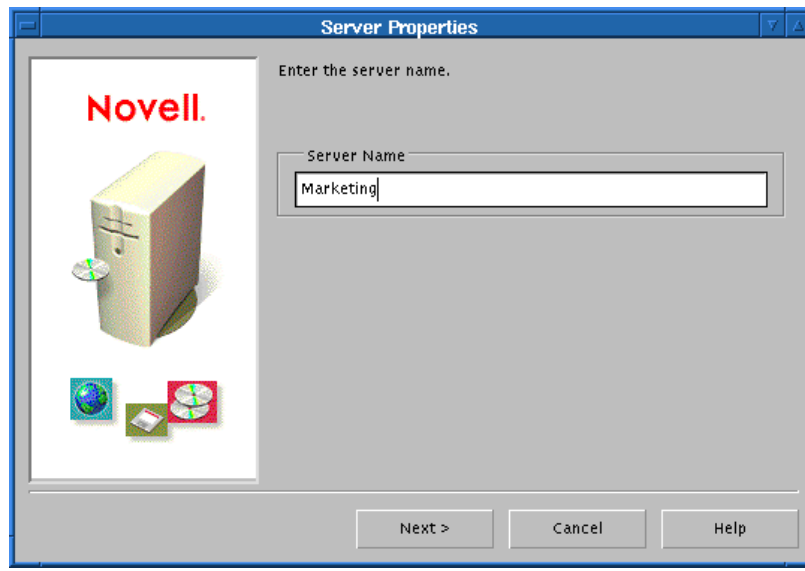
This chapter introduces exciting NetWare 5 and Novell Client features that can help you obtain maximum performance and benefit from your NetWare 5 network. For more information on optimizing servers and clients, see the NetWare 5 online documentation.

# NetWare 5 Servers

This section presents overviews of NetWare 5 server features. For an overview of Novell Client™ software, see “Novell Clients” on page 15.

## Installing NetWare 5

NetWare 5 includes a new graphical, Java*-based installation utility.




This utility guides you through installing a NetWare 5 server.

The NetWare 5 installation wizard autodetects the server’s hardware and network environment and presents you with default options for each installation choice. If you accept these defaults, your network will be installed, up and running with very little effort on your part.

You can also customize many aspects of the installation to ensure that your NetWare 5 server—and the network it supports—match your business and operational requirements.

Instructions for planning your network are found in Chapter 3, “Server Basics,” on page 73. For NetWare 5 server hardware and software requirements, see “Meet System and Software Requirements” on page 104.

## Upgrading to NetWare 5

If you are upgrading to NetWare 5, you will find everything you need to make your upgrade as smooth as possible.

- The Upgrade option in the NetWare 5 installation wizard lets you retain your current data (whether NDS™ or bindery and file system) on the existing hardware.
- The Novell Upgrade Wizard is a separate utility that lets you migrate your bindery and file system data to new hardware.

Both upgrade options convert bindery data to NDS automatically.

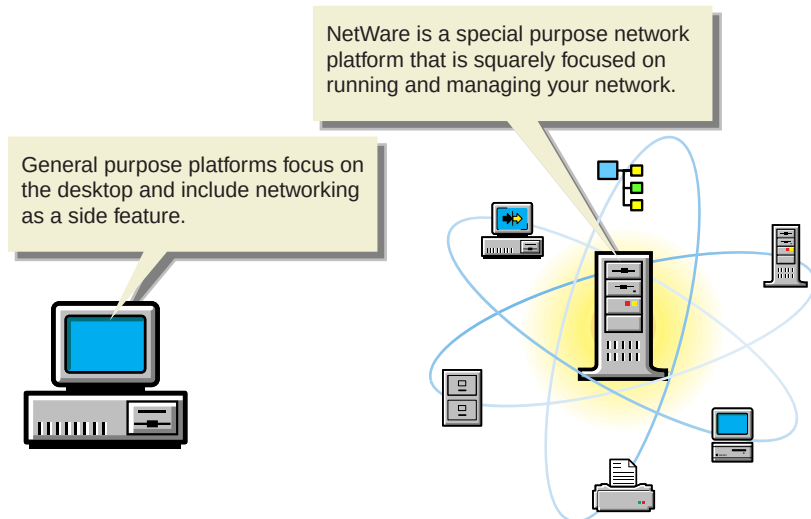
To begin planning for an upgrade, see Chapter 3, “Server Basics,” on page 73.

## The NetWare 5 Network Platform

Today's business climate demands optimal use of all resources. Independent researchers consistently conclude that, overall, NetWare delivers much more and costs much less to operate and maintain than other network platforms.

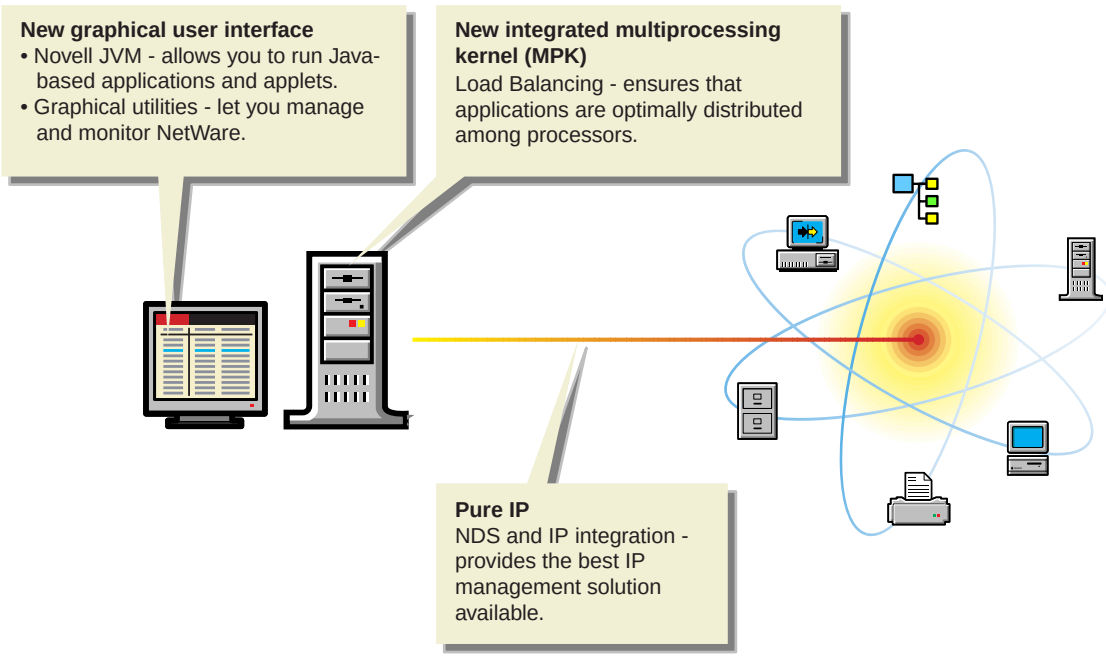
Other "network" platforms are actually general purpose operating systems that include networking as a feature. However, their primary focus is on the desktop. For this reason, they lack the robustness and power of NetWare.

Only NetWare is fully dedicated to running and managing your network.



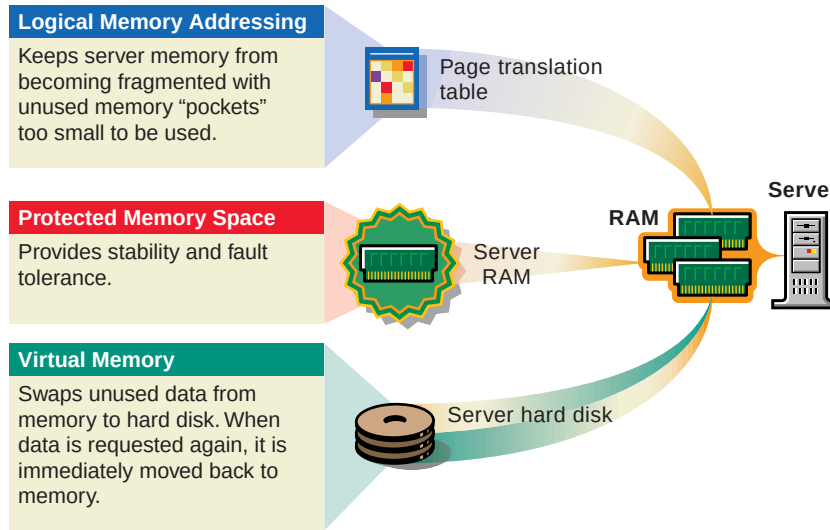
## New Features of the NetWare 5 Server

The NetWare 5 server includes powerful and important new features as shown in the following illustration:



## NetWare 5 Server Memory

NetWare 5 has important new memory management features as shown in the following illustration.




NetWare 5 can address up to 4 GB of RAM.

Memory management is a critical aspect of ensuring optimal server performance. See Chapter 3, "Server Basics," on page 73 for help in determining optimal memory amounts for your NetWare 5 servers. For further information and help with optimizing server memory and other memory management tasks, refer to Contents > NetWare Server Documentation > *NetWare Server Memory* in the NetWare 5 online documentation.

## NetWare 5 Server Security

NetWare 5 security features help protect the server. See Contents > NetWare Server Documentation > *NetWare Server Security* in the NetWare 5 online documentation for help in planning for your server's safety and security.

## Server Communications

Network communication protocols must accommodate four basic requirements:

- **Addressing.** Just as postal services are unable to deliver a package without an address, computers are unable to communicate with each other unless each has a unique address.

- **Finding Services.** Sharing services such as printing, e-mail, file services, and so on is the fundamental reason that networks exist. In order to leverage network services, a computer must first know what services are available.

- **Moving Packets.** Optimal network performance demands that data packets are transferred using the most efficient routes possible.

- **Synchronizing with other servers.** NetWare servers coordinate time and NDS replicas to ensure data integrity on the network.

NetWare became the network platform of choice in part because the IPX™ protocol handles the four communication requirements above with very little network administration overhead.

NetWare 5 now offers three communications protocol options: pure IP, IPX, or a combination of the two.

IP networks have traditionally been weak in two areas:

- Addressing has been complex and costly to administer.

- Locating available services has not been efficient.

To provide the ease of administration and lower cost of ownership that network administrators expect from Novell, NetWare 5 includes a pure IP solution that extends native IP functionality and greatly increases the manageability of a pure IP network in the following ways:

- **DHCP integration with NDS.** The well-known Dynamic Host Configuration Protocol enables network administrators to reduce administrative overhead by setting up DHCP servers to distribute IP addresses as computers connect to the network.

NetWare 5 delivers directory-based management of IP addresses, allowing you to manage your DHCP servers and workstation objects through NDS.

- **DNS integration with NDS.** Domain Name Service is a distributed database system that provides hostname-to-IP address mapping. It also supplies mappings to specific hosts for Internet services such as e-mail and Web access. Any computer on the Internet or an intranet can use DNS to locate any other computer on the same network.

  NetWare 5 provides the ability to manage DNS servers through NDS.

- **SLP integration with NDS.** NetWare 5 includes the first implementation of the Service Location Protocol's Directory Agent.

  SLP is the standard for publishing network service availability on an IP network. SLP registers services only in the local area. It assumes that the client will be able to locate global services.

  NetWare 5 integrates the SLP Directory Agent (DA) with NDS and compiles a global listing of all available services.

  Only NetWare 5 offers the SLP-DA feature.

In addition, the NetWare 5 pure IP solution is compatible with all IP networks. NetWare 5 integrates and extends the scope of the Internet Protocol (IP) suite to deliver the most manageable IP solution available.

For further information and help in determining which server communication options best meet your networking needs, see Contents > NetWare Server Documentation > *NetWare Server Communications* in the NetWare 5 online documentation.

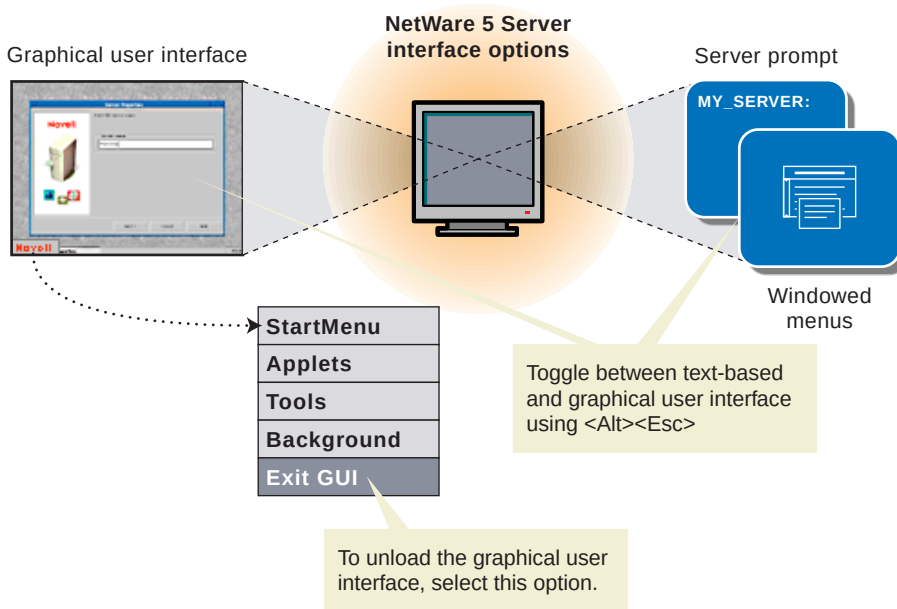
## Server Interface

NetWare 5 servers include multiple interface options:

- Servertop, a new graphical user interface that conforms to the X-Windows standard.
- The traditional NetWare command line prompt for entering console commands and starting menu utilities.

After the server is installed and restarted, the main console screen displays the graphical user interface. You can launch Java-based applications using the Start menu, toggle between various console screens using Alt + Esc, or select a screen by using Ctrl + Esc and then entering a screen number from the list of current screens.

The following illustrates the interface options available in NetWare 5.




For further information regarding features and usage of NetWare 5 server interface options, see Contents > NetWare Server Documentation > “ConsoleOne” in the NetWare 5 online documentation.

## Remote Server Management

You can manage your NetWare 5 network and perform most NetWare console tasks without direct physical access to the server. NetWare 5 includes two utilities for this purpose: DOS-based RCONSOLE, and Java-based RConsoleJ.

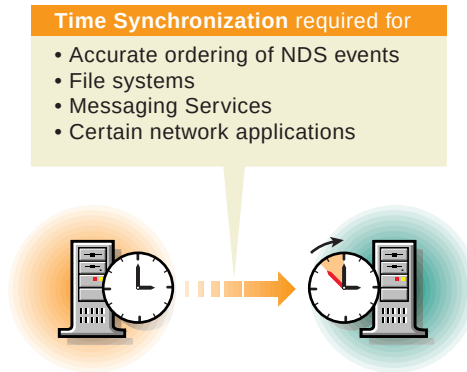
The following table summarizes the functional differences between the two remote server management utilities included in NetWare 5.

| Function | DOS-based RCONSOLE | Java-based RConsoleJ |
|---|---|---|
| Use console commands as you would at the server console | Yes | Yes |
| Scan directories and edit text files in NetWare and DOS partitions on a server (using edit.nlm) | Yes | Yes |
| Transfer files to, but not from, a server | Yes | No |
| Control the server using an IP connection | No | Yes |
| Control the server from another server | No | Yes |
| Stop or start a server | Yes | Yes |
| Install or upgrade NetWare | Yes | No |

See Contents > NetWare Server Documentation > *Remote Server Management* in the NetWare 5 online documentation for details on remote server management.

## NetWare 5 Time Management

Novell's directory service—NDS—requires that all internal clocks on all servers in an NDS tree be synchronized so that updates to objects on the tree can be ordered correctly. Time synchronization also affects other system functions as illustrated in the following graphic.




NetWare 5 provides the following time synchronization components:

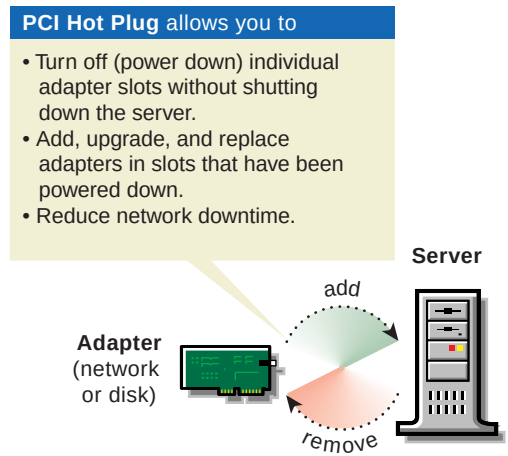
- NTP to obtain authoritative time from an Internet time source.
- TimeSync to synchronize time within a NetWare network.

If your network requires the use of an Internet time source, you can use NTP with TimeSync to query authoritative time servers using the Internet and to synchronize that time within the NetWare network.

For further information and help with optimizing time synchronization on your network, refer to Contents > *Network Time Management* in the NetWare 5 online documentation.

## Hot Plug Hardware Management

NetWare 5 includes support for computers with PCI Hot Plug capabilities.




The NCMCON utility allows you to view status information on PCI slots and to turn Hot Plug compatible slots off and on.

For further information regarding PCI Hot Plug, refer to Contents > NetWare Server Documentation > *HotPlug Hardware Management* in the NetWare 5 online documentation.

# Novell Clients

Novell Client software allows workstations to connect to the network.

## Client Platforms Supported

NetWare 5 comes with Novell Client software for three client platforms: DOS and Windows* 3.1*x*, Windows 95*, and Windows NT*.


The Novell Client for Windows 95 has also been tested successfully on the Windows 98 platform.

You can set the Novell Clients for Windows 95 and Windows NT to work with one of three network protocol options: IP only, IP and IPX, or IPX only.

The Novell Client for DOS and Windows 3.1*x* supplied with the initial release of NetWare 5 is an IPX application. To run this client on IP-only or mixed protocol networks, you must load

- Scmd.nlm on all IP-only servers, so that the servers are running Compatibility Mode.
- A Migration Agent on a NetWare 5 server on the network.

The Novell Client software delivered with NetWare 5 can be used with earlier versions of NetWare if IPX only or IPX/IP is selected during client installation.

## Installing the Novell Clients

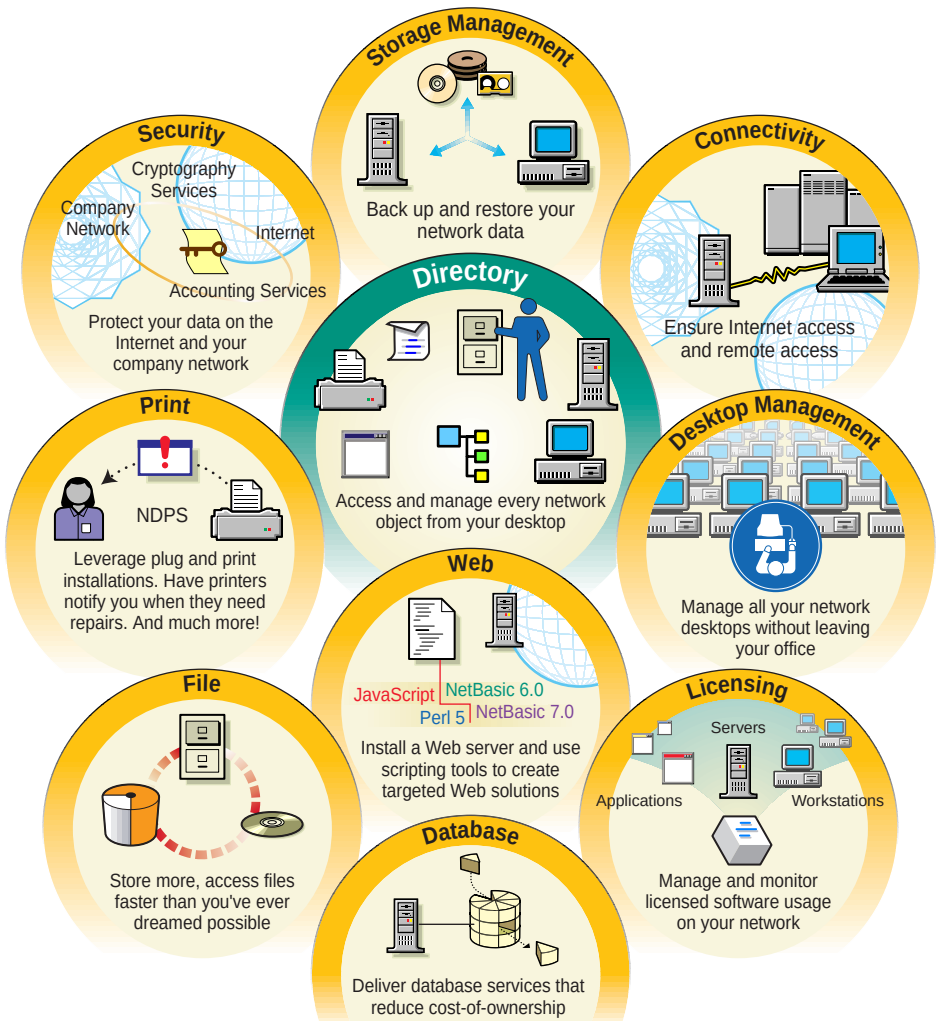
Novell Client installation options allow you to install a single client or multiple clients on multiple platforms.

For further information on installing Novell Client software, see Chapter 8, “Installing Novell Clients,” on page 209.

chapter **2**

# Network Services

Only NetWare 5™ delivers the following powerful network services to help you manage your whole business and contain costs.



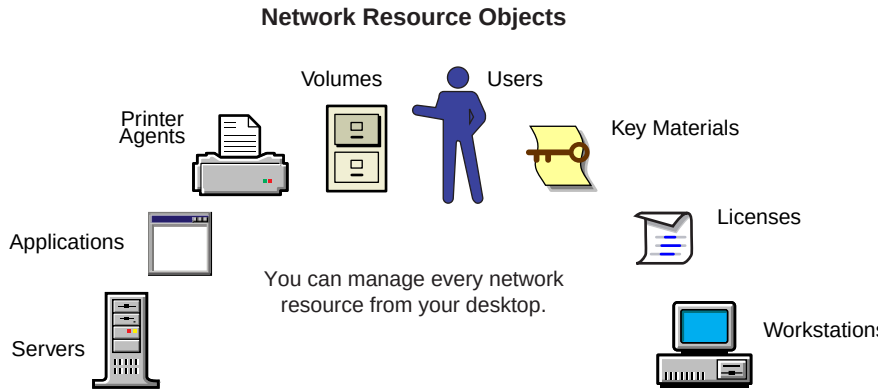
This chapter discusses each network service area shown in the previous graphic and answers the following basic questions:

- What is the service?
- How will it benefit my network users, myself, and my company or organization?
- What do I need to use this service?

# Directory Services

NDS™ is the most mature and powerful directory service available. It is the directory service of choice for large enterprises around the world. It lays the foundation for the powerful management features in NetWare®.

NDS lets you associate network resources with objects in a database. You can then manage each network resource without leaving your desk.




The network resource objects shown above are called “leaf” objects. They are found at the ends of branches in the NDS tree structure.

In contrast to leaf objects, container objects are the branches in the NDS tree structure. They contain leaf objects and other container objects. Container objects create a hierarchy that provides logical access to leaf objects.

## Benefits to Network Users

NDS provides network users a single login to the network. Once they have entered their login name and password and have been authenticated to the network, every network resource to which they have been granted rights is available to them, whether it’s the printer across the aisle or the server on the other side of the world.

Furthermore, if you install Z.E.N.works, users’ network and desktop environment settings are stored in NDS and are used to re-create their working environment wherever they log in to the network.

And if you are leveraging the power of Novell® Distributed Print Services™, network users can have bidirectional communications with network printers to which you have granted them access. See “Print Services” on page 29 for details.

## Benefits to You and Your Organization

NDS is the foundation upon which Novell’s suite of network management tools is built. NetWare 5 includes a number of powerful NDS-integrated management tools. For example,

- If you need to optimize WAN traffic, use WAN Traffic Manager to control the flow of NDS synchronization traffic across WAN links.

- If you need faster access to specific NDS information that exists on more than one partition, or if you need to speed up access to NDS object information located across WAN links, use Catalog Services to create and automatically update a local catalog of frequently accessed NDS objects.

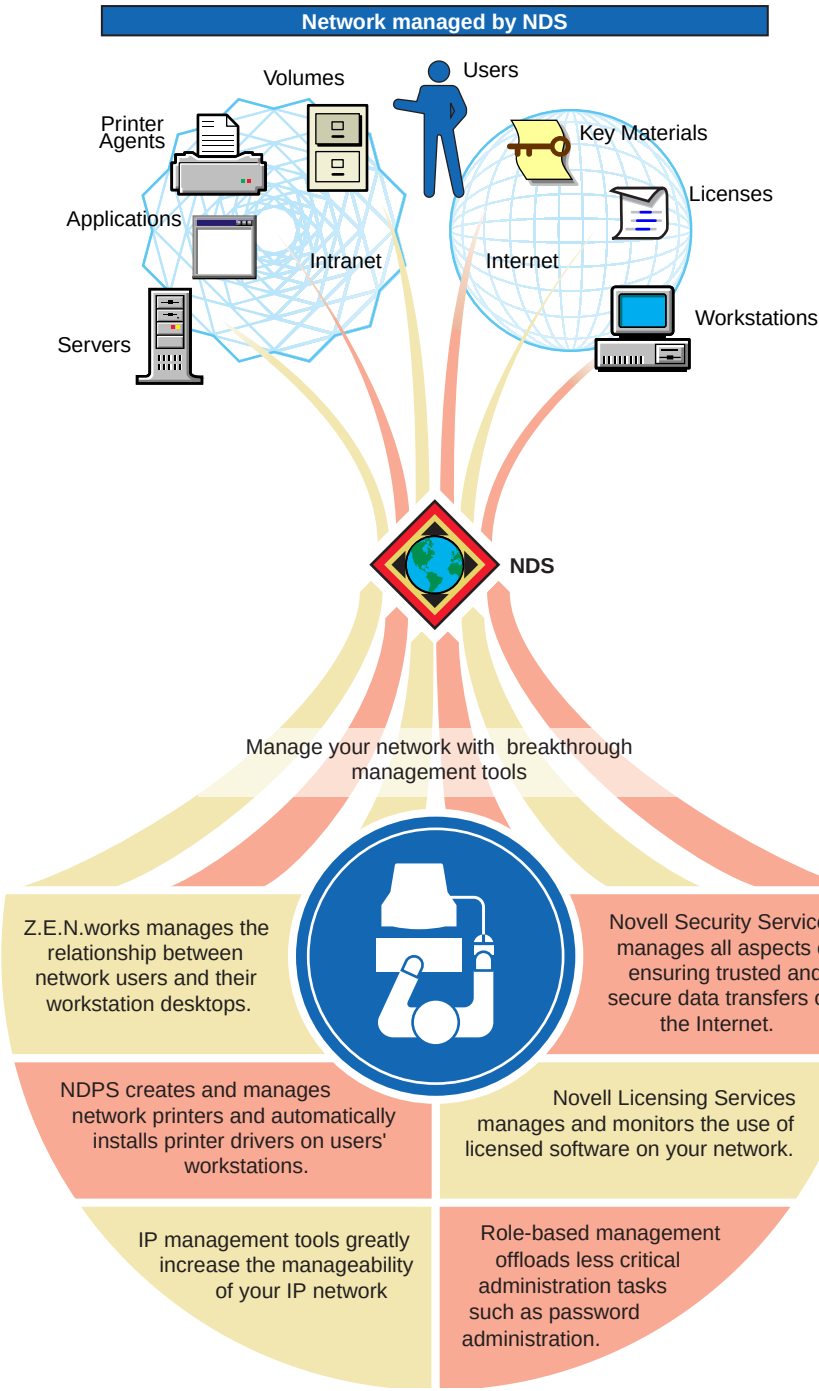
As you work with NDS, you will discover ways to leverage the network resource information stored in it. For example, you might decide to store network user or workstation information in NDS, publish it on your intranet, and allow network users to keep it current using their Web browsers and LDAP Services for NDS.

Other Novell products also leverage the power of NDS.

- If you have NT application servers on your network, consider using NDS for NT. This will save you the time and expense of managing trust relationships and pass-through authentication among domains.

- If you want to manage e-mail access and work flow from within NDS, consider the features and power of GroupWise®, yet another award-winning application from Novell.

Above all, be sure to take advantage of breakthrough NDS-integrated management tools and NDS features included in NetWare 5, as shown in the following illustration.


Network managed by NDS
Volumes
Users
Printer Agents
Key Materials
Licenses
Applications
Intranet
Internet
Workstations
Servers
NDS
Manage your network with breakthrough management tools
Z.E.N.works manages the relationship between network users and their workstation desktops.
Novell Security Services manages all aspects of ensuring trusted and secure data transfers on the Internet.
NDPS creates and manages network printers and automatically installs printer drivers on users' workstations.
Novell Licensing Services manages and monitors the use of licensed software on your network.
IP management tools greatly increase the manageability of your IP network
Role-based management offloads less critical administration tasks such as password administration.

## Requirements for Using NDS

NDS is tightly integrated and installed with the NetWare 5 server.

Each NetWare 5 server installation requires you to make decisions regarding your configuration of NDS. If your network will have fewer than 1,000 objects (users and resources), you can accept the default settings provided by the installation utility.

If you have a large network or are upgrading from a version of NetWare prior to NetWare 4™, you will want to read more about installing and optimizing NDS. The Installation section of this manual contains basic guidelines and issues to consider.

In addition, see Contents > “Directory Services” in your NetWare 5 online documentation for details regarding all aspects of NDS.

# Desktop Management Services

NetWare 5 includes the Z.E.N.works™ Starter Pack to let you manage the workstation environments on your network without leaving your office.

This section presents an overview of the Starter Pack and provides a brief summary of additional features in the full Z.E.N.works product, which is available separately.

## About the Z.E.N.works Starter Pack

Z.E.N.works is an integrated set of technologies that let you

- Manage workstations and user desktops on your network.
- Deliver to your network users an easy-to-use, reliable network system that ensures and maintains application integrity.
- Substantially reduce the cost of ownership for every workstation on your network.

Novell has expanded the NDS schema to store key network workstation management information in the NDS database. NDS now includes

- A Workstation object that transforms your network workstations into network resources that you can manage individually from one central location.
- A Workstation Group object so you can manage groups of workstations.

One of the far-reaching implications of these enhancements is that you can now create a “digital persona” for each network user.

A digital persona is the workstation configuration, desktop policy, application usage information, and individual user preference information associated with each user. You can create digital personas and store them in NDS if you install the Z.E.N.works Starter Pack.

## Benefits to Network Users

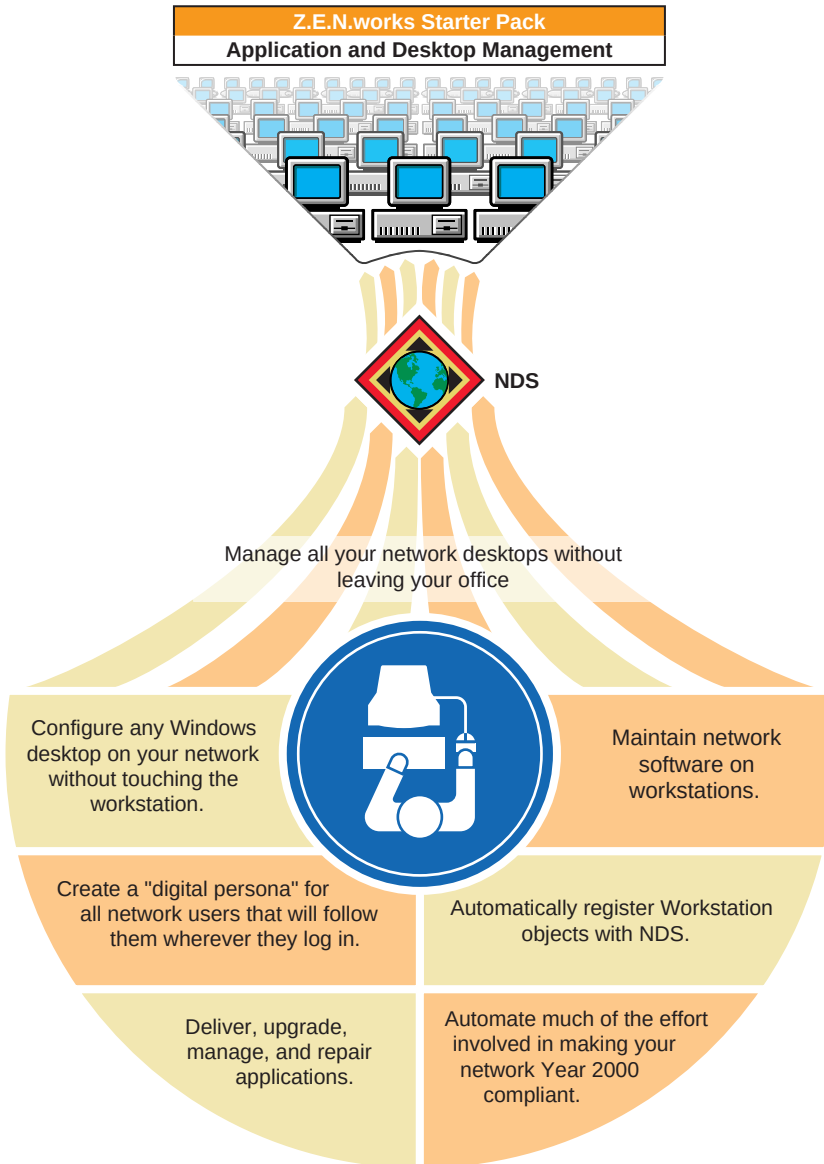
If users travel to other company sites or need to log in to the network from a different workstation for whatever reason, their “digital persona” is downloaded, and they can work exactly as they would at their regular desks.

Z.E.N.works allows network users to concentrate on their “real” work rather than on desktop management. Software upgrades happen automatically when scheduled. Users simply log in to the network. Everything else is automatic.

## Benefits to You

Because Z.E.N.works simplifies and speeds up network administration tasks, you will save time and your company or organization will save money.

The following illustration shows sample tasks that Z.E.N.works allows you to perform from your administrative workstation.


Z.E.N.works Starter Pack
Application and Desktop Management
NDS
Manage all your network desktops without leaving your office
Configure any Windows desktop on your network without touching the workstation.
Maintain network software on workstations.
Create a "digital persona" for all network users that will follow them wherever they log in.
Automatically register Workstation objects with NDS.
Deliver, upgrade, manage, and repair applications.
Automate much of the effort involved in making your network Year 2000 compliant.

## Savings to Your Organization

Z.E.N.works' primary goal is to reduce costs associated with owning and managing networked workstations. Consider the following statistics:

- Industry analysts estimate that 78% of network costs are associated with desktop maintenance.
- Independent research inside U.S. companies places the maintenance cost for each desktop at just under $4,000 per year.
- It is estimated that business PC users spend 27 minutes a day configuring and maintaining their computers.

Z.E.N.works dramatically reduces costs through simplifying or completely eliminating common desktop management tasks.

The following table provides a few typical examples of Z.E.N.works benefits that could translate into big cost savings for your company.

**Table 2-1**
**Solutions to Common Network User Problems**

| Network User Problem | Solution under Z.E.N.works |
|---|---|
| A user accidentally erases files that are part of a critical application. The problem isn't discovered until the application is needed. | When the user launches the application, the system asks if it should "verify" the application. If the answer is "yes," the system "heals" the application automatically by restoring needed files. |
| You need to create NDS Workstation objects for 10 new workstations at another company site. You also need to configure these workstations with applications, access to printers, etc. | When users log in to the network using new workstations with Z.E.N.works client software installed, the workstations are registered with NDS. You then import the workstations to create new Workstation objects and configure these objects from your administrative workstation. The next time users log in to the network, their environments are configured as you have specified. |
| Three network users share the same workstation at different times during the week. The time they spend setting preferences each time they log in decreases productivity. | You create a "digital persona" for each user. When the users log in, they get the environment that is properly customized for their needs. |

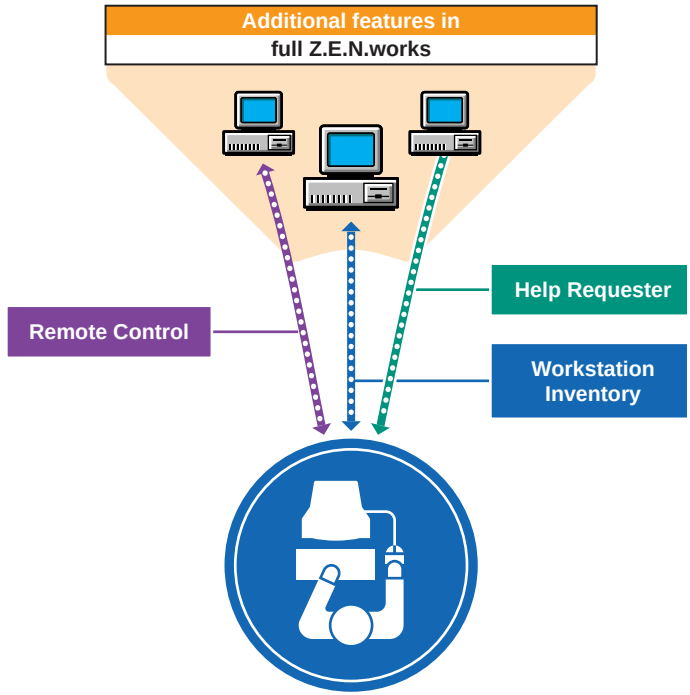
**Table 2-1**
**Solutions to Common Network User Problems**

| Network User Problem | Solution under Z.E.N.works |
|---|---|
| Twelve months after you install NetWare 5, Novell releases new Novell Client software. You need to upgrade hundreds of workstations on your network. | You schedule a single event that will download new client software to each workstation as each user logs in to the network. |

## About Full Z.E.N.works

The full Z.E.N.works product, available separately, includes all Starter Pack functionality and the following features:

- Remote Control allows you to remotely operate any Windows* workstation for repair or diagnostic purposes.
- Help Requester allows you to set up an e-mail based "trouble ticket" system for users to report workstation problems with the click of a mouse.
- Workstation Inventory lets you schedule when workstations send updated hardware inventory to their Workstation objects in NDS.




For further information, contact your Novell Authorized Reseller℠ representative or visit Novell's Internet site at www.novell.com and search for references to "ZEN". (To accommodate the search engine, leave the periods out.)

## Requirements for Using Z.E.N.works

To install the Z.E.N.works Starter Pack you need

- NetWare 4.11 or a later version running on the server
- The Novell Client for Windows 95* or Novell Client for Windows NT* included with NetWare 5
- Approximately 205 MB of free disk space—or 70 MB if you don't copy the Novell Clients to the server's sys volume
- The 32-bit NetWare Administrator utility (nwadmn32.exe)

# Print Services

Novell Distributed Print Services™ (NDPS) is the default and preferred print system in NetWare 5. NDPS™ supports IP-based as well as IPX-based printing.

Novell's legacy, queue-based print system is also fully supported in NetWare 5, allowing users to print as they always have until you complete the transition to NDPS.


This section contains only a brief overview of NetWare 5 print services. We urge you to view the "Multimedia Introduction to NDPS" and related links located in your NetWare 5 online documentation.

## About Novell Distributed Print Services

NDPS was designed to manage modern, networked printers and to exploit the new functionality they offer. As a result, NDPS will greatly reduce your network printing management costs by providing

- Centralized, simplified, single-point administration for all your network printing resources
- Bidirectional, real-time communication between administrators/users and the printer regarding printer or job status
- Configurable event notification
- Tight integration with NDS
- Tight integration with management features of printer hardware
- Automatic printer driver download and installation
- Support for existing printers and other output devices
- Compatibility with non-Novell clients and platforms

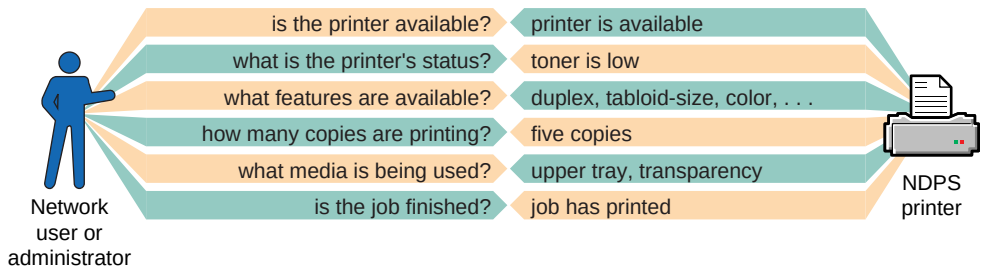
## NDPS Benefits to Network Users

With NDPS, when a user installs a printer, the printer driver is automatically downloaded and configured.

NDPS also allows network administrators to designate printers to be installed automatically when users log in to the network.

NDPS offers bidirectional communication with network printers from client workstations. Users can

- Inquire about the real-time status of a print job, the availability of a printer, or a printer's capabilities and current configuration.
- Give special instructions regarding print jobs they submit.
- Request that the printer notify them when specific events occur.




## NDPS Benefits to You and Your Organization

The following features will save you time.

| NDPS Feature | Explanation |
|---|---|
| Bidirectional Communication | Clients and printers exchange real-time information such as job and printer status, printer features and configuration properties, job hold and scheduling information, and copies being printed. |

| NDPS Feature | Explanation |
|---|---|
| Streamlined Printer Creation | You need only attach the printer to the network, create an NDS Printer Agent, and grant access to network users. Some third-party gateways and embedded solutions provide automatic plug and print functionality. |
| Automatic Printer Driver Download and Installation | NDPS provides a printer driver database from which drivers can be downloaded and installed to workstations automatically. You can also add drivers to the database. |
| Remote Management via NetWare Administrator | Through NetWare Administrator, you can manage all printing resources as controlled NDS objects, or you can maintain certain printers as public access printers available to everyone. |
| Configurable Event Notification | You specify who should be notified of a problem or event and how (pop-up message, e-mail, log file record, or a third party mechanism such as beeper notification).<br><br>This includes notification of real time printer status such as paper mis-feeds. Some vendors even provide animated graphics of their printers to ease remote troubleshooting. |

## Requirements for Using NDPS

There are no hardware requirements to consider when evaluating the benefits of NDPS. There are, however, some planning issues to understand as explained in the following sections.

### Printer Access Options

Any printer, regardless of its hardware type or connection mode, can be configured as either a controlled access printer or a public access printer.

The following table compares the two access methods.

**Table 2-2**
**Differences between Controlled Access Printers and Public Access Printers**

| Issue | Controlled Access Printers | Public Access Printers |
|---|---|---|
| Integration with NDS | Associated as an NDS Printer object. | Not associated as an NDS Printer object. |
| Availability | Available to network users through NDS rights. | Available to everyone on the network. Can be made automatically available through third-party gateways or embedded solutions. |
| Administration | Created and administered through NetWare Administrator as NDS objects. | Require minimal administrative action. Managed through the Tools menu of NetWare Administrator. |
| Network security | Full range of network security options through NDS. | No network security. |
| Event notification | Full range of event and status notification options including e-mail, pop-up windows, event logs, and third-party methods, such as beepers and faxes. | Provide only job event notification. |

### Protocol Support

NDPS is protocol independent. It can be used in an IPX-based environment, a pure IP environment, or a combination of both. Third-party gateways being developed to work with NDPS are also protocol independent.

### Compatibility Issues

NetWare 5 provides an enhanced client to take full advantage of NDPS features. Clients that are not NDPS-aware can print to NDPS printers but can't take advantage of all NDPS features.

NDPS is fully compatible with all types of printers, whether or not they have been configured to take advantage of the advanced features NDPS offers.

NDPS backward compatibility ensures that all of your current printers configured with NPRINTER, queue-based technology, LPR, or RP continue to function just as they always have.

## About Queue-Based Network Printing

The following table compares queue-based print services with NDPS.

**Table 2-3**
**Differences between NDPS and Queue-Based Print Services**

| Task | Queue-Based Print Services | NDPS |
|---|---|---|
| Setting Up | Administrators create and link print queues, printers, and print servers. All three objects are maintained separately. | Administrators create and maintain Printer Agents, allowing users to submit print jobs directly to printers. All management functions are centered on the printer itself. |
| Submitting a print job | Users submit jobs to queues | Users submit jobs to printers |
| Communicating with printers | Communications are one-directional. Event notification is via pop-up windows. | Communications are bidirectional. The only limit is the printer's capability.<br><br>Event notification is configurable, including e-mail, pop-up windows, event logs and third-party methods, such as beepers and faxes. |
| Creating Printers | Administrators must create and configure Printer objects manually.<br><br>Plug-and-print is not available. | For certain printers, administrators need only plug the printer onto the network to create a public-access printer. Any printer can be configured for either public access or controlled access (See Table 2-2, "Differences between Controlled Access Printers and Public Access Printers.") |
| Third Party Enhancements | Does not accommodate add-ons or extensions from third parties. | Has an extensible framework for print devices, including administrative console snap-in interfaces. Several printer vendors have already created custom snap-ins to fully represent the features available with their own devices. |

A detailed overview of the mechanisms involved in queue-based printing is found in Contents > Print Services > *Queue-Based Printing* in the NetWare 5 online documentation.

# Security Services

NetWare 5 security services include the following:

- NetWare Auditing to help you collect and examine records of network transactions to ensure that your server's resources are adequately protected. For more information, see "Auditing" on page 46.
- Public key cryptography services for protecting confidential data transmissions over public communications channels such as the Internet.
- NDS-based tools for managing these public key cryptography services.


The cryptography services available to you in NetWare 5 depend on the country in which your network is located. Cryptography-enabled applications, such as those mentioned in this section, will not function if cryptography services are not fully installed.

To ensure that you have the highest level of NetWare 5 cryptography services available in your area, contact your Novell Authorized Reseller representative.

The next section contains information regarding basic public key cryptography mechanisms. This background information is necessary to understand NetWare 5 cryptography services. If you are already familiar with these concepts, you might want to skip the section. The following table will help you decide where to go from here.

| If you want to | Go to |
|---|---|
| Learn the basic concepts of public key cryptography | "Public Key Cryptography Basics" on page 36 |
| Read about the public key cryptography features and services in NetWare 5 | "Public Key Cryptography in NetWare 5" on page 42 |
| Read about NetWare Auditing | "Auditing" on page 46 |

## Public Key Cryptography Basics

Public key cryptography mechanisms are not familiar to many network administrators. For this reason we have provided this section. Further information is available in Contents > Security Services > "Novell Public Key Infrastructure Services" in your NetWare 5 online documentation.

### The Need for Public Key Cryptography

The content of most Internet communications, such as Web page browsing or public chat forums, can be monitored by anyone equipped to do so. The content of other data transmissions, such as the exchange of credit card information for online purchases, needs to be kept private.

Public key cryptography is a widely used method for keeping data transmissions private and secure on the Internet.

### Secure Transmissions

Data transmissions are private and secure when two things happen:

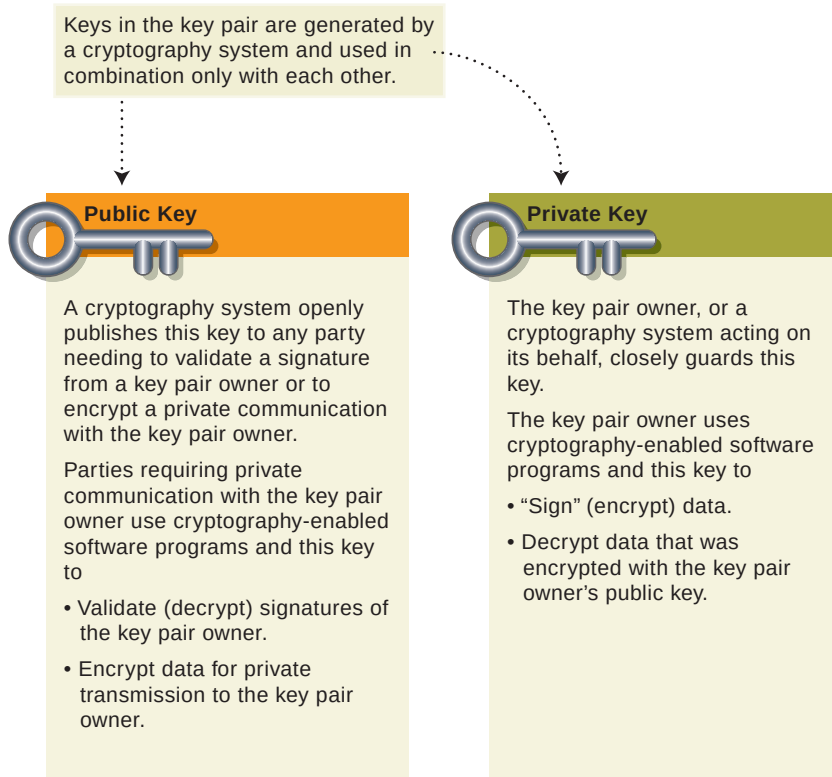
- **Authentication.** The data receiver knows that the data sender is exactly who or what it claims to be.
- **Encryption.** The data sent is encrypted so that it can be read only by the intended receiver.

#### Key Pairs

Authentication and encryption are both provided through the use of mathematically related pairs of digital codes or "keys." One key in each pair is publicly distributed; the other is kept strictly private.

Each data transmitter, whether a person, a software program, or some other entity such as a bank or business, is issued a key pair by a public key cryptography system similar to that included in NetWare 5.

The basic principles and functions of each key in the key pair are summarized in the following illustration.


Keys in the key pair are generated by a cryptography system and used in combination only with each other.
Public Key
A cryptography system openly publishes this key to any party needing to validate a signature from a key pair owner or to encrypt a private communication with the key pair owner.
Parties requiring private communication with the key pair owner use cryptography-enabled software programs and this key to
• Validate (decrypt) signatures of the key pair owner.
• Encrypt data for private transmission to the key pair owner.
Private Key
The key pair owner, or a cryptography system acting on its behalf, closely guards this key.
The key pair owner uses cryptography-enabled software programs and this key to
• “Sign” (encrypt) data.
• Decrypt data that was encrypted with the key pair owner’s public key.

### Key Pairs and Authentication

Authentication means the data receiver knows that the data sender is exactly who or what it claims to be.

Suppose that you want to authorize your bank to transfer funds from your account to another account. The bank needs proof that the message came from you, and that it has not been altered during transit. The following illustrates the process your online transaction would follow using public key cryptography.


**1.** You authorize the transfer using your banking application.

**2.** Your application creates a "digital signature" for the transfer request using your *private* key (which only your application can access).

**3.** The application then sends the request and your digital signature to your bank.

**4.** Your bank's computer receives the request and your digital signature.

**5.** A system operator then validates your signature against the request using your *public* key.

If the results compute correctly, the signature is "authenticated."

If not, the signature, the message, or both are assumed to be fraudulent, and the transaction is denied.

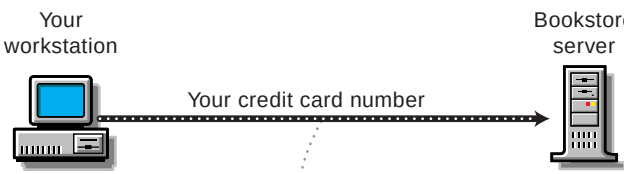
Digital signatures and their verification are further explained beginning with "More About Digital Signatures" on page 41.

### Key Pairs and Encryption

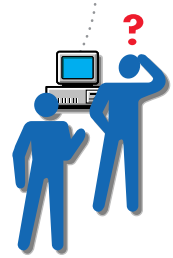
Encryption means that the data can be read only by the intended receiver.

Suppose you want to order a book from an Internet vendor and to use your credit card to pay for it. You don't want your credit card number read by anyone other than the intended recipient.

The encryption process in the following illustration provides the mechanisms through which your credit card number can be safely transmitted.




1. To place your order, you enter your credit card number into the bookstore's application.
2. The application gets the bookstore's public key directly from the bookstore or from a public directory.
3. The application uses this key to encrypt the message containing your credit card number.
4. The application sends the encrypted message to the bookstore server.



Others listening on the communications channel cannot decrypt the message and see your card number because they do not have the bookstore's private key.

5. The bookstore server uses the bookstore's private key to decrypt the message.

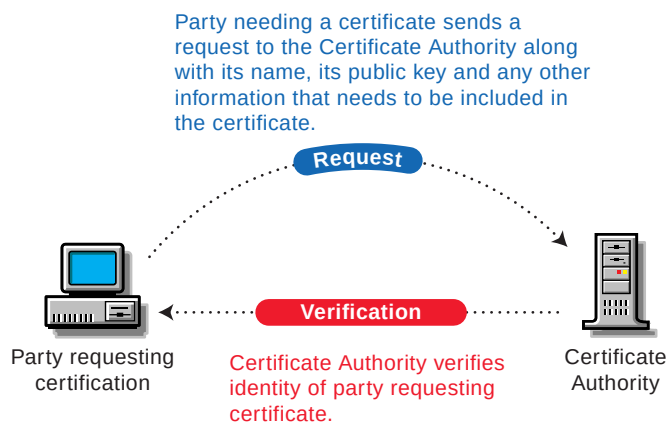
If a sender and receiver know and trust each other, they can simply exchange public keys and establish secure data transmission, including authentication and encryption as just described. To do this they would use each other's public keys and their own private keys.

Under normal circumstances, however, parties needing secure data transmissions have no foundation for trusting the identity of each other. Each needs a third party, whom they both trust, to provide proof of their identity.

### Certificate Authorities

A party needing to prove its identity in a public key cryptography environment enlists the services of a trusted third party known as a Certificate Authority (CA).

The CA's primary purpose is to verify that a party is who or what it claims to be and then to issue a public key certificate for that party to use. The public key certificate verifies that the public key contained in the certificate belongs to the party named in the certificate.

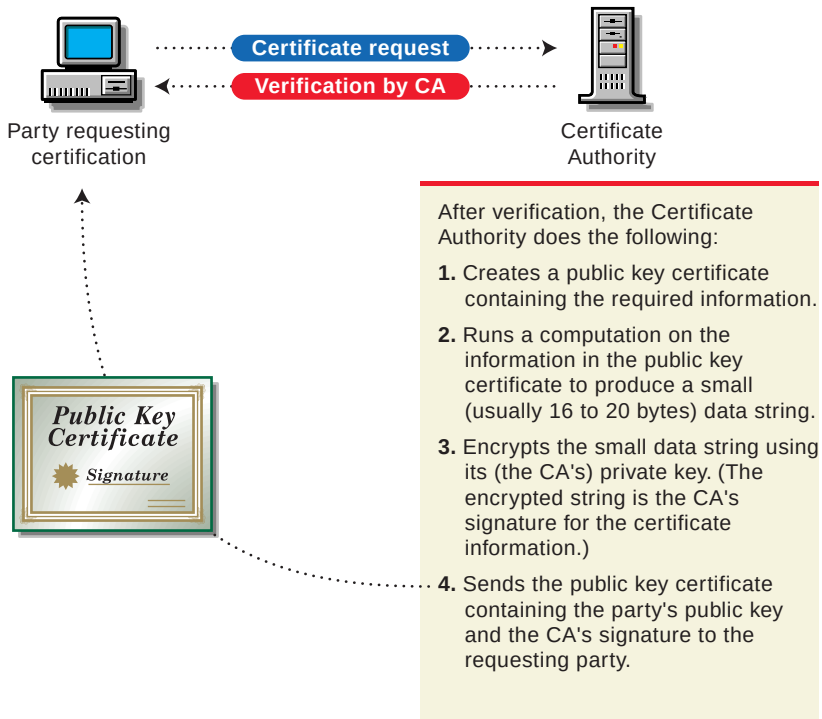



Once the identity of the requesting party has been established to the satisfaction of the CA, the CA issues an electronic "certificate" and applies its digital signature (as shown in the next section).

## More About Digital Signatures

Just as a personal signature applied to a paper document indicates the authenticity of the document, a digital signature indicates the authenticity of electronic data.

To create a digital signature, the software used to create the signature links the data being signed with the private key of the signer. The following illustration shows the process that a CA follows to create its digital signature for a public key certificate.




A digital signature is uniquely linked to the signer and the data. No one else can duplicate the signature because no one else has the signer's private key. In addition, the signer cannot deny having signed the data. This is known as non-repudiation.

When a Certificate Authority signs a public key certificate, it guarantees that it has verified the identity of the public key owner according to the CA's established and published policies.

After signed data (such as a public key certificate) is received, software verifies data authenticity by applying the same computation to the data that the signing software used originally. If the data is unaltered, both computations will produce identical results. It can then be safely assumed that neither the data nor the signature was modified in transit.

## Public Key Cryptography in NetWare 5

### Product Components

The public key cryptography components in NetWare 5 include

- The Novell International Cryptographic Infrastructure or NICI—the underlying cryptographic infrastructure on which NetWare 5 public key cryptography services are built. (See Important information in “” on page 35.)

  Using NetWare Administrator, you request that key pairs be generated for each cryptography-enabled application. NICI fills these requests.

- Novell Public Key Infrastructure (PKI) Services—NetWare Administrator tools for managing the mechanisms and components that provide public key cryptography services in NetWare 5.

  After installing Novell PKI Services, you can use NetWare Administrator to

  - Create an NDS tree CA for your organization.
  - Request public key certificates from the tree CA or from an external CA.
  - Create a Key Material object for each cryptography-enabled application. (Key Material objects are NDS objects that store an application’s public key certificate and encrypted private key.)

- Novell Secure Authentication Services (SAS), which includes support for the Secure Socket Layer (SSL) protocol.

  SSL is a protocol that establishes and maintains secure communications between SSL-enabled servers and clients across the Internet. Novell SAS and SSL are an integral part of LDAP Services for NDS, a cryptography-enabled application included in NetWare 5.

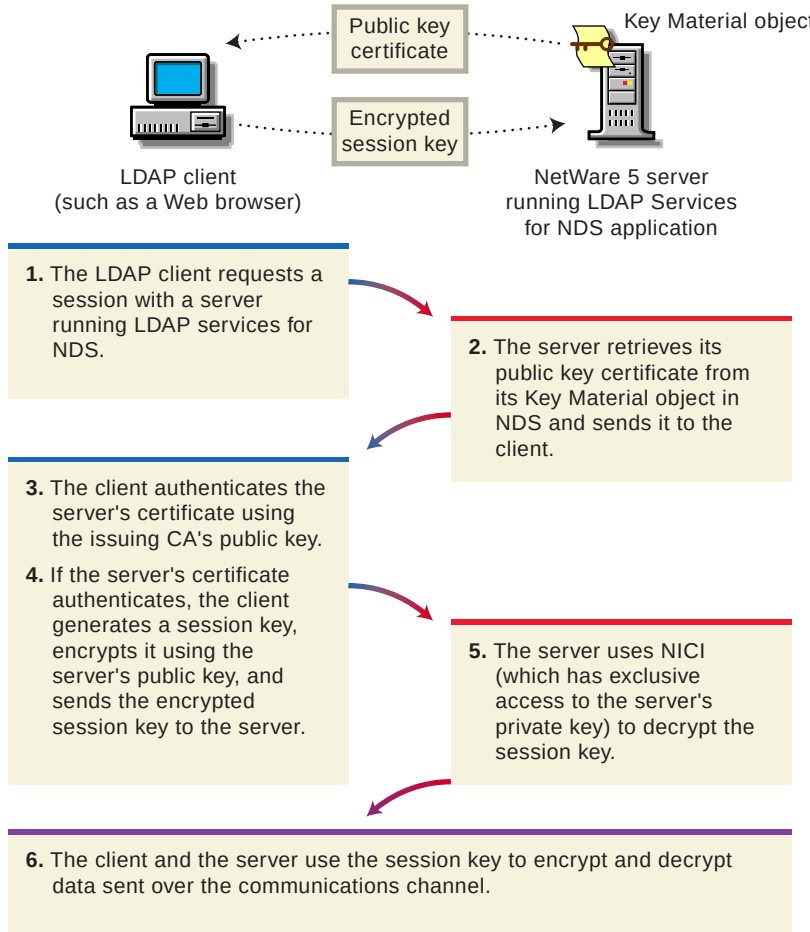
### An Example of Public Key Cryptography in NetWare 5

The Lightweight Directory Access Protocol (LDAP) is an Internet communications protocol that allows client applications (such as a Web browser) to access information, such as telephone numbers and e-mail addresses, stored on LDAP-compliant servers.

NetWare 5 includes LDAP Services for NDS, a server application that allows LDAP clients (such as a Web browser) to access information stored in NDS. Using this application, you can selectively publish information in your NDS tree to Web browsers or other LDAP clients.

LDAP Services for NDS is integrated with Novell SAS, specifically SSL, to provide secure data transmission between an LDAP client and LDAP Services for NDS running on a NetWare 5 server.

The following illustration shows the SSL authentication process involved when an LDAP client establishes a data transmission session with LDAP Services for NDS running on a NetWare 5 server.


Public key certificate
Key Material object
Encrypted session key
LDAP client (such as a Web browser)
NetWare 5 server running LDAP Services for NDS application
1. The LDAP client requests a session with a server running LDAP services for NDS.
2. The server retrieves its public key certificate from its Key Material object in NDS and sends it to the client.
3. The client authenticates the server's certificate using the issuing CA's public key.
4. If the server's certificate authenticates, the client generates a session key, encrypts it using the server's public key, and sends the encrypted session key to the server.
5. The server uses NICI (which has exclusive access to the server's private key) to decrypt the session key.
6. The client and the server use the session key to encrypt and decrypt data sent over the communications channel.

### Benefits to You and Your Organization

Public key cryptography presents unique challenges to you as a network administrator. NetWare 5 helps you meet these challenges as shown in the following table.

**Table 2-4**
**Benefits of Using NetWare 5 to Manage Cryptography**

| Management Need | How NetWare 5 Helps |
|---|---|
| Provide public key cryptography services on your network. | You can create an organizational-specific NDS tree CA within your NDS tree, use the services of an external CA, or use a combination of both as your Certificate Authority needs dictate.<br><br>You can manage all components using the power of NDS. |
| Control the costs associated with obtaining key pairs and managing public key certificates. | NetWare 5 lets you create a tree CA, generate unlimited key pairs, and issue unlimited public key certificates through the NDS tree CA at no charge. |
| Allow public keys and public key certificates to be openly available while also protecting them against tampering. | Key pairs are stored in NDS and can therefore leverage NDS replication and access control features. |
| Allow private keys to be accessible to only the software routines that use them for signing and decrypting operations. | Private keys are encrypted by NICI and made available only to the software routines using them for signing and decrypting operations. |
| Securely back up private keys. | Private keys are encrypted by NICI, stored in NDS, and backed up using standard NDS backup utilities. |

### Requirements for Using NetWare 5 Cryptography Services

You must install the following on all servers in the NDS tree that run applications integrated with NetWare 5 cryptography services:

- Novell Secure Authentication Services (SAS) including SSL
- Novell PKI Services
- NICI Cryptographic Modules appropriate to your locale

After the service components are installed, we recommend you use 32-bit NetWare Administrator (nwadmn32.exe) to set up a tree CA.

You must create and manage a Key Material object in the NDS tree for applications whose secure transmissions you want to manage using Novell PKI Services.

See the NetWare 5 Quick Starts, the NetWare 5 online documentation, and the NetWare Administrator online help for instructions on setting up and using NetWare 5 public key cryptography services.

## Auditing

NetWare 5 includes auditing services that allow you or your organization to collect and examine records of specific network transactions to ensure that your server's resources are being adequately protected.

Businesses and other organizations such as government agencies often contract with independent parties to audit network transactions. These auditors review various events as requested. Generally, auditors are granted rights only to track events and activities, but they cannot open or modify network files (other than audit files).

You enable auditing using the AUDITCON utility. After auditing is enabled, audit data and history files are automatically created for the volumes and containers you specify. Audit files continue to accept records until auditing is disabled or the file becomes full.

For more information regarding NetWare 5 auditing services, see Contents > Security Services > "Auditing the Network" in the NetWare 5 online documentation.

# Licensing Services

Novell Licensing Services (NLS) help you manage and monitor the use of licensed software in your NDS network.

NLS includes Novell's implementation of the LSAPI standard. NLS is designed to help network administrators ensure compliance with software licensing agreements.

Novell Licensing Services is tightly integrated with NDS to facilitate

- The interaction between software and the licenses that allow it to run.
- Your ability to manage that interaction and monitor licensed software usage on your network.

NetWare 5 includes two tools you can use to install software licenses and monitor and manage license usage:

- **NLS Manager**—a stand-alone tool that lets you monitor and manage all aspects of configuring your licensing services, including generating reports on license usage.
- **NLS snap-in**—a NetWare Administrator snap-in that lets you do everything NLS Manager does except generate reports on license usage.


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

## Understanding NLS

You can think of NLS in terms of three basic components: NLS clients, License Service Providers (LSPs), and License container objects in NDS.

### NLS Clients

Ensuring compliance with license agreements requires confirmation of an available license *before* software is used.

In NLS this compliance is accomplished by the software making a request for a license before the software runs. Any software that makes a license request is referred to as an "NLS client."

If software is license-enabled, NLS client functionality is built in, and the software can request a license, receive a response to the request, and execute only if a license is available.

If an application is not license-enabled, you can configure Z.E.N.works to act as an NLS client on behalf of the application.

### License Service Providers (LSP)

The NLS client locates a license by contacting a License Service Provider and asking it to check whether a license is available.

A License Service Provider is simply an NLM called NLSLSP that runs on a NetWare 4.11 or later server.

To use NLS, you must have one or more LSPs in your NDS tree. The LSP receiving the request searches the NDS tree for a license appropriate to the software.

First it locates an NDS object called a License container object that corresponds to the software. Then it asks the License container object whether it has any available licenses for the software.

If the License container object has no available licenses, the LSP continues its search until it has either found a license or contacted all License container objects in the tree.

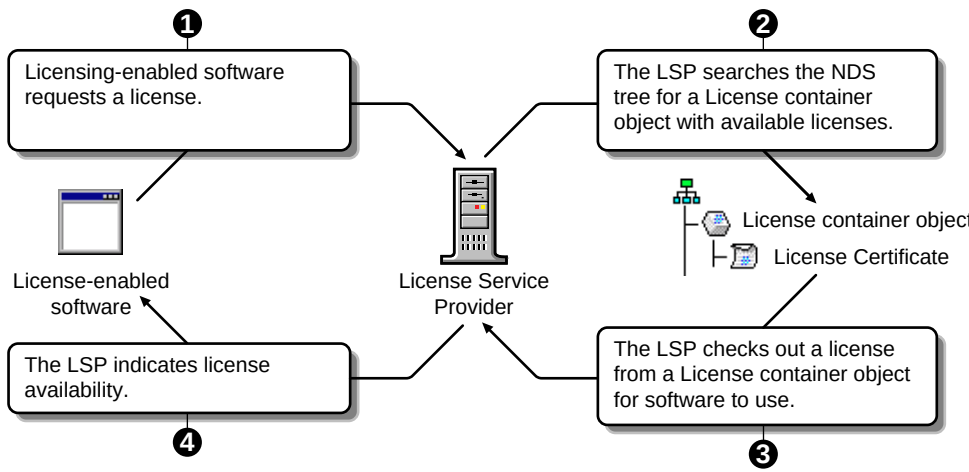
### License container objects

The License object contains NDS leaf objects called License Certificate objects, which represent software licenses. Each License object contains License Certificates for only one piece of software.

Stored with the License container object in NDS is information such as how many licenses the License object contains, what kind of licenses they are (single-use, multiple-use, etc.), and how many licenses are currently in use.

### NLS Graphical Summary

NLS component functionality is illustrated by the following:

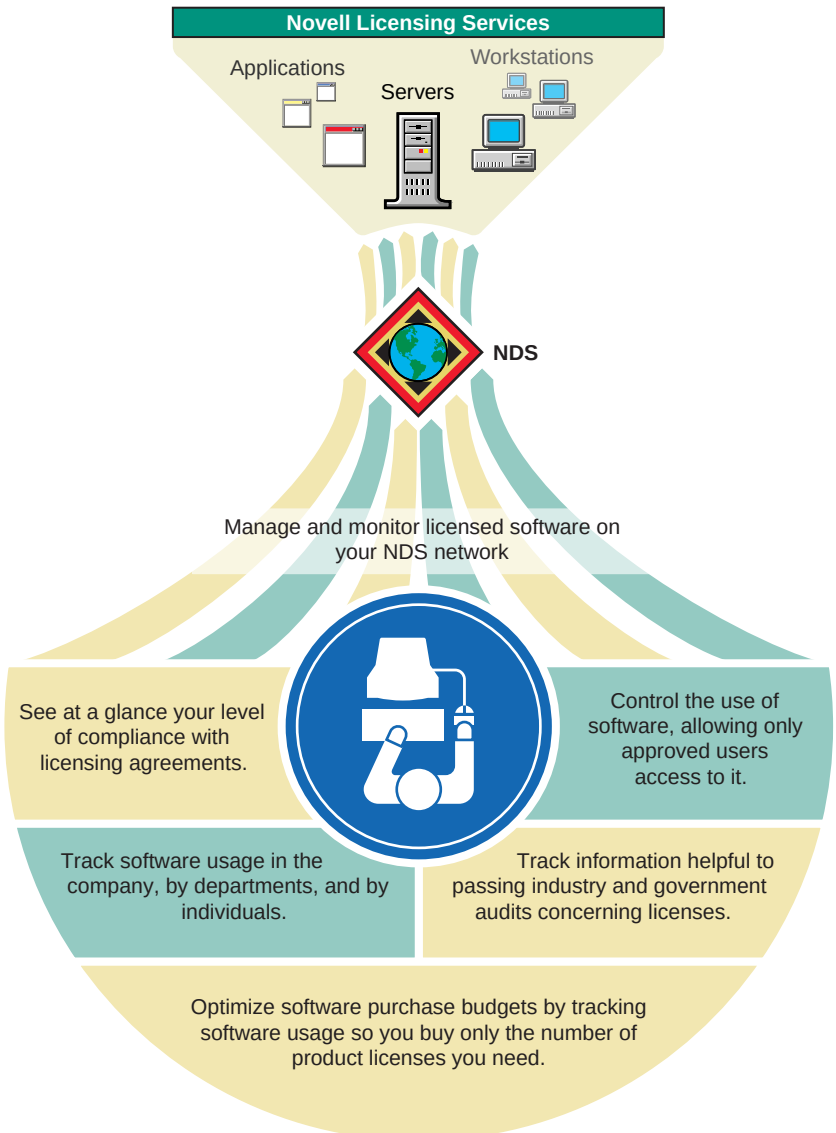



## Benefits to Network Users

NLS will help your network users be certain they are using only licensed software.

## Benefits to You and Your Organization

NLS allows you to manage and monitor the use of licensed software as shown in the following illustration.



## Requirements for Using Licensing Services

To use Novell Licensing Services you must

- Ensure NLS is installed on your network. (By default, when you install a NetWare 5 server or upgrade from NetWare 3 or NetWare 4, NLS is installed on that server.)
- Install or create License Certificates in the appropriate NDS context.
- For each NDS partition, ensure that at least one server with a master or secondary replica is functioning as a License Service Provider (nlslsp.nlm is running on the server).
- Configure Z.E.N.works to function as the NLS client for non-license-enabled applications you want to manage.

For further information see Contents > *Novell Licensing Services* in the NetWare 5 online documentation.

# File Services

NetWare 5 offers two choices of mutually compatible file services: Novell Storage Services™ (NSS) and the traditional NetWare File System. Both kinds of file services let you store, organize, manage, access, and retrieve data on the network.

With either service, NetWare stores directories and files in logical containers known as volumes.

Users, groups of users, and other NDS objects are granted access rights to volumes, directories, and files as required. Your network's data security depends on specifying which objects can access which files, and whether they can merely read a file or modify it.

This section introduces the main features of NSS. For more details regarding the traditional NetWare file system, see Contents > File Services > *Traditional File Services* in the NetWare 5 online documentation.

## Novell Storage Services

NSS is a powerful new modular storage service that runs on NetWare 5 and is fully compatible with the traditional NetWare File System.

NSS gathers all unpartitioned free space that exists on all the hard drives connected to your server, together with any unused space in NetWare volumes, and places it into a storage pool. You create NSS volumes from this storage pool during server installation or later through NWCONFIG.

The following table provides a quick overview of the tremendous storage capacity and astonishing response times NSS delivers.

| Feature | NSS Capability |
|---|---|
| Number of files per server | 8 trillion |
| Maximum file size | 8 terabytes |
| Maximum simultaneously open files | 1 million per server |
| Time to open files | Independent of file size—all files open immediately |
| Maximum volume size | 8 terabytes |
| Maximum number of volumes on a single server | 255 mounted |
| Volume segments | Unlimited |
| Directory tree depth | As limited by client |
| Volume mount time | Dependent on volume size—generally less than one minute |
| RAM required | 4 MB minimum; add RAM as needed for cache performance |

### NSS Benefits to Network Users

If your network users are accustomed to the industry-leading file services of a Novell network, they will get even better service from NSS.

If the network is being upgraded from a non-Novell network, network users will notice substantial improvements in storage services. If they are using very large files, such as large databases, the service improvements are dramatic.

You can rely on NSS to exceed any network user file size or file service performance demands. Including NSS volumes on your network will give you the following benefits.

- You can access CD-ROM and other storage devices attached to the server from within the NSS space without loading additional device drivers.
- You can leverage traditional NetWare features such as NetWare drive mappings, search drive mappings, and NDS Map objects to provide direct access to working areas and applications for your network users.
- You can maintain volumes with far less downtime because of NSS fast volume mounting.
- You can use NSS flexible RAM requirements to better tune your server to your needs.

## Requirements for Using NetWare 5 File Services

The Traditional NetWare File System requires specific amounts of RAM, depending on the total disk space supported by your server. NSS requires at least 4 MB of free RAM and unpartitioned free space on the disk.

You can upgrade traditional NetWare volumes to NSS at any time. Keep in mind that not all features of the traditional NetWare File System are currently supported in NSS. For further information on NSS, see Contents > File Services > *Novell Storage Services* in the NetWare 5 online documentation.

# Storage Management Services

Novell Storage Management Services™ (SMS) lets you back up, restore, and verify data stored on the network and on network clients.

SMS™ is an extensive architecture for platform independent utilities. Many third parties have built backup solutions based on Novell SMS technology.

You will want to ensure that all data on your network (including the NDS database) is protected against corruption and loss by backing up data at regular intervals. For this reason, Novell has included Enhanced SBACKUP with SMS in NetWare 5.

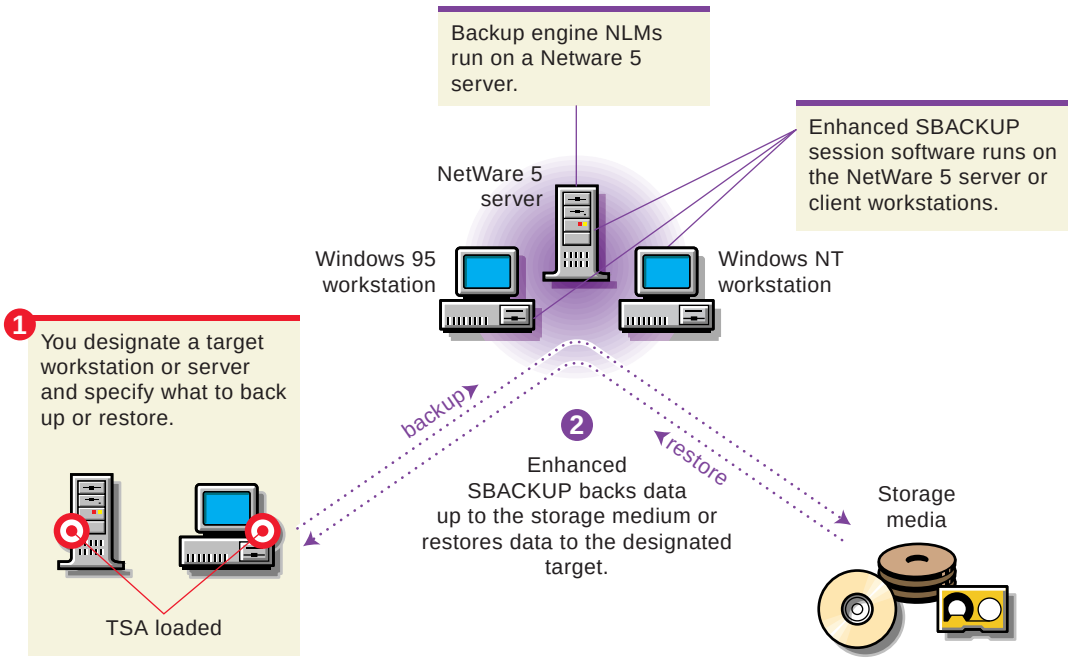
Enhanced SBACKUP lets you back up and restore

- Your NDS database
- Bindery data
- GroupWise data
- The file systems on your NetWare server (including NSS and DOS partitions) and on attached Novell Client™ workstations.

The Enhanced SBACKUP utility runs on a host server, a Windows 95 client, or a Windows NT client and includes the following improvements over previous releases:

- Queue-based backup / restore job definition / control
- Scheduling and automatic rerun
- A graphical interface for administration of 32-bit client backup / restore sessions
- Improved SMS performance
- Pure IP support (automatically available to third-party SMS-compliant solutions)
- Auto loader support

To back up information, Enhanced SBACKUP reads the information on the target device and copies it onto the storage medium you specify. The restore process works in reverse.




## Benefits to Network Users

Most of your network users will probably never think about protecting their data until they need something they have lost. Enhanced SBACKUP will ensure that you can help them recover what they need quickly.

## Benefits to You and Your Organization

Enhanced SBACKUP is simple to understand and easy to use.

You will be able to concentrate better on your other network management tasks if you know all the data on your network is protected by Enhanced SBACKUP.

## Requirements for Using Enhanced SBACKUP

To use Enhanced SBACKUP you need

- The backup engine NLM programs running on a NetWare 5 server.
- The Enhanced SBACKUP session software—sbcon.nlm or nwback32.exe—running on a NetWare 5 server or on a Windows 95 or Windows NT Novell Client, respectively.
- The appropriate Target Software Agent (TSA) loaded on each server or workstation to be backed up.

Enhanced SBACKUP features three types of backup sessions:

- **Full**—backs up the entire file system and clears the modify bit on all files.
- **Differential**—backs up data that has the modify bit set, but does not clear the modify bit on backed-up files.
- **Incremental**—backs up data that has the modify bit set and clears the modify bit on backed-up files.

You need to plan which combination of session types to use as part of your backup strategy.


Differential and Incremental backup sessions must not be used in combination with each other.

For further detail regarding Enhanced SBACKUP, see Contents > *Backup and Restore Services* in the NetWare 5 online documentation.

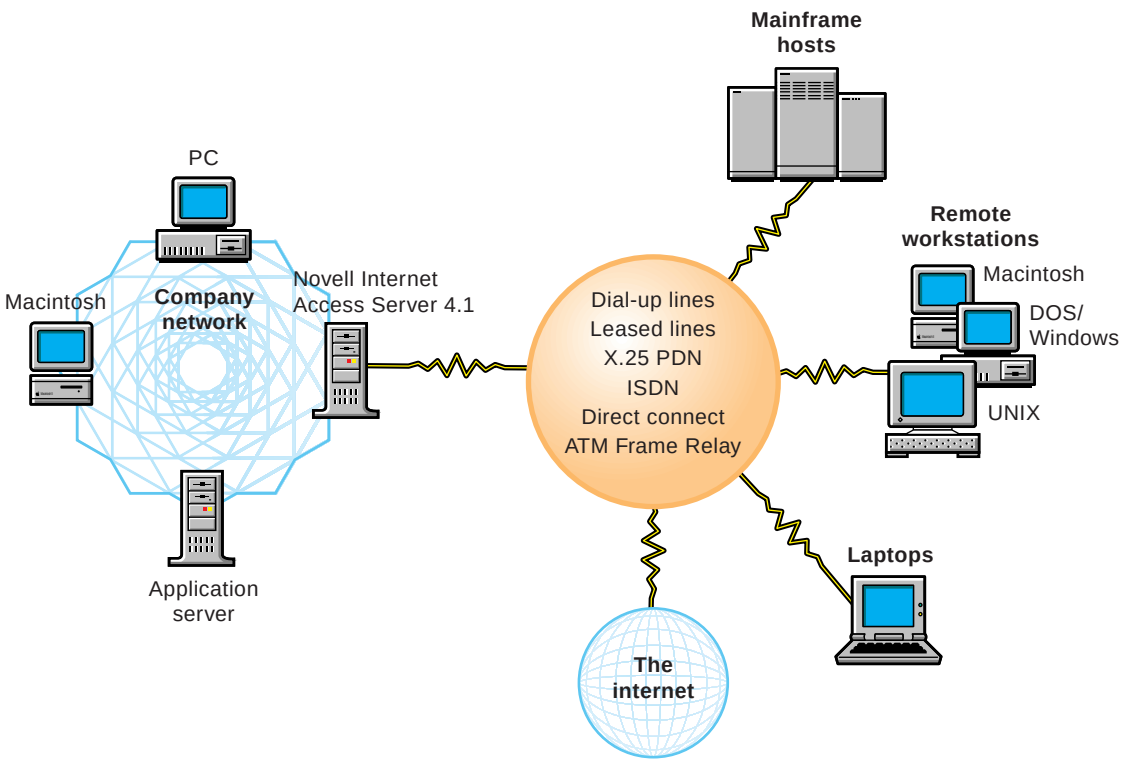
# Connectivity Services

NetWare 5 offers you the option of installing one of Novell's award-winning connectivity products—Novell Internet Access Server 4.1—on your NetWare 5 server.

Novell Internet Access Server 4.1 provides the following services:

- **Routing** between local and remote LANs running a variety of protocols to create a cohesive network.
- **Remote access** to all company network resources (including e-mail and Internet access) through a modem or other connection.
- **Remote service management** of all connectivity services and servers from your workstation.

The following figure illustrates connectivity services provided by Novell Internet Access Server 4.1.



## Routing

Novell Internet Access Server routing software supports the following:

- **IPX™**—the original network-layer protocol used by NetWare.
- **TCP/IP**—a suite of networking protocols widely used to enable dissimilar nodes to communicate in a heterogeneous environment.
- **AppleTalk***—the native protocol for communication between AppleTalk nodes.
- **Source Route Bridging**—Novell's software solution for linking token ring networks.
- **NetWare Link/PPP**—Novell's implementation of the Point-to-Point Protocol, which enables point-to-point high-speed transmission of data over leased lines or asynchronous / synchronous switched transmission facilities.
- **NetWare Link/ATM**—Novell's connectivity solution to ATM networks, which provide a unified communications infrastructure capable of supporting voice, video, and data communications worldwide.
- **NetWare Link/X.25**—Novell's connectivity solution to X.25 backbones.
- **NetWare Link/Frame Relay**—Novell's connectivity solution to Frame Relay, a streamlined, connection-oriented frame mode data service optimized for modern, reliable digital and fiber-optic transmission networks.

## Remote Access Connection Types

Remote workstations can use two types of connections:

- **Remote Node.** The remote workstation functions as if it were a workstation directly connected to the LAN. All data required for a session (file data and application packets) is transferred over the communications link. Data processing occurs on the remote workstation.

- **Remote Control.** The remote workstation controls a dedicated workstation on the LAN. Only keystrokes and screen updates are transferred over the communications link. Data processing occurs on the dedicated workstation on the LAN.


Macintosh remote node connections are made through Apple* Remote Client and the AppleTalk Remote Access Service (ARAS) server.

## Remote Service Management Using ConnectView 2.x

ConnectView 2.x is the management utility associated with Novell Internet Access Server 4.1 connectivity services. This utility allows you to

- View and manage Novell Internet Access Server 4.1 servers, including their ports and connections.

- Manage current remote connections and current sessions as part of your system.

- Create and run an accounting system for monitoring and charging remote users.

- Print and store network event histories and remote access usage records.

## Benefits to Network Users

Network users can access the Internet from their regular workstations as well as from remote connections.

They can also access the company network when they are teleworking and do everything they could if they were sitting at their dedicated office workstation.

If they need to use their personal workstation, they can connect to it using a Remote Control connection.

## Benefits to You and Your Organization

You might already provide your network users with access to the Internet and some forms of remote access to your network. Novell Internet Access Server 4.1 will greatly expand and enhance your connectivity options and the power and quality of service you provide.

For more information regarding Novell Internet Access Server 4.1, refer to Contents > "Connectivity Services" in the NetWare 5 online documentation.

## Requirements for Using Novell Internet Access Server 4.1

To support Novell Internet Access Server, you need

- NetWare 4.11 or a later version running on the server.
- Novell Client software provided with NetWare 5.
- Approximately 60 MB of free disk space, with an additional 40 MB on the sys volume (needed only during installation).
- Approximately 48 MB of free RAM on the server.

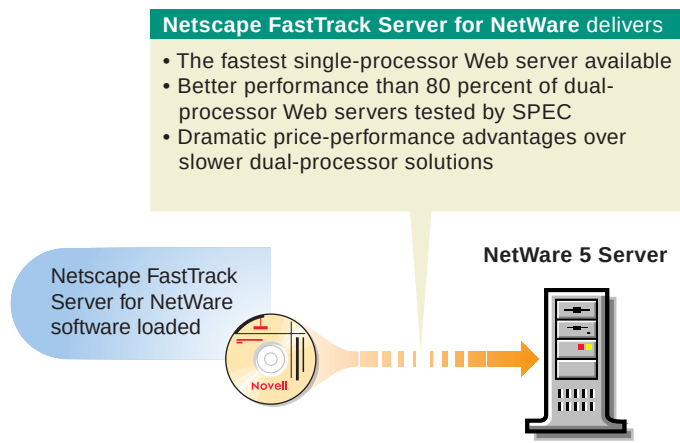
# Web Services

The NetWare 5 product package includes

- The Netscape* FastTrack* Server for NetWare, a powerful Web server you can install on a NetWare 5 server.
- Support for the major Web scripting languages so you can leverage your scripting expertise in creating customized server-side applications.

## Netscape FastTrack Server for NetWare

Your NetWare 5 server can function as an extremely fast and efficient intranet and / or Web server.




Note The performance statistics listed in this graphic are based on recent benchmark tests conducted by the Standard Performance Evaluation Corporation (SPEC).

### Benefits to You and Your Organization

With no additional investment in hardware or software, you can install a Web server to benefit network users and your company. For example,

- You can create a company intranet to provide network users with easy access to company news, department information, company policies and procedures, and other information they need in order to be more efficient and productive.
- You can create a Web server to publish company information on the Internet.

### Requirements for Using Netscape FastTrack Server for NetWare

To install the Netscape FastTrack Server from the CD included in the NetWare 5 product package, you must have the following system resources:

- A Windows 95 or Windows NT 4.0 client machine that
  - Is running the appropriate Novell 32-bit Client.
  - Is running a Netscape 3 or later browser.
  - Has a CD-ROM drive.
  - Has 100 MB free disk space (for use only during the install process).
- A target NetWare server that
  - Is running NetWare 4.11 or a later version.
  - Has at least 32 MB of free RAM (64 MB is recommended).
  - Has at least 100 MB free disk space on the sys volume.

For more information regarding the Netscape FastTrack Server for NetWare, see Contents > Web Services > “Netscape FastTrack Server for NetWare: Getting Started” in the NetWare 5 online documentation.

## Scripting and Component Support in NetWare 5

NetWare 5 supports the major scripting languages available, including

- Perl 5
- NetBasic* 6.0
- NetBasic 7.0 (a VB Script-compatible language)
- JavaScript*

Java* programmers can write servlets using the LCGI servlet Gateway running alongside the Netscape FastTrack Server for NetWare. In addition, pre-built NetBasic 7.0 components, Java Beans, and ActiveX controls make it easy to assemble powerful and effective network applications.

Using the development environment of choice, web scripters and RAD developers can quickly and easily embed network services into Web pages and construct server-side applications that leverage the security and power of NetWare.

### Benefits to Network Users

Scripting languages and reusable components afford server and Web developers the power, versatility, and compatibility to respond to the needs of network users.

Developers can incorporate NDS, login and authentication, file management, printing, Oracle* and Btrieve* database management, and other NetWare services into network solutions tailored to the specific needs of the enterprise. Timely and targeted network solutions allow both the end user and network developer the ability to be more productive.

### Benefits to You and Your Organization

NetWare 5 scripting and component services offer you choice, compatibility, and speed.

You can choose the best scripting option to run on the fastest network and Web server. The Netscape FastTrack Server for NetWare running on

NetWare 5 delivers twice the performance of its closest competitor. And by using the scripting and component technology that fits you best, you not only leverage your current network and scripting investment, you also leverage your existing development expertise.

### Requirements for Using Scripting Services

Requirements depend on your scripting choice.

- Support for NetBasic 6.0 and Perl 5 scripting is available on the NetWare 5 CD.
- JavaScript components are installed with the Netscape FastTrack Server for NetWare (included in the NetWare 5 product package).
- NetBasic 7.0, and the LCGI servlet Gateway for Java are available on the Novell developer Web site.

  To obtain these, go to http://developer.novell.com and follow the appropriate links to the kits and download area. Download the Web Services pack.

  You will need to subscribe to DeveloperNet and obtain a password. There is no charge for DeveloperNet services.

# Database Services

NetWare 5 is the ideal platform for high performance databases and database applications because it delivers

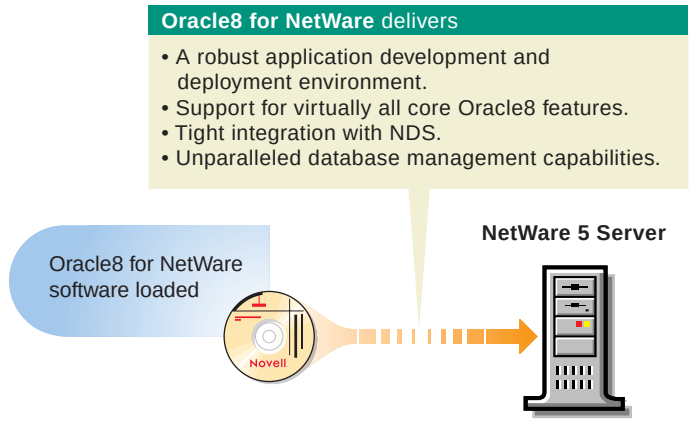
- Database server and application manageability through NDS.
- Lightning-fast, highest-capacity storage services through NSS.
- Outstanding scalability through enhanced native support for multiprocessor hardware.
- Memory protection features that bolster the reliability of the NetWare platform.

The NetWare 5 product package includes the world's leading database software, Oracle8, as well as the ever-popular key-indexed file management system, Btrieve.

## Oracle8 for NetWare

The 5-user version of Oracle8 for NetWare in NetWare 5 includes

- An intuitive installation for getting a pre-tuned and pre-configured Oracle8 database up and running.
- Wizards to help you
  - Create databases
  - Migrate Oracle7 Server databases to Oracle 8
  - Create HTML web pages based on data retrieved from Oracle8 (no knowledge of SQL or HTML syntax is required)
- The Oracle Migration Assistant for Microsoft* Access* for complete and easy migration from your Microsoft Access database to Oracle8 for NetWare.




Oracle8 for NetWare was created to meet the needs of the most demanding and complex database applications.

Oracle8 for NetWare

- Takes full advantage of NetWare 5 multitasking and I/O capabilities.
- Provides much higher scalability than earlier versions of Oracle, supporting thousands of users and extremely high-volume transaction work loads.
- Provides exceptional scalability on Symmetric Multiprocessing (SMP) machines.
- Handles the most demanding online transaction processing (OLTP) and data warehousing applications. (Novell Storage Services supports database files up to 8 terabytes.)

### Benefits to Network Users

Network users will experience exceptional performance from database applications that are built on Oracle8 for NetWare. And because of the product's NDS integration, they need remember only their network password to sign on and authenticate to any Oracle Server on the network.

### Benefits to You and Your Organization

You can use Oracle8 for NetWare to

- Deliver premier database services across your network that will reduce cost-of-ownership and streamline business processes.

  Oracle8 for NetWare includes all the necessary tools developers need to build business-critical applications that comprehensively and easily manage corporate data.

- Manage all your Oracle8 servers and associated applications using tools that leverage the power of NDS.

  The NDS-enabled Oracle Enterprise Manager allows administrators at any experience level to perform complex management tasks with point-and-click ease.

- Build enhanced network computing applications that execute on Novell's JVM and offer database access via Java Database Connectivity (JDBC) by leveraging Novell's Open Systems Architecture and Oracle's Network Computing Architecture.

- Build distributed network applications by leveraging the Oracle Java Class libraries for NetWare.

### Requirements for Using Oracle8

Oracle8 for NetWare requires a NetWare 4.1*x* or NetWare 5 server with the following resources.

- 48 MB free RAM (minimum)
- 16 MB additional free RAM for the Advanced Replication option
- 200 MB free disk space (minimum)

Oracle8 client software requires

- A 486 or higher processor
- Windows 95, Windows NT Workstation version 4, or Windows NT Server version 4 operating system
- 16 MB free RAM
- 25 MB free disk space (minimum)

The Oracle Enterprise Manager running on an Oracle8 client requires

- 32 MB free RAM
- 25 MB free disk space for the manager

## Btrieve Installation and Operation

The Btrieve key-indexed record management system included with NetWare 5 is designed for high-performance data handling and improved programming productivity. Btrieve allows an application to retrieve, insert, update, or delete records either by key value, or by sequential or random access methods.

For more information, see Contents > Database Services> Btrieve in the NetWare 5 online documentation.

part II

# Installation

The installation section of this manual provides detailed instructions on the following:

- Chapter 3, “Server Basics,” on page 73 introduces the concepts and features that you must understand to successfully install or upgrade a NetWare® 5™ server.
- Chapter 4, “Installing a NetWare 5 Server,” on page 103 guides you through the steps required to install a new NetWare 5 server.
- Chapter 5, “Customizing the Server Installation,” on page 143 provides instructions for customizing the server installation or server upgrade for your network environment.
- Chapter 6, “Upgrading an Existing Server to NetWare 5,” on page 169 guides you through the steps for upgrading an existing NetWare 3.1*x* or NetWare 4.1*x* server to NetWare 5.
- Chapter 7, “Moving Bindery Objects and Files to NDS,” on page 197 explains concepts and provides steps for moving bindery and data files from one server to another server.
- Chapter 8, “Installing Novell Clients,” on page 209 guides you through the installation of client workstations.

chapter 3

# Server Basics

Successful server installation requires some understanding of NetWare® and networking. Concepts in this chapter provide background for tasks you will need to complete and decisions you will need to make as you install or upgrade to the NetWare 5™ operating system.

## Basic Network Components

A basic network consists of a server, client workstations, and printers. Each is connected to the network with cabling and a network board. More complex networks might include routers and gateways.

- **Server**—The server manages the communication on the network. Because many users will access and use the server, a NetWare server should contain a fast processor and large amounts of disk space and memory.

- **Client Workstations**—Client workstations are computers running operating systems such as DOS, Windows*, and Mac* OS. Each client workstation requires Novell® Client™ software and a network board to connect to the network.

- **Printers**—Because many users need access to printers, placing printers on the network is cost-effective. Printers connect to the network with a network board.

- **Network boards**—Network boards (also called LAN cards, network adapters, network interface cards, or NICs) provide the connection between the computing device and the network. Each device on the network must have a network board. Network boards are designed for specific network architectures such as Ethernet, token ring, and FDDI.

- **Cabling**—The network cabling connects each device on the network. The cable can be coaxial, twisted-pair, or fiber-optic depending on the network architecture. For certain network types, you need cable both for the main network trunk and also for attaching individual computing devices to the main trunk. The "attachment" cable is often called a drop, patch, adapter, or transceiver cable.

- **Router**—A router provides a path from a device on one network to a device on another network. Multi-protocol routers can handle several protocols at the same time. (A *protocol* is the format that packets conform to on a network.) Routers can filter different packet types and restrict certain network addresses from reaching other networks.

- **Gateway**—A gateway is a computer dedicated to providing a network with access to a different type of network or computing environment. A gateway computer needs at least one network board, plus software to provide the conversion and translation services to communicate with the other network. Gateway computers need a considerable amount of disk storage and memory.

# Server Requirements

The NetWare 5 operating system must run on a server-class computer with a Pentium* processor, 64 MB of memory, and 550 MB of disk space.

To upgrade an existing NetWare server, the server must have a Pentium processor, 64 MB of memory, 400 MB of disk space available on volume Sys, and 35 MB of disk space available on the boot partition.


The system requirements listed above are minumum requirements. You can optimize the server performance by increasing the amount of server memory.

## Boot Partition

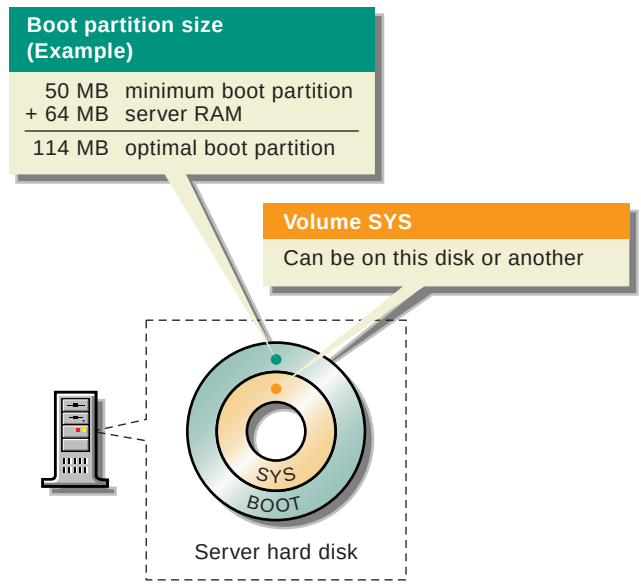
A NetWare server's hard disk must contain a boot partition. A boot partition is an active DOS partition formatted with DOS 3.3 or later. The boot partition starts the computer and loads the NetWare operating system.

The NetWare operating system requires a minimum boot partition size of 50 MB. The disk must also have enough available space outside the boot partition to accomodate volume Sys. Most of the NetWare products are installed on volume Sys, so you must have enough available disk space to accomodate NetWare and all products to be installed. For a list of product sizes, see Table 4-1 on page 120.

## Boot Partition Size

Depending on the size of your storage devices (hard disks, CD-ROMs, etc.) and the amount of server memory, you might want to make the boot partition much larger than the suggested minimum of 50 MB. A larger boot partition will allow the server to perform a memory dump to the local drive, if required, for troubleshooting server problems.

To determine the optimal size of a boot partition, add the amount of server memory to the minimum size of the boot partition (50 MB). For example, a server with 64 MB of RAM would have an optimal boot partition of 114 MB (64 MB + 50 MB = 114 MB).

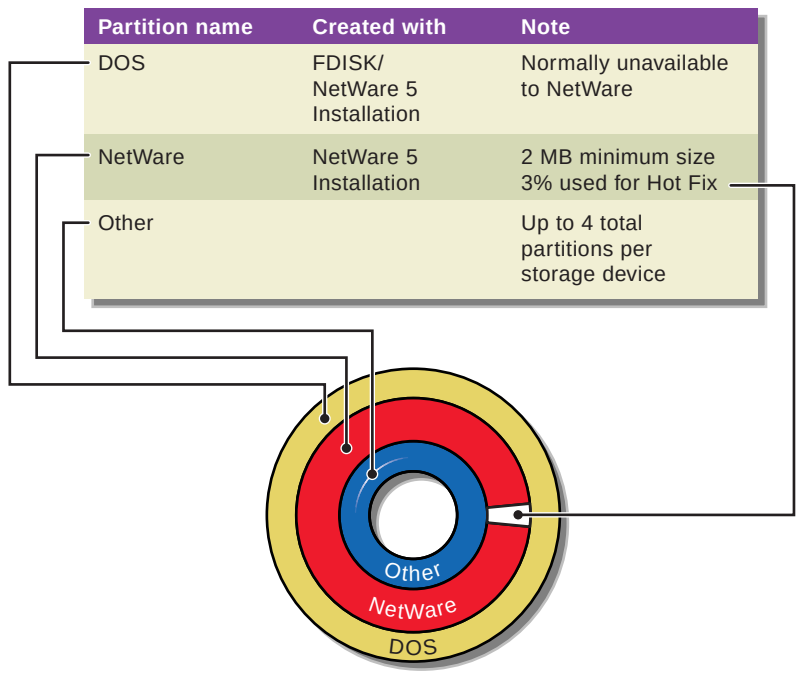



NetWare requires the boot partition to provide enough free space to copy and store startup files. Make sure your server meets the minimum requirements for free space on the boot partition.

## Existing Partitions

Creating a new boot partition will remove all data on the first hard disk. Additionally, creating a new boot partition will remove all partition types except system / utility partitions created by the computer manufacturer. Make sure you back up any desired data before creating a new boot partition.

You can use the FDISK utility to set up a boot partition before you run the installation program. Or, if you have a computer that will boot automatically from the CD-ROM drive, the installation program will guide you through the steps required to create a boot partition.



### Bootable CD-ROM Drive

For computers with bootable CD-ROM drives that meet El Torito standards, the NetWare installation program will boot when the CD-ROM is inserted. The installation program will help you configure your hard disk for server installation. The program will detect existing partitions and allow you to retain an existing DOS partition or create a new boot partition.

To determine whether your computer meets the El Torito CD-ROM standards, contact your computer manufacturer.

## Regional Settings

The NetWare operating system is available for many different languages. Because of different hardware standards required by different languages, the hardware settings must conform to a specific language. Settings include:

- **Country**—Determines how locale-specific items, such as dates or numbers, are displayed. For example, country 001 (USA) displays dates as May 2, 1999, while country 081 (Japan) displays dates as 99.5.2.

- **Code page**—A code page is a table of characters supporting one or more languages. The code page determines which characters are valid for displaying and naming files and directories.

  A single-byte code page represents up to 256 uppercase and lowercase letters, numbers, punctuation marks, and mathematical symbols on a keyboard.

  Some Roman character-based languages have a larger alphabet and require more than 256 characters and, therefore, require specific code pages. Other languages, such as Chinese and Japanese, use completely different characters. The character sets for these languages contain thousands of characters and require a double-byte code page.

Selecting the wrong code page can cause display and readability problems. Solutions are:

- Using the code page recommended by the PC manufacturer.
- Using a common code page (850), which presents most character sets of the Roman script; however, it does not include some line draw characters.


Unicode*, which supports over 65,000 characters, is used for NDS™, but is not yet available for the server.

- **Keyboard**—The type of keyboard you specify determines what characters will be entered when you press the keys on the keyboard. Keyboards conform to a specific language and keyboard layout, which can vary by country or region.

# Hardware Configuration Options

Some computers use special software drivers to support specific features or configurations. In addition to supporting basic configurations, NetWare supports multiple processor configurations and PCI Hot Plug hardware. The installation program will automatically detect and load these during the server installation.

## Platform Support Module

A platform support module (PSM) is a software driver that provides increased performance for multi-processor computers and some specific hardware configurations. Platform support modules have a .psm filename extension.

## PCI Hot Plug Module

A PCI Hot Plug module is software that allows network boards and other boards to be inserted and removed while the computer is on and the server operating system is running. The computer requires only a single PCI Hot Plug module to be loaded, not one for each device. PCI Hot Plug modules have a .nlm filename extension.


If your computer does not support PCI Hot Plug technology, do not remove network boards while the computer is on.

# Disk Drives and Storage Devices

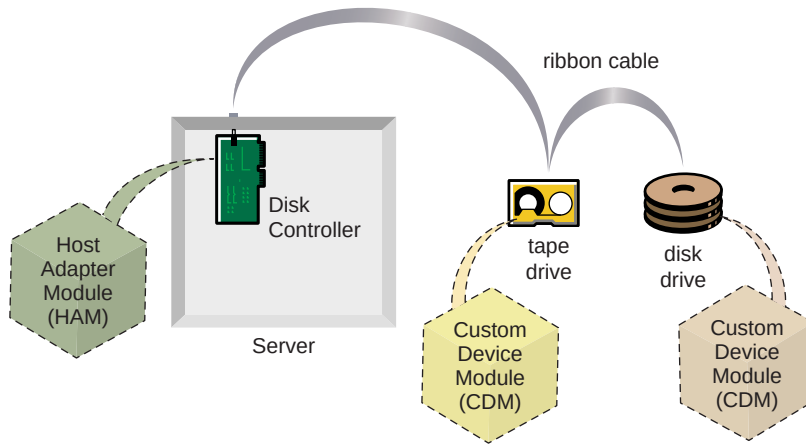
NetWare supports many types of storage devices, including disk drives and CD-ROMs. Storage devices require a drive controller or storage adapter to communicate with the computer. The storage device controller is known by many terms, such as host bus adapter and controller board. Throughout this manual, the term *storage adapter* refers to the board that controls a storage device.

The installation program will detect the types of storage adapters and devices in the computer. You can add a new driver, select a different driver, or modify the properties of the existing driver during the installation, if necessary.

## NetWare Peripheral Architecture

NetWare provides more flexibility and functionality in storage device support than other networking products. As part of NetWare Peripheral Architecture™ (NWPA), the traditional storage device driver (DSK) is now replaced by a host adapter module (HAM) and a custom device module (CDM).

Note NetWare no longer supports the older format of disk drivers (which had the .dsk filename extension). HAMs and CDMs provide more flexibility and functionality in storage device support.



- **Host Adapter Module (HAM)**—The software driver that controls the storage adapter. Because a single adapter can control many devices, only a single HAM is required. Host adapter modules have a .ham filename extension.

- **Custom Device Module (CDM)**—The software driver that controls a specific storage device, such as a disk drive. If you have several storage devices such as disk drives and tape drives, a CDM is required for each device type. Custom device modules have a .cdm filename extension.

## Properties of a Storage Adapter

Storage adapter properties must be set correctly or the storage adapter will not function. The properties are often preset at the factory and usually do not need to be changed. You might need to change the default properties if a conflict exists. Common properties include:

- **Int**—An interrupt (or IRQ) is how the storage adapter/controller board gets the attention of the computer. The interrupt value can be set through software or by setting jumpers or DIP switches on your network board. The interrupt must not conflict with any other device in the computer.

- **Port value**—A port is an I/O address that is associated with a hardware port and provides a channel for information moving between devices.

- **Slot**—The slot number identifies the location of the adapter in the computer. In many computers, the slot number is assigned through a hardware instance number (HIN). The HIN identifies each instance of detectable hardware. Some legacy storage adapters/controller boards cannot be detected and will not be assigned a slot number. The slot number can be detected for EISA, PCMCIA, PNP ISA, MCA, and PCI adapters.

# Network Boards

Network boards provide the crucial link between the network and the computer. Network boards are controlled by software called a LAN driver. The LAN driver has a .lan filename extension.

The installation program will detect the LAN driver for many types of network boards. You can add a new LAN driver, select a different driver, or modify the properties of the detected driver during the installation, if necessary.

## Properties of Network Boards

Properties of the network board must be set correctly or the network board will not function. Although the properties are often preset at the factory, you might need to change the properties if a conflict exists. Common properties include:

- **Int**—An interrupt (or IRQ) is how the network board gets the attention of the computer. The interrupt value can be set through software or by setting jumpers or DIP switches on your network board. The interrupt must not conflict with any other device in the computer.

- **Port value**—A port is an I/O address that is associated with a hardware port and provides a channel for information moving between devices.

- **Slot**—The slot number identifies the location of the network board in the computer. In many computers, the slot number is assigned through a hardware instance number (HIN). The HIN identifies each instance of detectable hardware. Some legacy netowork boards cannot be detected and will not be assigned a slot number. The slot number can be detected for EISA, PCMCIA, PNP ISA, MCA, and PCI adapters.

# NetWare File System

The NetWare file system refers to the physical and logical aspects of storing files on storage devices such as a disk drive. The NetWare file system consists of NetWare partitions, NetWare volumes, and NSS volumes.

During the installation, you will set up the NetWare file system. During the initial stages of the installation program, you will create a single NetWare partition and a single NetWare volume named Sys.

You can create additional partitions and volumes as you continue the installation. You can also add partitions and volumes after installation using the NWCONFIG utility.

## NetWare Partition

A partition isolates one operating system from another. If multiple operating systems exist on a storage device, each operating system requires and uses its own partition. A single storage device can contain up to four partitions.

The NetWare operating system will read and write data to and from the NetWare partition. Other partitions on the server's storage device, such as a DOS partition, are not normally accessible to the NetWare operating system.

### Creating and Modifying Partitions

You will create a single NetWare partition during the basic NetWare installation. Volume Sys must be created inside the NetWare partition.

Modifying any type of partition during NetWare installation will result in the loss of all data contained in the partition. A new partition can be added to a storage device that already contains a partition as long as the existing partition is not changed. Adding a new partition does not affect the data in the existing partition.

## NetWare Partition Properties

Partition properties can be customized to complement your networking environment and hardware configuration.

### Partition Size

The size of the NetWare partition can vary from 2 MB up to the size of the entire storage device. Partitions usually do not span storage devices unless you are using RAID technology. RAID technology presents multiple storage devices as a single storage device.

### Hot Fix

When the NetWare partition is created, a portion of the partition is reserved as the Hot Fix™ Redirection Area. NetWare uses the Hot Fix data protection feature in conjuction with read-after-write verification to ensure that data is stored safely on the server's disk. NetWare keeps data in memory until it can verify that the data has been successfully written to the hard disk.

If the transaction cannot be verified after several attempts, NetWare will mark the block as bad and redirect the data to the Hot Fix Redirection Area. NetWare will then verify that the data has been successfully written to the hard disk.

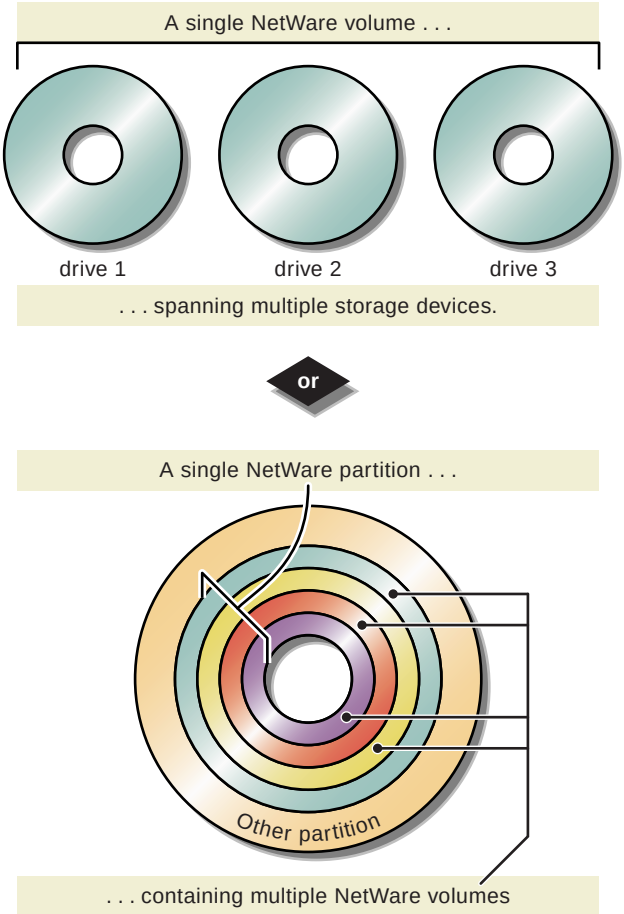
Once the operating system records the address of the defective block in a section of the Hot Fix Redirection Area reserved for that purpose, the server doesn't attempt to store data in defective blocks.

By default, the Hot Fix feature is automatically enabled and 3% of the disk partition's space is set aside as the Hot Fix Redirection Area. After installation, the Hot Fix feature is always active unless the disk fails and is inoperative, or unless the Hot Fix Redirection Area is full.


Because RAID devices include hardware redirection, they do not need the Hot Fix data protection feature.

## Volumes

A volume is used to divide NetWare partitions into smaller sections. Unlike a partition, a volume is independent of a physical storage device. You can have as few as one volume, which can span multiple storage devices and partitions, or you can have several volumes on a single disk partition. You can determine the number of volumes and the size of each volume during installation.



### Volume Limits

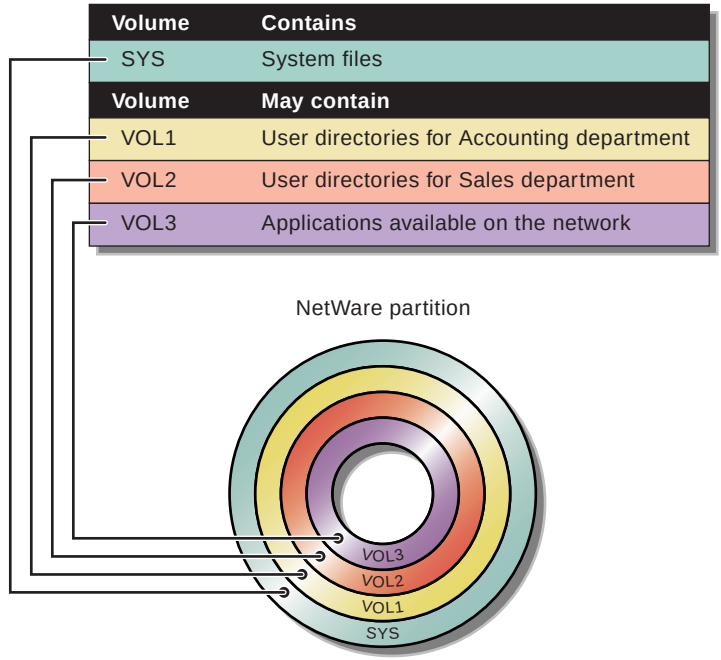
Each disk can have up to four partitions. Each NetWare partition can have up to eight volume segments. A volume can include up to 32 volume segments.


Although many configurations are possible, the most common configuration is to create a separate volume on each disk.

### Using Volumes

Volumes should be created to meet the requirements of your organization. NetWare requires only a single volume named Sys. Volume Sys contains the NetWare operating system files. Volume Sys could also contain your data files, but you might want to create additional volumes to separate your data from the NetWare operating system files.

Multiple volumes allow you to provide, and restrict access to, certain divisions of information. For example, volume Sys contains all the system files, Vol1 might contain user directories for the accounting department, Vol2 might contain user directories for the sales department, and Vol3 might contain applications available on the network.




## Types of Volumes

You can create two types of volumes: traditional NetWare volumes and Novell Storage Services™ (NSS) volumes.

### Traditional NetWare Volume

The traditional NetWare volume type supports all of NetWare's volume technologies including suballocation, compression, and Transaction Tracking System™ (TTS™).

### NSS Volume

Novell Storage Service (NSS) is advanced file system technology that enhances the management of large files, large volumes, name spaces, and storage devices. NSS allows you to create files and volumes up to 8 TB (terabytes), depending on the amount of unpartitioned free space on your hard disk. The time required to mount large volumes is significantly reduced with NSS.

NSS volumes must be created from free space outside of a NetWare partition.

In the initial release of NetWare 5, NSS volumes do not support data migration, data duplexing, disk mirroring, disk striping, file compression, TTS, File Transfer Protocol (FTP), VREPAIR, Network File System (NFS), or file and record locks.

### Suggestions for Creating Volumes

- Select free space *within* the NetWare partition to create a volume.
- Select free space *outside* the NetWare partition to create an NSS volume.
- Reserve volume Sys for the NetWare system files and create one or more additional volumes for applications and data.
- Volume Sys must be a traditional volume. All other volumes can be NSS or traditional.
- Do not create volumes that span storage devices unless you are using an enhanced fault-tolerance technology such as mirroring or RAID. If any of the spanned storage devices fail without fault-tolerance technology, all data on the entire volume will be lost.

### Volume Properties

Although default settings work for most installations, you might need to modify volume properties such as block size, file compression, data migration, and suballocation.

#### Block Size

NetWare reads and writes data in blocks. A *block* is the smallest unit of measure on the storage device. The size of the block is determined for you during installation. Optimal block sizes are determined by the size of the volume. The larger the volume, the larger the block size.

| Volume size | Block size |
|---|---|
| 0 to 32 MB | 4 KB |

| Volume size | Block size |
|---|---|
| 32 to 150 MB | 8 KB |
| 150 to 500 MB | 16 KB |
| 500 to 2,000 MB | 32 KB |
| 2,000+ MB | 64 KB |

Block sizes range from 4 KB to 64 KB. The larger the block size, the fewer blocks there are to manage. With fewer blocks to manage, the server can operate more quickly.

Although a larger block size will increase the server throughput, a smaller block size might be recommended when most of the files are small. If you need a different block size, you must change it during the installation.

### File Compression

NetWare file compression technology saves disk space by allowing files to be compressed on the hard disk and uncompressed as they are being accessed. Files can also be automatically compressed after a predetermined period of inactivity. Compression maximizes disk space but increases the file access time.

By default, compression is enabled. Compression can be disabled during installation, and then after installation it can be enabled on the volume with the SET command.


Compression works on traditional volumes only.

### Data Migration

Data migration frees up disk space by identifying inactive files and moving them from the server hard disk to another storage media such as a read / write optical device. A file is moved based on when it was created, last accessed, and modified. If a file has been inactive within a certain time period that you can set (for example, three months), the data migration feature will move the files from the server's hard disk to another media.

Files moved to another media will still appear on the server; however, the server can take longer to access files on the other media. File attributes can be set to prevent files from being migrated to other storage devices.

By default, data migration is disabled. You can enable data migration during the installation program or after intallation using the NetWare Administrator utility.


Data migration works on traditional volumes only.

### Block Suballocation

Block suballocation optimizes server disk space by dividing partially used disk blocks into smaller (512-byte) suballocation blocks. These suballocation blocks are used to share the remainder of the block with leftover fragments of other files.

For example, if the block size is 64 KB and a 65KB file is created

- Without suballocation, the 65KB file requires two disk blocks, or 128 KB.
- With suballocation, you use one disk block (64 KB) plus two 512-byte suballocation blocks. The remaining 63 KB of the second block can still be used by other files.

By default, block suballocation is enabled. Suballocation increases the memory required to track disk utilization. If your server is low on memory, you might want to disable block suballocation (or increase the amount of server memory).

### Mirroring and Duplexing

You can protect your data by duplicating it on multiple storage devices. Two types of disk duplication are available in NetWare.

- **Disk mirroring**—Mirroring stores identical data on two or more separate disks using the same storage adapter.

- **Disk duplexing**—Duplexing stores identical data on two or more separate disks using separate storage adapters. Duplexing can also include using two different types of storage adapters or device drivers. Duplexing is preferred over mirroring, since two storage adapters rarely fail simultaneously.

Although you can mirror one partition to as many as eight other partitions, mirroring or duplexing two partitions is usually sufficient fault tolerance for most systems.

You can set up mirroring during the installation, or you can add a new disk later and mirror new partitions to existing partitions using the NWCONFIG utility.


Mirroring and duplexing work on traditional volumes only.

## Networking Protocols

Network protocols specify how data should be packaged or formatted so that all network devices can transmit and receive data. That is, they define how the network board should communicate with the network.

Each network board must have at least one network protocol bound to it so that the board knows which protocol to use when communicating with the network. A single network board can support one or more protocols.

The networking protocols available in NetWare are Internet Protocol (IP) and Internetwork Packet Exchange™ (IPX™).


If you are upgrading an existing server, you can only add new protocols, such as IP. You cannot change existing protocols, such as IPX.

## Internet Protocol

Internet protocol (IP) is the protocol used on the Internet. Using IP requires a unique IP address, a subnet mask, and a router or gateway address.

- **IP address**—An IP address identifies each device on the network. The address consists of 32 bits, which are represented as decimal values separated by periods, such as 123.45.67.89.

  If your server will connect to the Internet, you must obtain a unique IP address. For information on receiving an IP address, contact your Internet service provider (ISP).

- **Subnet mask**—Subnet masks allow you to break up your network into smaller networks. Your network could have too many nodes or could be too geographically diverse to manage as a single network.

  Dividing your network into smaller networks allows the network routers to filter and reduce the network activity seen by any of the nodes. However, dividing your network and using several network addresses might not be appropriate on a large network that needs to appear as a single network.

- **Router (gateway)**—The router or gateway is the device that connects two different environments such as a LAN and the Internet.

  You can enter a specific router (gateway) address, or you can rely on the network to automatically find the nearest router. If you specify the address, remember that the router having that address must exist on your network segment.

### IP Frame Types

**IP frame types**—Frames, also called packets or datagrams, carry data across the network. They consist of a header, data, and a trailer. The format of the frame depends on the protocol that sent the frame.

NetWare will automatically load and bind the appropriate IP frame type for your network board, such as Tokenring_SNAP, FDDI_SNAP, or Ethernet_II. The NetWare installation program does not add Ethernet_SNAP for IP frame types.

## Internetwork Packet Exchange (IPX)

Internetwork Packet Exchange (IPX) is the traditional Novell communications protocol that sends data packets to requested destinations (such as workstations or servers).

### How IPX Works

Servers running the IPX protocol advertise their services to the entire network. The location of devices offering services is recorded and stored on servers and routers throughout the network.

When a device requires a specific network service, it broadcasts packets requesting the service to the entire network. Servers and routers check the list of recorded services and respond with the location of the device providing the service.

### IPX Network Address

An IPX network address is a hexadecimal number, one to eight digits (1 to FFFFFFFE), that identifies a specific network cable segment. IPX network segments can process more than one frame type. Each frame type that is used on the network is treated as a logical network segment and requires its own IPX address—even though each frame type is using the same network board and physical cable segment.

## Protocol Installation Options

NetWare 5 can process IP network packets and traditional IPX packets. You can install networking protocols in the following ways:

- Internet Protocol (IP) only
- IP with IPX Compatibility Mode
- Internetwork Packet Exchange (IPX) only
- IP and IPX

### Internet Protocol (IP) Only

NetWare 5 processes packets in using the Internet Protocol (IP). Previous versions of NetWare supported IP by tunneling. NetWare 5 no longer uses tunneling or encapsulation to process IP packets.

### Internet Protocol with IPX Compatibility Mode

Although only IP is selected, passive support for IPX is provided. If an IPX request arrives at the server, NetWare 5 will process the IPX request. This passive support for IPX is called IPX Compatibility and is automatically enabled to provide service for applications that require IPX.

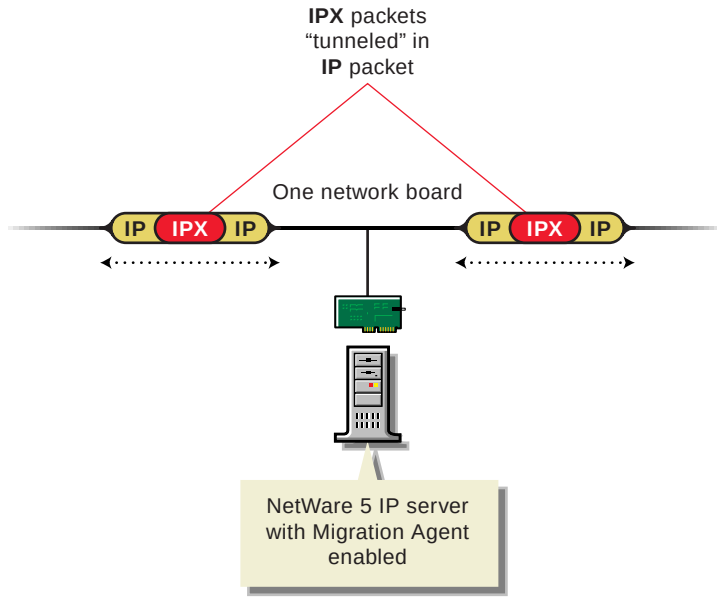

You can disable Compatibility Mode during the customize portion of the server installation or after installation by removing the **LOAD SCMD** command from the server's autoexec.ncf file.

### Internet Protocol with Migration Agent

You can install the Migration Agent on NetWare 5 servers that are running the IP protocol. Migration Agent regulates the protocol function on different network segments. It determines how packets will be forwarded onto network segments communicating with a different protocol.

### Migration Agent with One Network Board

If your server contains only a single network board, enabling Migration Agent causes IPX packets destined for other networks to be “tunneled” in IP packets.



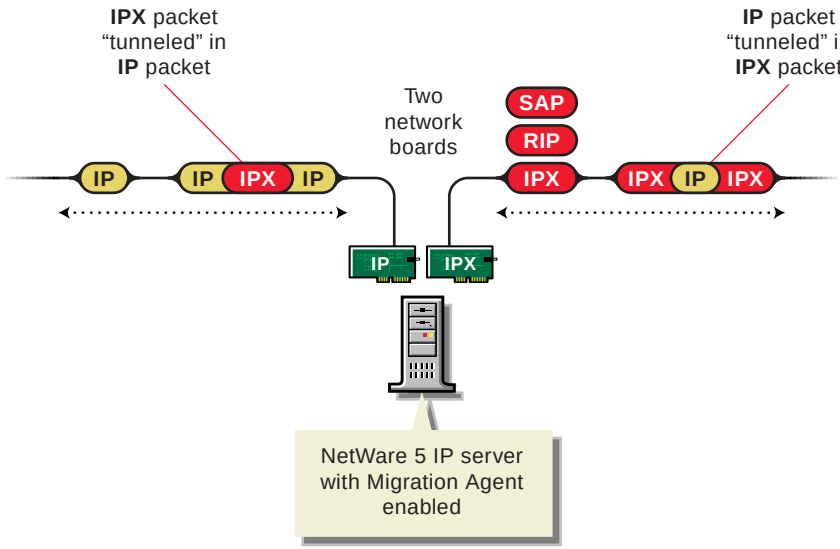

### Migration Agent with Two Network Boards

If your server contains two network boards, enabling Migration Agent causes the server to function as a gateway. The server functioning as a gateway filters or forwards the packets in each network environment.

For example, a server acting as a Migration Agent might have one network board communicating with the IP network segment and another network board communicating with the IPX network segment.

IPX requests destined to travel across the IP network are tunneled in an IP packet. IP packets destined to travel across the IPX network segment are tunneled in an IPX packet.

Separating the protocols on network segments reduces the traffic on both segments. IPX packets such as RIP and SAP are kept on the IPX segment, while IP packets remain on the IP segment.




### IP and IPX

IP and IPX can be installed and coexist simultaneously. If you have network clients or applications that require IPX and IP, you might want to install both protocols. Both protocols can be assigned to a single network board.

When an IP or IPX packet is received at the server, it will be processed without encapsulation or tunneling. The server will actively broadcast and manage IPX services using SAP and RIP.

### IPX Only

You can choose to install only IPX. Using IPX will provide your network with all the traditional benefits of the NetWare operating system. All applications requiring IPX will continue to function properly.

## Other Protocol Services

You can use other services, such as DNS and SNMP, to simplify the management of your networking environment.

### Domain Name Service (DNS)

Domain Name Service (DNS) is the functionality that matches text names, such as novell.com, with numbers used by computers, such as 123.45.67.89.

- **Domain name**—Domain names divide the Internet into functional categories. The top level domains identify types of organizations such as commercial (com), eduational (edu), government (gov), international entities (int), U.S. military agencies (mil), network providers (net), and other organizations (org).

  Domain names can also use two-letter country codes to specify geographical locations such as United States (us) or United Kingdom (uk).

  Domain names are separated into individual levels with periods, such as sales.acme.com or acct.acme.ut.us. They are not case-sensitive.

- **Name Server(s)**—In addition to domain names, DNS manages domain name servers. A name server is a computer that translates names into IP addresses for workstations on the network.

### Simple Network Management Protocol (SNMP)

Network management utilities, such as Novell's ManageWise® utility, use Simple Network Management Protocol (SNMP) to record and communicate information about network devices. Threshold levels and specific events such as packets per second or error rates can be set and monitored using an SNMP-compatible utility.

When an event occurs, information such as event type, hardware description, server name, server location, and network administrator name is recorded. The information is then sent to the destination address of the workstation running the SNMP-compatible management utility.

You can specify which devices will receive the SNMP information when a event occurs. Each device should be running an SNMP-compatible management utility such as the ManageWise utility. You can specify IPX and IP destination addresses of the devices to receive the information.

# NDS, Novell's Directory Technology

NDS, Novell's directory technology, provides global access to all networking resources. NDS allows users with the proper access rights to log in to the network and view and access network resources.

During the server installation, you will set up a minimal NDS framework. The minimal framework consists of an NDS tree, one or more container objects, a NetWare server object, and an ADMIN user object.

After installation, you can create additional NDS objects using the NetWare Administrator utility.

## NDS Trees

The NDS tree represents the entire network. Network resources such as servers and printers are presented hierarchically in the NDS tree. Users log in to the NDS tree with a single login name and password instead of logging in to specific servers.

### Tree Name

The NDS tree is given a name during the first NetWare server installation. The name of the tree should represent your entire organization. It can be up to 64 characters long and can contain underscores and dashes. Although other special characters are permitted, using special characters in the NDS tree name is not recommended.

## Objects

Objects are used to represent network divisions or network resources such as an organization or a NetWare server. Objects have properties that define their characteristics. You can create two types of objects: container objects and leaf objects.

### Container Objects

Container objects are used to organize the structure of the NDS tree. A container object can contain another container object, a leaf object, or both. The two main kinds of container objects are Organization and Organizational Unit objects. However, all of the following container objects are available:

- **[Root]**—In the NDS tree, [Root] is the highest-level container object. [Root] is created when a new NDS tree is created. [Root] cannot be renamed. All NDS objects exist in [Root]. A user with rights to the Root object has rights to the entire NDS tree. Only Country and Organization objects can be placed under [Root].

- **Organization**—An Organization (O) object is a container object that represents the first level of grouping for most networks. Depending on the scope of your network, this level could represent a company, division, or department. At least one Organization object is required in an NDS tree. An Organization object can contain Organizational Unit (OU) objects or other NDS objects.

- **Organizational Unit**—Organizational Unit (OU) objects are container objects that can be used to organize objects in the NDS tree into subsets. For example, Organization Unit objects might be departments or project groups. Organizational Unit objects are optional, but must exist below an Organization (O) object or another Organizational Unit (OU) object.

- **Country**—Country (C) objects are container objects that can be placed only directly off the [Root]. Although you can have as many Country objects as desired, they add a level of complexity to your NDS tree that might not be necessary. The Country container object is provided to comply with X.500 global naming specifications.

- **Locality**—The Locality (L) container object is provided to distinguish the geographical location of an object.

When you create a new NDS tree, you must create the container objects, such as an Organization or Organizational Unit object, that will contain the NetWare Server object.

### Leaf Objects

Leaf objects represent information about network resources such as servers or printers. Unlike container objects, leaf objects cannot contain other NDS objects. Many types of leaf objects exist, such as Application, Computer, Printer, User, and NetWare Server object. At least two leaf objects are created during the server installation.

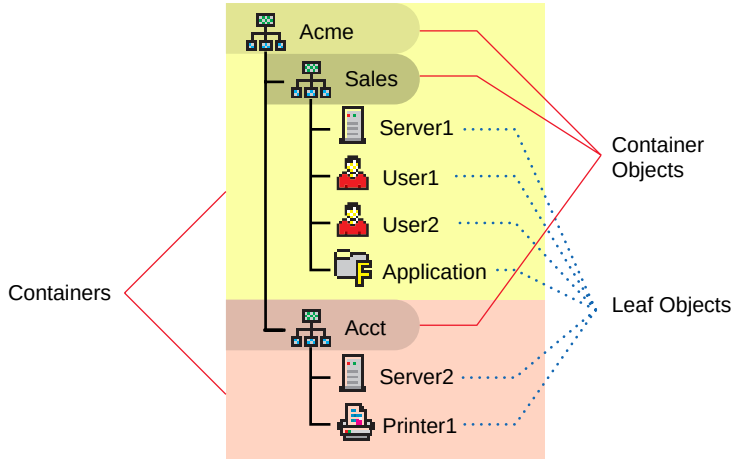
- **NetWare Server**—The NetWare Server is a leaf object that represents any server running any version of the NetWare operating system. The NetWare Server object is automatically created and placed into the NDS tree during server installation.

- **Admin User**—When a new NDS tree is created, a user named ADMIN is automatically created and assigned a password. ADMIN has Supervisor rights to the entire NDS tree. Supervisor rights allow a user to create and manage all objects in the tree.


For security reasons, you may rename user ADMIN during the installation program or after the installation using the NetWare Administrator utility.

Other users can be assigned Supervisor rights to other container objects and all their leaf objects. Having Supervisor rights to a container object allows the user to create and manage all objects in the container.

When installing a new server into an existing tree, you must have Supervisor rights in the container in which you are installing the new server.




Depending on which products you select to be installed, additional objects, such as an NDPS broker object, might be created and added to the NDS tree during the installation program.

## NDS Context

NDS allows you to refer to objects according to their positions within a tree. The NDS context describes the full path (including container objects) of an object in the NDS tree structure.

The notation to describe the NDS context is the list of container objects, separated by periods, between the leaf object and [Root]. For example, the context of the NetWare Server object SERVER1 to be placed in the Organizational Unit (OU) container SALES in the Organization (O) container ACME would be noted as: SALES.ACME. The full NDS context name for this server would be SERVER1.SALES.ACME.

NDS context can also be noted using *typeful* names. Typeful names include the object abbreviation types. For example, the NDS context described above written in typeful notation would be CN=SERVER1.OU=SALES.O=ACME.

Note

When referencing a leaf object, the leftmost object is assumed to be a leaf object. Leaf objects have common names (CN) which are described in typeful notation with a preceding CN=*object name*.

For more information on planning and implementing NDS, see Contents > Network Services Documentation > Directory Services > NDS Concepts and Planning in the NetWare 5 online documentation.

## Time Synchronization

NetWare time synchronization maintains consistent time for networks with multiple servers.

NetWare distinguishes three types of time servers that provide network time: Single Reference, Reference, and Primary. All other servers are called Secondary time servers.

- **Single Reference time server**—The first server in a network is automatically designated as a Single Reference time server. A Single Reference time server provides time to the entire network.

- **Primary time server**—A Primary time server is responsible for determining and setting the network time. A Primary time server will poll other primary and reference servers to determine the "average network time." The average network time is then distributed to other requesting servers.

- **Reference time server**—A network usually has only one Reference time server. A Reference time server provides a network time for all Primary time servers to migrate to. It is used on larger networks where Primary time servers are required.


If more than one Reference time server exists, each must be synchronized to the same external time source, such as an atomic clock.

- **Secondary time server**—By default, all servers except the first server are designated as Secondary time servers. A Secondary time server relies on other sources such as a Single Reference time server to provide them with network time. A Secondary time server can get the network time from another Secondary time server or from a Single Reference, Reference, or Primary time server.


If the network has fewer than 30 servers, use the default installation settings of a Single Reference time server and Secondary time servers. If the network has more than 30 servers, you might need to customize the environment using different types of time servers.

# Other Networking Products

After completing the NetWare server portion of the installation, you can select other networking products to install. Other networking products provide enhanced functionality to NetWare, such as security, network management, and Internet access.

Although you can choose which products to install, installing the products that are already selected by default will ensure that you receive the features recommended for your networking environment.

chapter 4

# Installing a NetWare 5 Server

This chapter describes how to install a NetWare® 5 server. The installation process includes the following tasks:

- Meet system and software requirements
- Prepare the network for a NetWare 5™ server
- Prepare the computer for server installation
- Begin the installation
- Select the type of installation and regional settings
- Select the platform support module and storage adapter
- Select the storage device and network board
- Create a NetWare partition and volume Sys
- Name the NetWare 5 server
- Install the NetWare 5 server file system
- Install networking protocols
- Set the server time zone
- Set up NDS™, Novell's directory technology
- License the NetWare 5 server
- Select other networking products to install
- Customize your NetWare 5 server installation

# Meet System and Software Requirements

## System Requirements

NetWare 5 requires the following minimum system requirements:


- ❑ A server-class PC with a Pentium* or higher processor.
- ❑ A VGA or higher resolution display adapter (SVGA recommended).
- ❑ 550 MB of available disk space (50 MB for a boot partition, 500 MB for a NetWare partition).
- ❑ 64 MB of RAM (128 MB recommended to run Java*-based applications).
- ❑ One or more network boards.
- ❑ A CD-ROM drive that can read ISO 9660-formatted CD-ROM disks. Computers with bootable CD-ROM drives must fully support the El Torito specification.

A PS/2* or serial mouse is recommended, but not required.


The system requirements listed above are minimum requirements. You can optimize the server performance by increasing the amount of server memory, disk space, and processor speed.

## Software Requirements

Before installing, make sure that you have the following software and information:


- ❑ DOS 3.3 or later. (DOS 7 is included on the NetWare 5 License diskette. Do not use the version of DOS that ships with Windows 95*, Windows 98, or Windows NT operating systems.)
- ❑ DOS CD-ROM drivers.
- ❑ NetWare 5 Operating System CD-ROM.
- ❑ NetWare 5 License diskette.

- ❑ Novell® Client for DOS and Windows 3.1*x* (optional, for installing from a network).
- ❑ An IP address (optional, if the server will connect to the Internet). For information on receiving an IP address, contact your Internet service provider (ISP).
- ❑ Network board and storage device properties, such as the interrupt and port address. For more information, contact your computer hardware manufacturer.

Next, you should prepare the network to receive a NetWare 5 server. If this server is not being integrated into an existing network, you can skip to "Prepare the Computer for Server Installation" on page 106.

## Prepare the Network for a NetWare 5 Server

When you introduce a NetWare 5 server into an existing environment containing NetWare 4.1*x* servers, you must update the servers in the existing networking environment before installing a NetWare 5 server into the network.

Note A network consisting of NetWare 3.1*x* servers does not need to be updated.

To prepare the network for a NetWare 5 server, you must

- Update to NDS 5.99 or higher.

  NDS 5.99 is available on the NetWare 5 Operating System CD-ROM.

- Install Novell Licensing Services.

Note Instructions for updating NDS, installing Novell Licensing Services, and meeting other update requirements are located in \products\411_upg\411_upg.txt on the NetWare 5 Operating System CD-ROM.

# Prepare the Computer for Server Installation

To prepare your computer for NetWare 5, you must

- Install computer and networking hardware
- Create and format a DOS boot partition
- Access the installation files

## Install Computer and Networking Hardware

Follow the manufacturer's instructions to install and connect the network board and network cabling to your computer. Make sure that all storage devices are properly attached to storage adapters.

## Create and Format a Boot Partition

NetWare requires a boot partition of at least 50 MB to start the computer and load NetWare. The boot partition contains the NetWare startup and server files.


You should increase the size of your boot partition to accomodate your specific configuration requirements. For more information, see "Boot Partition" on page 74.

To create and format a boot partition, complete the following steps.


1. **Back up any desired data to another computer or off-line storage media.**

2. **If the computer already has an operating system installed, such as Windows, you should completely remove the operating system.**


If you want to maintain multiple operating systems on one computer, contact a vendor of boot manager software.

3. **Boot your computer with DOS 3.3 or later.**


You can boot from the NetWare 5 License diskette. DOS 7 and all required DOS utilities are included on the diskette. Do not use the version of DOS that ships with Windows 95, Windows 98, or Windows NT operating systems.

4. **Use FDISK to create a 50MB active DOS partition by typing `FDISK`. (Create a primary DOS partition, and make it the active partition.)**

   The computer will restart.

5. **Format and transfer DOS system files to the partition by changing to A: and typing `FORMAT C: /S`.**

Your computer should now have an active boot partition of at least 50 MB. Continue the installation by accessing the installation files.

## Access the Installation Files

NetWare 5 can be installed from a local CD-ROM or from installation files located on the network. To access the NetWare 5 installation files, complete the following steps.


If you are using a bootable CD-ROM drive, skip to "Navigating in the Character-Based Screens" on page 108.


1. **Install the DOS CD-ROM driver for your CD-ROM device onto the boot partition. DOS CD-ROM drivers are provided by the CD-ROM manufacturer.**


   Make sure that the logical filename of your CD-ROM drive (specified in the config.sys and autoexec.bat files) is not CDROM or CDINST.

2. **Make sure that the config.sys file contains the following commands: `FILES=40` and `BUFFERS=30`**

3. **(Conditional) If you are installing from files located on a network, install the Novell Client™ for DOS and Windows 3.1*x* software located on the Z.E.N.works™ CD-ROM. For more information, see "Installing Clients from DOS" on page 213.**

After accessing the files for the installation program, you can begin the installation.

# Begin the Installation

To begin the installation, complete the following steps.


1. **Insert the NetWare 5 CD-ROM or log in to the network and access the installation files on the network.**

2. **At the CD-ROM drive or network drive prompt, type `INSTALL`.**

## Navigating in the Character-Based Screens

The initial screens of the installation program display in text-based mode. Auto-detected and default settings appear on each screen.

You can accept the detected and default settings, or you can modify the settings to meet the needs of your networking environment.


To continue the installation with the standard settings: Use the arrow key to highlight Continue in the Options box. Press Enter.

To modify the settings: Use the arrow key to highlight Modify in the Options box. Press Enter. Highlight the field to be modified. Press Enter. Select or enter the appropriate value.

Some screens require additional keystrokes in order to navigate through the interface. Information about screen navigation appears at the bottom of each screen.

# Select the Type of Installation and Regional Settings

To select the type of installation and select regional settings, you must

- Select the language and accept the License Agreement
- Select the type of installation
- Select the regional settings
- Select the mouse and video type

## Select the Language and Accept the License Agreement

The installation program is available in several languages. You can install other language options, such as the language for the operating system or for users, later during the installation program.

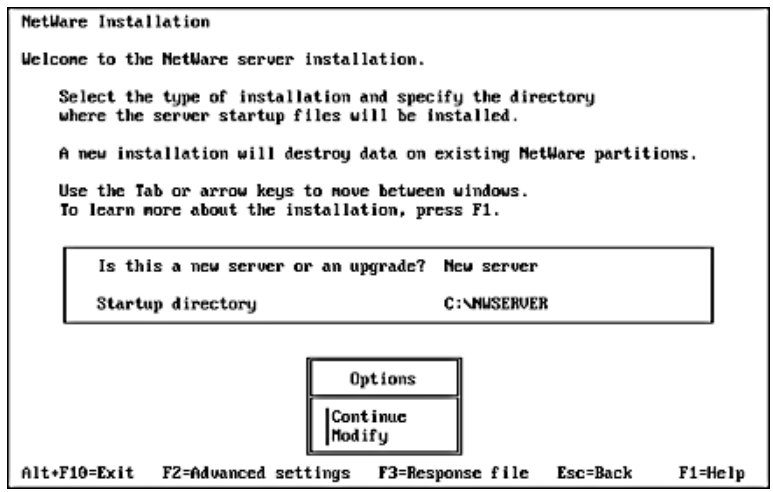
Accepting the License Agreement means that you have read and you accept terms and conditions contained in the License Agreement.

Hint

Press F10 to accept the License Agreement.

## Select the Type of Installation

You can install NetWare on a new computer or you can upgrade an existing computer running NetWare 3.1*x* or NetWare 4.1*x*.




Hint

To select the type of installation: In the Options box, select Modify. Select Type of Installation. Select New Server. Return to the Options box to continue.

- **New Server**—If you are performing a new server installation, select New Server. The server installation will not delete system partitions or other partitions such as DOS, UNIX*, or Windows.

Note

If there is an existing NetWare partition, the new server installation will delete the NetWare partition containing volume Sys, and any other volumes that are part of that NetWare partition. If you want to keep volumes that are part of that NetWare partition, select Upgrade.

The NetWare installation program guides you through a basic server installation using default values. You can also customize the server installation to include more advanced options.

- **Upgrade**—If you are upgrading an existing server from a previous version of NetWare, select Upgrade from NetWare 3.1*x* or 4.1*x*. Upgrading retains all your server data such as files, directory structures, partitions, and volumes.

- **Startup Directory**—The startup directory is the directory on the boot partition that contains the files to launch the NetWare server.

Although default settings work for most configurations, you can also specify advanced settings such as server ID number, reboot options, and SET parameters.

### Advanced Settings

The Type of Installation screen allows you to change the default settings to settings specific to your networking environment. You can change the following settings.


Press F2 for advanced settings.

- **Server ID Number**—A unique server identification number (up to eight hexadecimal digits) identifies the server on the network. The server ID number functions like an internal IPX™ number. Although a server ID number is automatically created, you might need to enter a specific server ID number if you are installing in either of the following conditions:

  - **Filtered environment**—Routers between network segments can be configured to forward data only from specific computer addresses. Data being sent from other computer addresses is not forwarded to other segments.

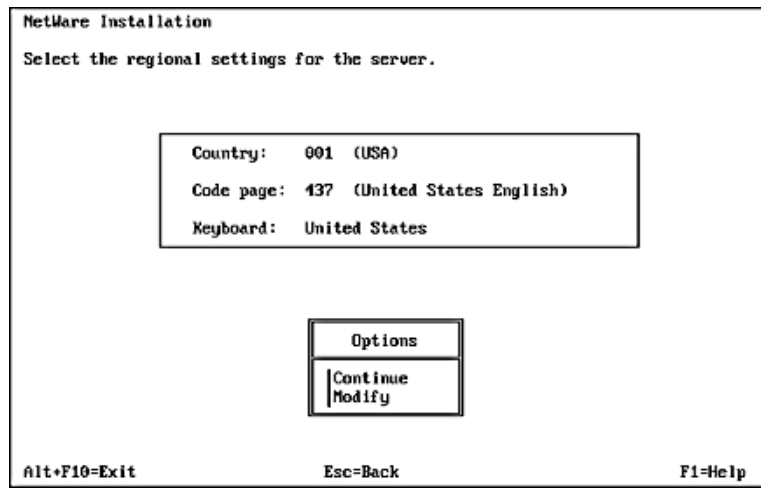

If you are accessing the installation files from a server on a different network segment, you might not be able to reconnect to the server to complete the installation unless you specify an unfiltered server ID number.

- **Numbering scheme**—Some network administrators set up a predetermined numbering scheme to identify servers in particular locations or organizations. For example, all servers in building A might begin with 0101, and all servers in building B might begin with 0102.

- **Load Server at Reboot**—Select No if you do not want the autoexec.bat and config.sys files to contain the commands to automatically load the server operating system when the computer reboots. If the field is Yes, the old autoexec.bat and config.sys files are renamed and saved with a .00*x* extension.

- **Server SET Parameters**—You might need to modify the SET parameters for some device drivers, such as for network boards and storage devices, in order to complete installation. SET parameters are saved to the startup.ncf file.

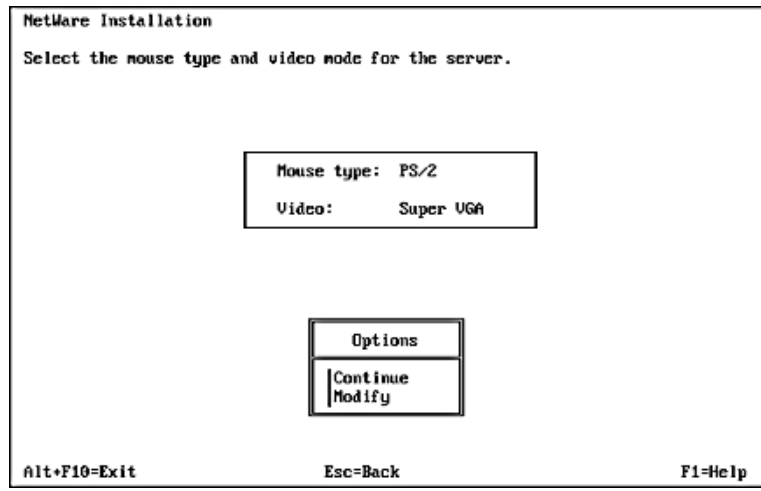
## Select the Regional Settings




Choose the appropriate country, code page, and keyboard mapping for your language and computer.

## Select the Mouse and Video Type

Note The mouse type and video type are not auto-detected by the installation program. You must select the settings for the computer.



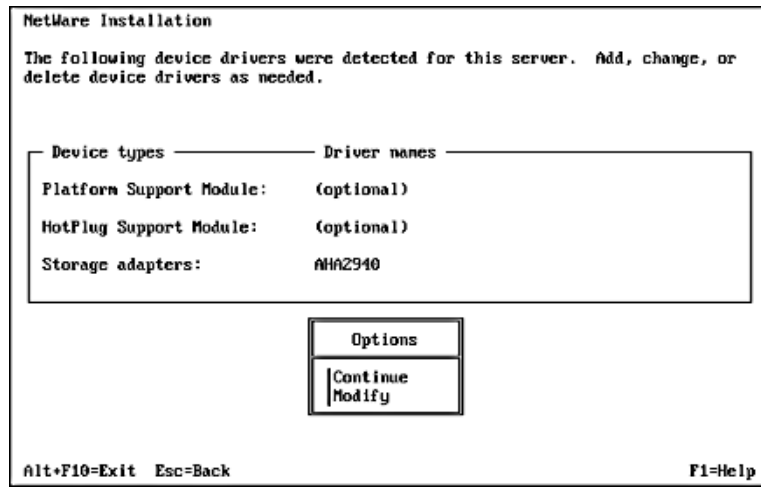

- **Mouse Type**—Choose a mouse type, if available on the computer. The installation program supports PS/2 or serial mouse types, but a mouse is not required.

- **Video Type**—The NetWare installation program is optimized to display with video display hardware that is VESA 2 compliant. Choose Standard VGA only if your video board does not support 256 colors.

# Select a Platform Support Module and Storage Adapter

To select a platform support module and storage adapter, you must

- Select a platform support module (if required)
- Select a PCI Hot Plug module (if required)
- Select and configure a storage adapter




Hint

To *add* a driver: In the Options box, select Modify. Select the driver and press Enter. Press Insert to select from a list of drivers provided with NetWare. Press Insert again to install a driver from diskette.

To *delete* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to delete and press Delete.

To *modify* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to modify and press Enter. Select the property to modify.

## Select a Platform Support Module (If Required)

A platform support module (PSM) provides increased performance for multi-processor computers and some specific hardware configurations.

The installation program might auto-detect a PSM. If the installation program does not detect a PSM driver, your computer does not need one.


If a PSM driver is detected on a computer without multiple processors, you can allow the driver to load without adversely affecting performance.

## Select a PCI Hot Plug Module (If Required)

Computers that support PCI Hot Plug technology allow storage adapters and network boards to be inserted and removed while the computer is on.

If the installation program does not detect a PCI Hot Plug support module, your computer probably does not support the PCI Hot Plug technology.

## Select a Storage Adapter

A storage adapter is the adapter that plugs into the computer and provides a link between the computer and one or more storage devices. The storage adapter requires a software driver called a host adapter module (HAM) to communicate with the computer (host). Storage devices require a separate driver called a custom device module (CDM).


.Dsk drivers are no longer supported. Instead, NetWare uses the enhanced capability of NetWare Peripheral Architecture™ (NWPA). NWPA requires a HAM and a CDM.

Because a single adapter can control more than one type of storage device, your computer might require only a single HAM, even though it can have more than one type of storage device—and therefore multiple CDMs.

The installation program auto-detects many types of storage adapters, such as IDE and SCSI adapters. If your storage adapter is not detected, choose the appropriate driver from the list of available drivers provided with NetWare 5 or add a new driver from a diskette. You can obtain HAMs from the storage adapter manufacturer.

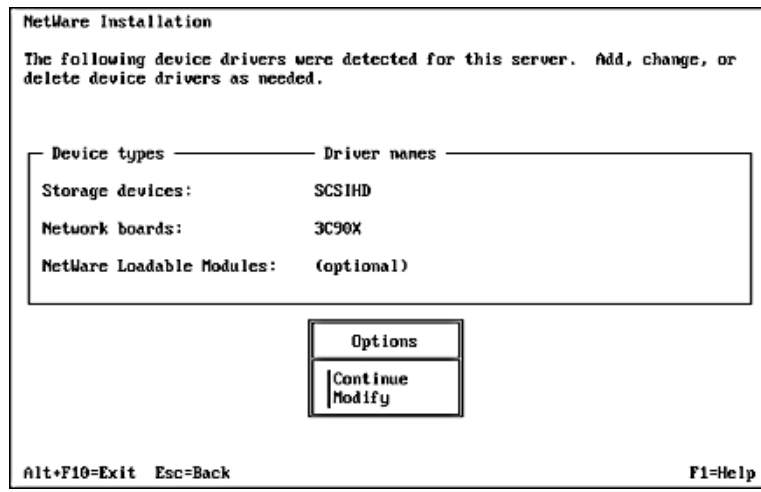
### Edit the Properties of the Storage Adapter (If Required)

The storage adapter must be installed and configured correctly. Properties such as interrupt, port value, and slot must not conflict with any other device in the computer. If you need specific storage adapter properties, contact the storage adapter manufacturer.

## Select a Storage Device and a Network Board

To select a storage device and network board, you must

- Select and configure the storage device
- Select and configure the network board
- Load a NetWare Loadable Module™ program (if required)




To *add* a driver: In the Options box, select Modify. Select the driver and press Enter. Press Insert to select from a list of drivers provided with NetWare. Press Insert again to install a driver from diskette.

To *delete* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to delete and press Delete.

To *modify* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to modify and press Enter. Select the property to modify.

## Select a Storage Device

Storage devices such as hard disks, CD-ROMs, and tape devices require a software driver to communicate with the storage adapter. The software driver for the storage device is called a *custom device module* (CDM). Each type of storage device requires a CDM.

The installation program auto-detects many types of storage devices such as IDE drives, SCSI drives, CD-ROM drives, and tape drives. If your storage device is not detected, choose the appropriate driver from the list of available drivers provided with NetWare 5 or add a new driver from a diskette. CDMs can be obtained from the storage device manufacturer.

## Select a Network Board

Network boards, such as the Novell NE3200™ board, require a software driver in order to communicate with the network. The software driver for a network board is called a *LAN driver*.

The installation program auto-detects many types of network boards. If your network board is not detected, choose the driver for the network board from the list provided with NetWare 5 or add a new driver from a diskette. You can obtain LAN drivers from the network board manufacturer.

### Edit the Properties of the Network Board (If Required)

The network board must be installed and configured correctly. Properties such as interrupt, port value, and slot must not conflict with any other device in the computer. If you need specific network board properties, contact the network board manufacturer.

### Load a NetWare Loadable Module (If Required)

Some server and network configurations require you to load a NetWare Loadable Module (NLM™) program before completing the server installation. For example, you can load ROUTE.NLM for installing in a token ring environment.

## Create a NetWare Partition and Volume Sys

Partitions correspond with operating systems, such as NetWare, DOS, or UNIX. Partitions divide a large storage region into smaller, more manageable sections. A single storage device can contain up to four partitions.

You can use volumes to divide NetWare partitions into smaller sections. Each NetWare partition can contain up to eight volumes.

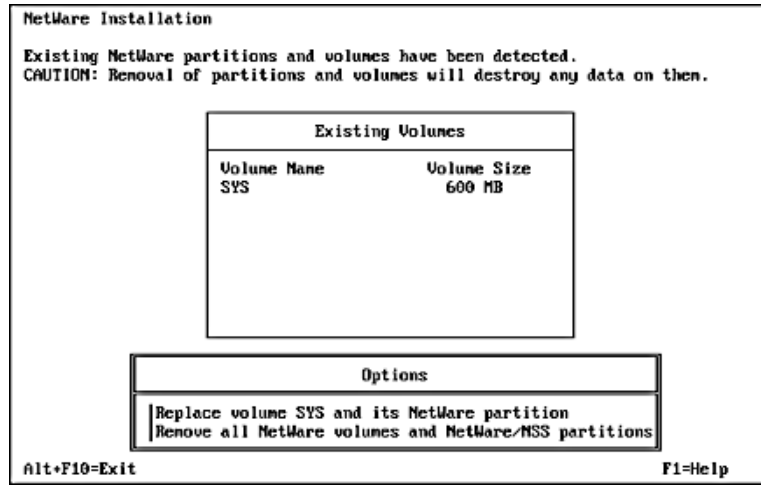
To create a NetWare partition and volume Sys you must

- Remove an existing volume Sys (conditional)
- Create a NetWare partition
- Create volume Sys
- Set the size of the NetWare partition and volume Sys (if required)
- Modify the properties of volume Sys (if required)

### Remove an Existing Volume Sys (Conditional)

If volume Sys already exists on the server, you must replace volume Sys when doing a new server installation.


To retain the data on volume Sys, you shoud exit and restart the installation program and select Upgrade from the Type of Installation screen.




When removing volume Sys during a new server installation, you must choose one of the following options:

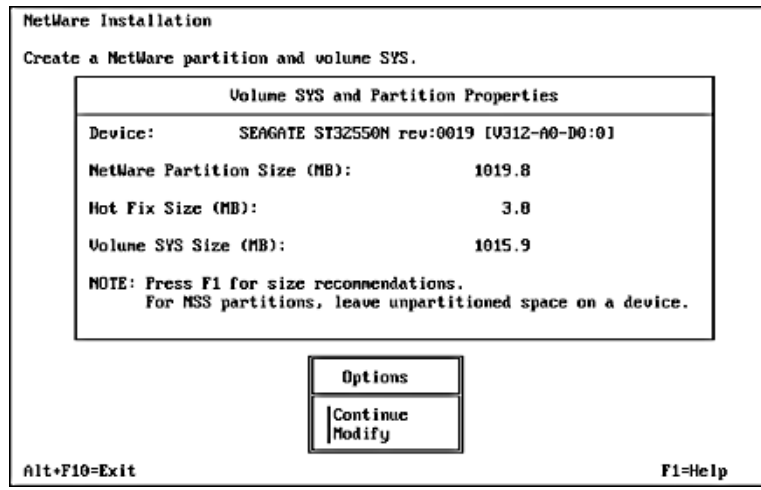
- **Replace Volume Sys and its NetWare Partition**—This will remove the existing volume Sys, as well as the entire NetWare partition containing volume Sys. Any volume that is part of the NetWare partition that contains volume Sys is also removed—even if the volume spans to other NetWare partitions.

- **Remove All NetWare Volumes and NetWare/NSS Partitions**—This will remove all NetWare volumes and all NetWare / NSS partitions.

Either option will remove only NetWare partitions. Other types of partitions, such as DOS, UNIX, and system / utility partitions, will not be removed.

## Create a NetWare Partition

During the initial stages of installation, the installation program guides you through the steps to create a single NetWare partition containing volume Sys.




**NetWare Partition Size**—All available space on the storage device will be allocated to the NetWare partition, unless you change the size.

Hint To modify the NetWare partition size: In the Options box select Modify. Select the appropriate storage device. Select NetWare Partition Size and press Enter. Backspace over the current size. Type the new size and press Enter. Press F10 to save the settings and continue.

Note NSS volumes use disk space *outside* of the NetWare partition. If you want to create NSS volumes, remember to reduce the size of the NetWare partition so the appropriate amount of disk space is available for NSS volumes.

## Hot Fix

Hot Fix™ is NetWare's data protection feature that is optimized for your storage device. Hot Fix maintains a list of defective areas on the storage device and redirects data from defective locations to safe locations.

If your storage devices include hardware redirection, you can turn off Hot Fix by setting the Hot Fix size to 0. For more information on hardware redirection, contact your storage device vendor.

## Create Volume Sys

The NetWare 5 operating system requires a volume of at least 350 MB named Sys. Although the NetWare operating system requires only 350 MB, volume Sys must be large enough to accomodate all of the NetWare products that will be installed.


Volume Sys must be a traditional volume. It cannot be an NSS volume.

**Table 4-1**
**Volume Sys Size**

| NetWare 5 Products | Minimum Volume Sys Size |
|---|---|
| NetWare 5 operating system | 350 MB |
| NetWare 5 with default products | 450 MB |
| NetWare 5 with all products | 550 MB |
| NetWare 5 with all products and documentation | 700 MB |


In addition to the sizes in the table, you should add as much as 100 MB to the volume Sys size. For optimal performance, volume Sys should always have available space for system operations.

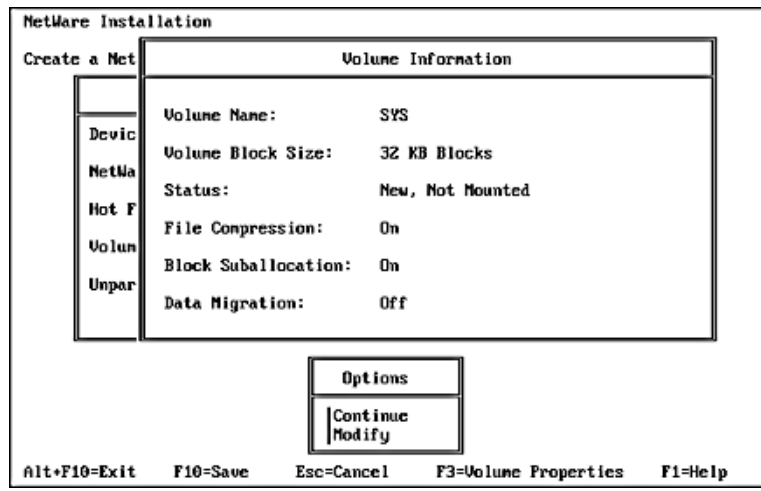
**Volume Sys size**—By default, volume Sys will use all available space on the NetWare partition.

Hint To modify volume Sys size: In the Options box select Modify. Select the appropriate storage device. Select Volume Sys Size and press Enter. Backspace over the current size. Type the new size and press Enter. Press F10 to save the settings and continue.

Note If you plan to have additional volumes on the NetWare partition, remember to reduce the size of volume Sys so the appropriate amount of disk space is available for other volumes.

## Edit Volume Sys Properties (If Required)

Although default settings work for most installations, you might need to modify volume properties such as block size, file compression, data migration, and suballocation.




Hint To modify the properties of volume Sys, press F3.

- **Block size**—Block size is automatically optimized for your server based on the size of the volume. Typically, a larger block size optimizes the volume for large files.
- **File compression**—By default, compression is automatically enabled. Enabling compression maximizes disk space but increases the file access time.

Note Some backup programs cannot back up compressed files.

- **Data migration**—By default, data migration is automatically disabled. Data migration is used to identify inactive files and move them to near-line storage systems, such as optical disks.
- **Suballocation**—By default, suballocation is automatically enabled. Suballocation allows more efficient use of disk space with only a slight increase in access time. Suballocation allows blocks to contain data from more than one file.

### Summary

NetWare system files will now be copied to volume Sys.

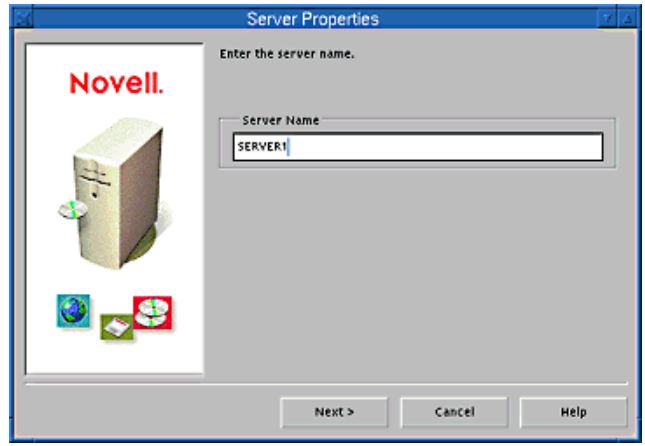
Note If you are installing from the network, you will be prompted to reconnect to the network. To continue the installation, enter the password for the user that originally logged in.

The NetWare 5 installation program will continue in graphical display mode.

## Name the NetWare 5 Server

The NetWare 5 server name must be unique from all other servers on the NDS tree. The name can be between 2 and 47 alphanumeric characters and can contain underscores and dashes, but no spaces. The first character cannot be a period.

Note The server name should be different from the name you plan to use for the NDS tree.




Although a mouse is recommended, you can use the keyboard commands in Table 4-2 to navigate through the installation program. Use the arrow keys on the numeric keypad for cursor movements.

Note NumLock (number lock) must be on in order for cursor movements to be enabled on the keypad.

**Table 4-2**
**Graphical Keyboard Actions**

| Keystroke | Action |
|---|---|
| Tab | Move focus to next element |
| Shift+Tab | Move focus to previous element |
| Enter | Select |
| Up-arrow (keypad 8) | Move cursor up |
| Down-arrow (keypad 2) | Move cursor down |
| Right-arrow (keypad 6) | Move cursor right |
| Left-arrow (keypad 4) | Move cursor left |
| Hold Shift while pressing keypad | Accelerate cursor movement |
| Keypad 5 | Select or click an object |

**Table 4-2**
**Graphical Keyboard Actions**

| Keystroke | Action |
|---|---|
| Keypad 0 | Lock a selected object (for dragging) |
| Keypad . (period) | Unlock a selected object (to drop) |
| Keypad + (plus) | Double-click an object |
| Alt+F7 | Move to next window |
| Alt+F8 | Move to previous window |

# Install the NetWare Server File System

The server should now have a single NetWare partition and one volume named Sys. If you have space available for creating additional partitions and volumes, you can create them now.


If you have allocated all available space to volume Sys, you will not be prompted for NetWare server file system information. You can skip to “Install Networking Protocols” on page 128.

When installing the NetWare file system, you can

- Create additional volumes
- Modify volumes
- Delete volumes

## Understand Volumes

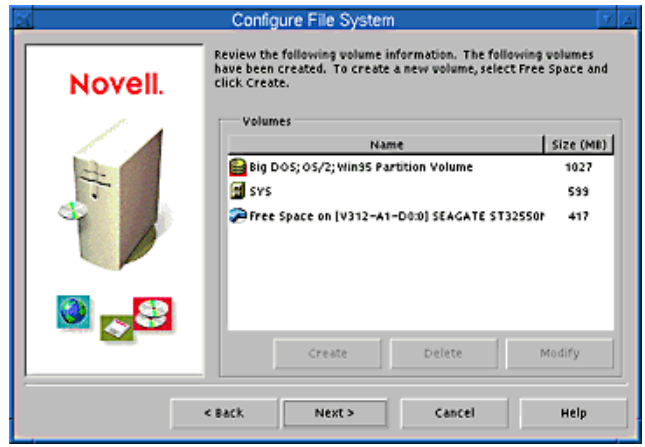
Volumes allow you to subdivide your partitions into more manageable sections. You can create two types of volumes—traditional or Novell Storage Services (NSS) volumes.

- **Traditional NetWare volume**—The traditional NetWare volume type supports all of NetWare’s volume technologies including suballocation, compression, and Transaction Tracking System™ (TTS™).

- **NSS volume**—NSS is advanced file system technology that enhances the management of large files, large volumes, name spaces, and storage devices. The time required to mount large volumes is significantly reduced with NSS.

Note

NSS volumes in NetWare 5 do not support data migration, data duplexing, disk mirroring, disk striping, file compression, transaction tracking, File Transfer Protocol (FTP), VREPAIR, Network File System (NFS*), or file name locks. If you require any of these technologies, use a traditional NetWare volume.




## Create Volumes

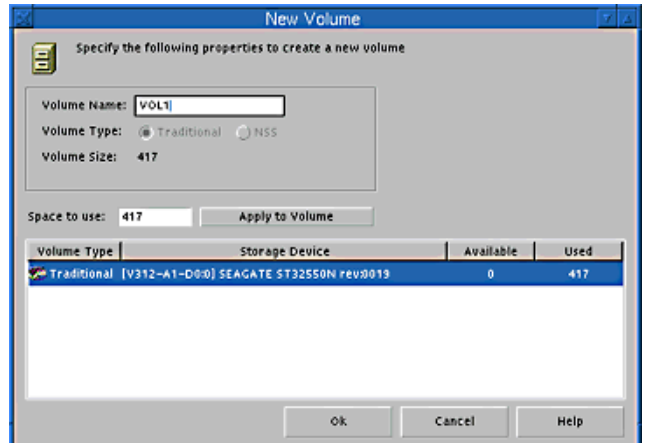
Additional volumes can be created from any available free space on a storage device. Volume names can be between 2 and 15 characters. Valid characters include A through Z, 0 through 9 and characters _ ! - @ # $ % & ( ). The volume name cannot begin with an underscore or have two or more consecutive underscores.

A large disk can be divided into several volumes during installation. Conversely, a volume can be distributed over multiple disks.

Warning

Creating a volume that spans two or more storage devices is not recommended. If a volume spans disk devices and one of the devices fails, all data on the entire volume could be lost.

Traditional volumes can be created from either traditional or unpartitioned free space. Both types of free space appear the same on the NetWare File System screen.



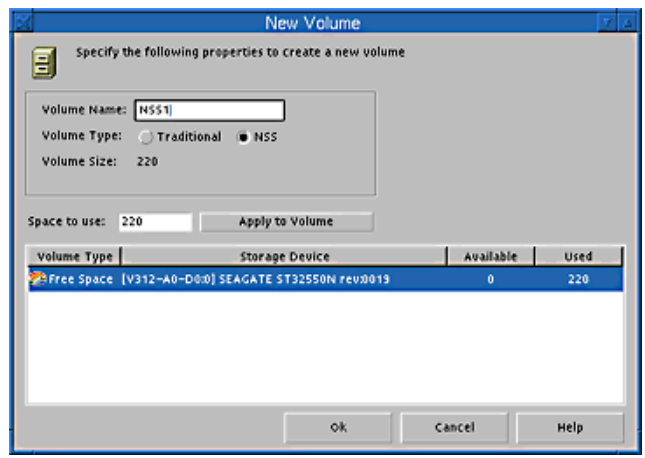

Hint

To create a traditional volume: Select free space and click Create. Type the name of the volume and click OK.

To allocate only a portion of the free space to the volume, type the amount of space to use, and click Apply to Volume.

To make the volume include additional free space, select an additional free space, type the amount of space to use, and click Apply to Volume.

NSS volumes can be created from unpartitioned free space.




To create an NSS volume: Select free space and click Create. (If the Volume Type option is not available, the selected free space is not available for NSS. Go back to the previous screen and select another free space.) Select Volume Type NSS. Type the name of the volume and click OK.

To allocate only a portion of the free space to the volume, type the amount of space to use, and click Apply to Volume.

To apply more free space to a volume, select an additional free space, type the amount of space to use, and click Apply to Volume.

## Modify Volumes

The size of any existing volume can be increased but not reduced. To reduce the size of an existing volume, the volume must be deleted and re-created.


To modify a volume: Select the volume to be modified. Click Modify.

## Delete Volumes

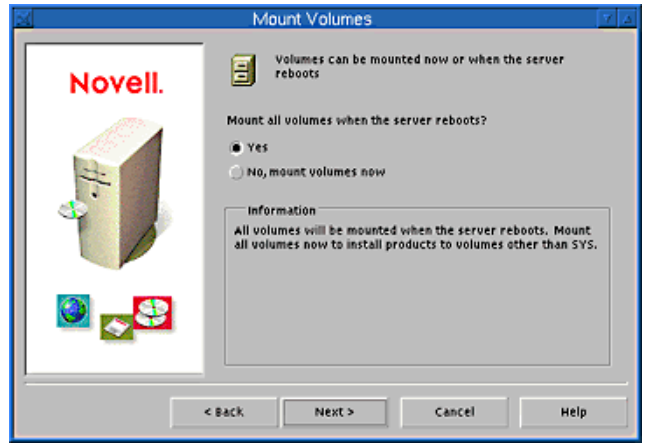
You can delete any volume you have created, except volume Sys. When a volume is deleted, all data on the volume is lost.


To delete a volume: Select the volume to be deleted. Click Delete.

## Mount Volumes

In order for volumes to be accessed by NetWare, they must be mounted. Volumes can be mounted immediately or at the end of installation.


Depending on their size, volumes can take a considerable amount of time to mount.




- **Mount Volumes Now**—You should mount volumes now if you plan to install additional products and services, such as documentation, on volumes *other* than volume Sys.

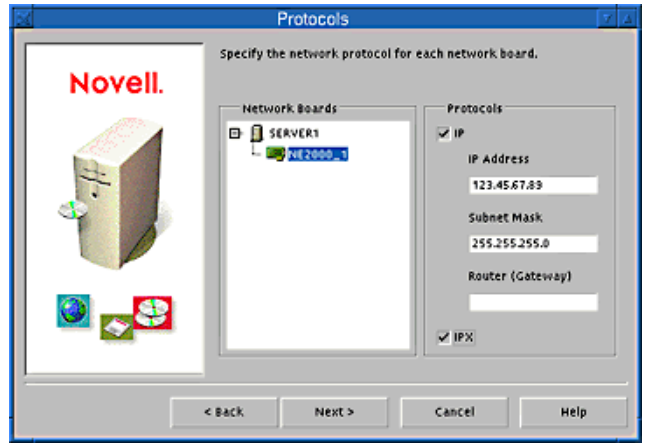
- **Mount Volumes after Installation Completes**—You can wait to mount volumes after the installation program completes, if you are installing products and services on volume Sys only.

## Install Networking Protocols

NetWare 5 can process IP network packets and traditional IPX packets. You can install networking protocols in the following ways:

- IP with IPX Compatibility Mode
- Internet Protocol (IP) only
- Internetwork Packet Exchange (IPX) only
- IP and IPX

Protocols are assigned to network boards. Both protocols can be assigned to a single network board, which allows the server to communicate using IP and IPX.




Hint To install IP with IPX Compatibility: Click a network board. Check the IP check box. Enter the required IP information.

To install IPX: Click a network board. Check the IPX check box.

## Install Internet Protocol (IP) with IPX Compatibility Mode

Internet protocol (IP) allows your network to share data with other IP networks, including the Internet. Using IP requires a unique IP address, a subnet, and a router or gateway address.

When IP is selected, passive support for IPX is also provided. If an IPX request arrives at the server, NetWare 5 will process the IPX request. This passive support for IPX is called Compatibility Mode and is automatically enabled to provide service for applications that require IPX.

- **IP Address**—An IP address identifies each device on the network. The address consists of 32 bits, which are represented as decimal values separated by periods, such as 123.45.67.89.

  If your server will connect to the Internet, you must obtain a unique IP address. For information on receiving an IP address, contact your Internet service provider (ISP).

- **Subnet Mask**—Subnet masks allow you to break up your network into smaller networks. Your network might have too many nodes or might be too geographically dispersed to manage as a single network.

  Dividing your network into smaller networks allows the network routers to filter and reduce the network activity seen by any of the nodes. However, dividing your network and using several network addresses might not be appropriate on a large network that needs to appear to network administrators as a single network.

- **Router (Gateway)**—The router (gateway) is the address of the router that connects two different environments, such as a LAN and the Internet.

  You can enter a specific router (gateway) address, or you can rely on the network to automatically find the nearest router. If you specify the address, remember that the router must exist on your network segment.

Installing IP will automatically bind to the Ethernet_II frame type.

## Install IP Only

Internet Protocol (IP) can be installed without IPX Compatibility Mode enabled. When IPX Compatibility Mode is disabled, the server will process only IP packets. Applications that require IPX will not function properly.


You can also disable Compatibility Mode by removing the **LOAD SCMD** command from the server's autoexec.ncf file.

## Install Internetwork Packet Exchange (IPX)

Novell's traditional protocol, Internetwork Packet Exchange™ (IPX), will allow you to continue using IPX-based applications. If only IPX is installed on your server, it will actively process IPX packets and ignore packets using other protocols, such as IP.

During the installation program, existing IPX frame types will be detected. The installation program will detect one of the following conditions.

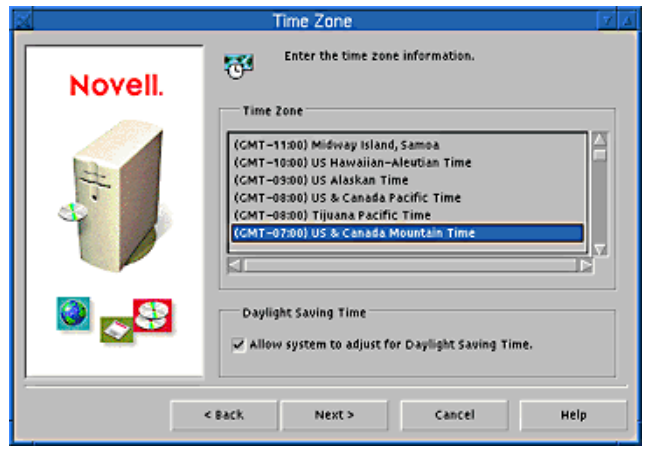
- **A single IPX frame type**—If a single frame type is detected, it will be installed.
- **Multiple IPX frame types**—If detected, you will be prompted to choose the frame types you want to install.
- **No IPX frame types**—If no frame types are detected, Ethernet_802.2 will be installed by default.

## Install Both IP and IPX

If you have network clients or applications that require IPX and IP, you can install both protocols. Both protocols can be bound to a single network board. When selected, both IP and IPX protocols are actively supported. The server will process IP requests using IP. The server will broadcast and reply to IPX requests using IPX.

# Set the Server Time Zone

The server time and time zone are important in order to synchronize network events. Advanced time synchronization settings are available during the Customize section of the installation.




# Set Up NDS, Novell's Directory Technology

NDS, Novell's directory technology, provides global access to all networking resources. NDS allows users with the proper access rights to log in to the network and view and access network resources.

Network resources such as servers and printers are presented hierarchically in an NDS tree. Users log in to the NDS tree with a single login name and password instead of logging in to specific servers.

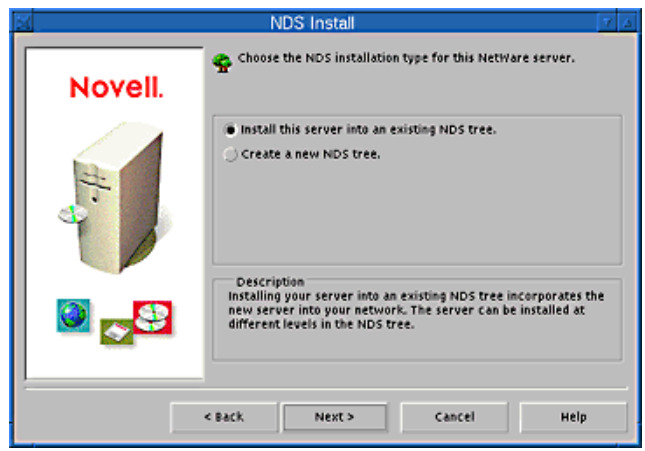
## Choose the Type of NDS Installation

To set up NDS, you must choose one of the following options:

- Install the server into an existing NDS tree
- Create a new NDS tree

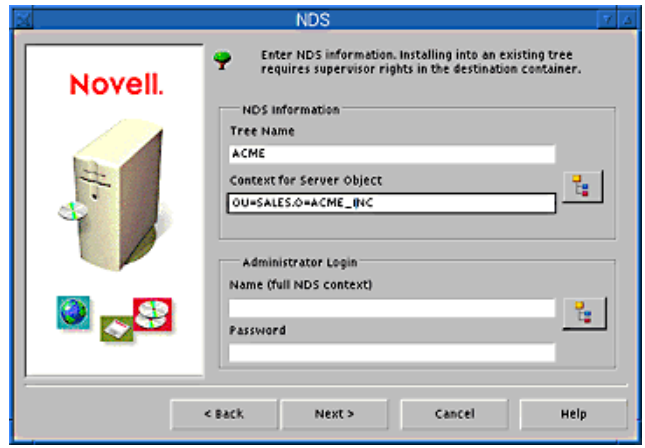
Before completing this task, you should understand the concepts relating to NDS trees, containers, and context. For more information, see “NDS, Novell’s Directory Technology” on page 97.

- **Tree**—The NDS tree name is the top level of the available network resources and must be unique from other NDS tree names on the network.
- **Containers**—Container objects, much like subdirectories, contain network objects. The server can be installed into two types of container objects: Organization (O) and Organizational Unit (OU).
- **Context**—The context, much like DOS directory paths, denotes the full path of a network object in the NDS tree. For example, a NetWare server might be installed into an Organizational Unit (OU) named Sales under the organization (O) named Acme. The context would be denoted as OU=Sales.O=Acme or Sales.Acme.



## Install the Server into an Existing NDS Tree

Installing your server into the existing NDS tree incorporates the server into your network.



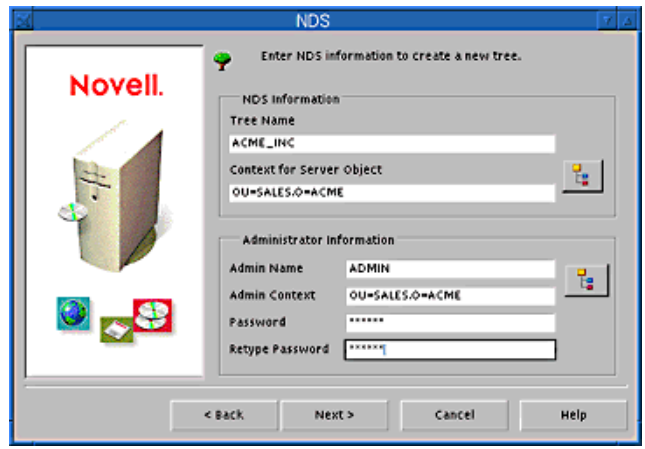

The server can be installed in any Organization (O) or Organizational Unit (OU) container in the NDS tree where you have Supervisor rights. You can create containers during the installation program. You will be required to log in and supply the context, username, and password for the user with Supervisor rights to the container.

Note If this is the first NetWare 5 server to be installed into an NDS tree with NetWare 4.1*x* servers, you will be prompted to modify the schema. When prompted, you must provide the administrator name and password for the entire NDS tree. Modifying the NDS schema requires Supervisor rights at the root of the existing NDS tree.

Note All NetWare 4.1*x* file servers must be running DS.NLM version 5.99 or higher.

## Create a New NDS Tree

Create a new tree if you are creating a new network or if this server requires a separate NDS tree. The resources available on the new tree will only be available to users logged in to the new tree.




Each NDS tree must have a name unique from other NDS trees on the network. You will also be prompted to create a user (default name ADMIN) with Supervisor rights, identify an NDS context, and assign a password.

## Summary

You have created a new NDS tree or installed the server into an existing NDS tree. The NetWare Server object and Volume objects will be installed in the container you specified.


If you have created a new NDS tree, a user (default name ADMIN) with Supervisor rights to the NDS tree will be created in the same NDS container as the NetWare Server object.

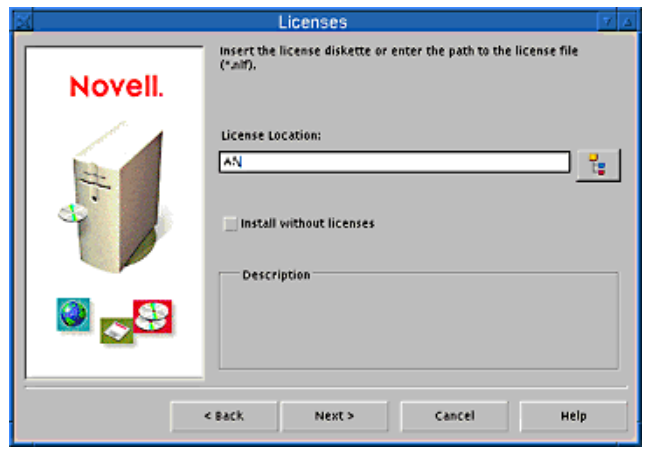
Important

Record the administrator password and other relevant information before proceeding.

# License the NetWare Server

NetWare 5 must have a valid license in order to function as a server. You can install the license from the NetWare 5 License diskette or browse to a directory that contains NetWare 5 licenses.

**Install without Licenses**—Although the server can be installed without a license, the unlicensed server will allow only two user connections. After installation, you can use the NetWare Administrator utility to install licenses.



# Install Other Networking Products

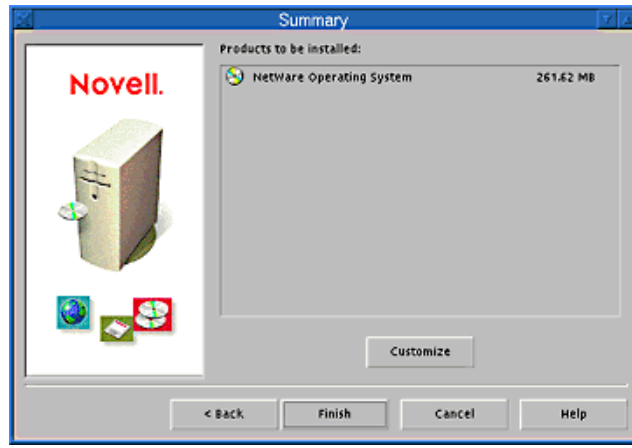
After completing the NetWare server portion of the installation, you can select other networking products to install. Other networking products provide enhanced functionality to NetWare 5, such as network management and Internet access.


Hint To install a product: Check the check box next to the product to be installed.

Although you can choose which products to install, installing the products that are already selected by default will ensure that you receive the features recommended for NetWare.

# Customize the NetWare 5 Installation

You can customize the installation of many products for your networking environment.



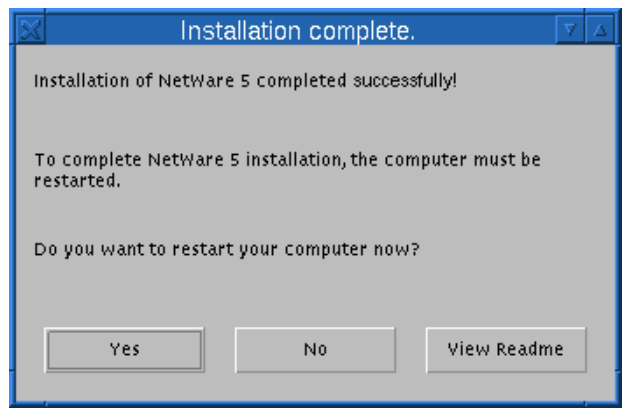

Hint To customize products and components: From the Summary screen, click Customize. Select the product to customize. Click Properties. Modify the product as required. Click OK.

For more information on customizing the installation, see Chapter 5, “Customizing the Server Installation,” on page 143.

# Complete the Server Installation

The basic server installation is now complete. Depending on which additional products you are installing, you might be prompted to insert additional CD-ROMs.


Hint From the Summary screen, click Finish to begin installing NetWare 5 and additional products. After all files are copied, the server must be rebooted in order for the settings to take effect.




After the files are copied, click Yes to reboot the server.

NetWare 5 is automatically loaded when the computer reboots, or you can load it manually.


To load the server manually: Reboot the server by clicking Yes. Change to the startup directory containing the NetWare server files (c:\nwserver). Enter **SERVER**.

You should now connect workstations to the NetWare 5 server. For more information, see Chapter 8, “Installing Novell Clients,” on page 209.

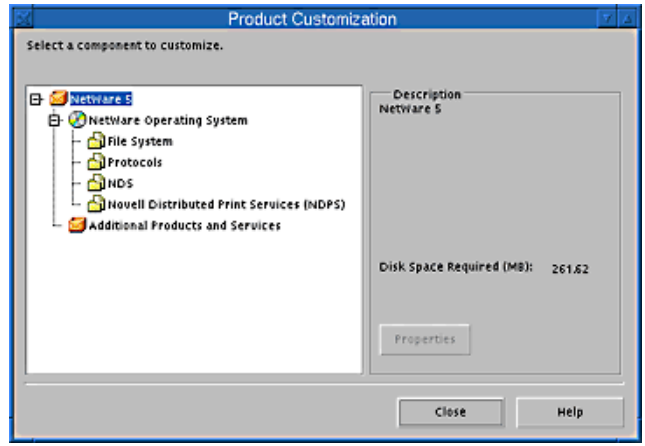
chapter 5

# Customizing the Server Installation

This chapter describes how to set advanced options and customize the installation of your NetWare® 5 server. Advanced options are available throughout the installation, and customization is available from the Summary screen at the end of the installation program.

After you select the additional products and services to install, the installation program provides a summary screen with a Customize button. Click Customize to customize the installation of each product and service for your networking environment. The following options can be customized:

- NetWare operating system
- File system
- Network protocols
- NDS™
- Novell® Distributed Print Services™ (NDPS™)



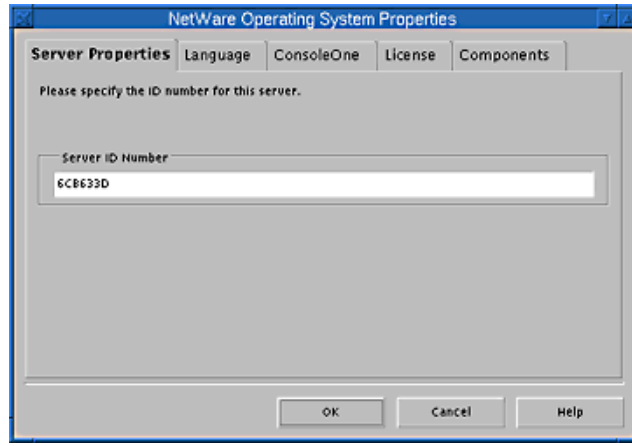

Hint To customize the NetWare installation: Start the installation. From the Summary screen, click Customize. Choose the product to customize. Click Properties.

# NetWare Operating System Properties

NetWare operating system properties include server, language, ConsoleOne™, license, and component properties. Each property can be accessed by selecting the appropriate tab.

## Server Properties

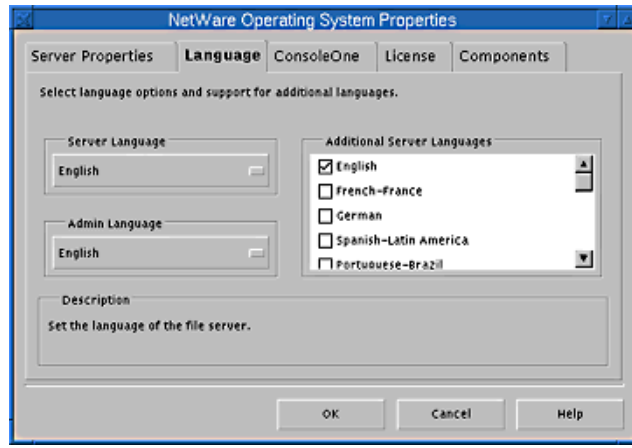
The server property that can be changed is Server ID Number.




**Server ID Number**—The server requires a unique identification number. Changing the server ID number during the Customize portion of the installation will place the new server ID number in the autoexec.ncf file. The new server ID number will take effect after you reboot the server.

## Language

NetWare 5 can be customized to function in several languages.




- **Server Language**—The server language determines which language the server console and error messages will appear in.

Hint

The language on the server console can be changed. For more information, enter **LANGUAGE /?** at the server console.

- **Admin Language**—The admin language determines which language the network administrator User object will use to log in to the network. When additional NDS objects are created by the administrator, they will use the same language as the admin language.

Hint

For information on changing the language of the network client, see the client operating system's documentation.

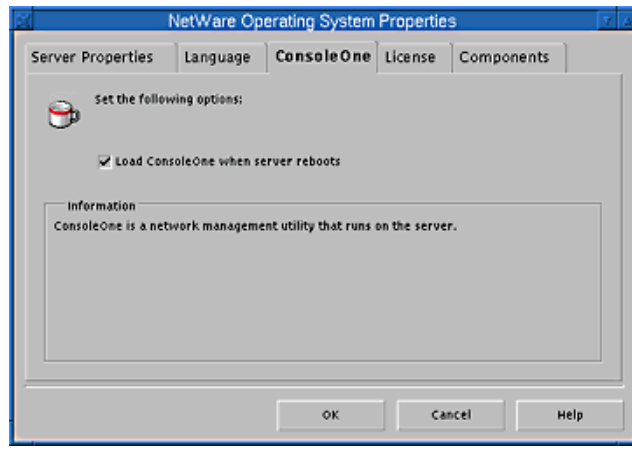
- **Additional Server Languages**—You can use NetWare server and client utilities in other languages, if the additional languages have been installed on the server.

Hint

Check the box next to the languages you might need installed on the server or client.

## ConsoleOne

Options for ConsoleOne, a network management utility that runs on the server, can be customized for your networking environment.

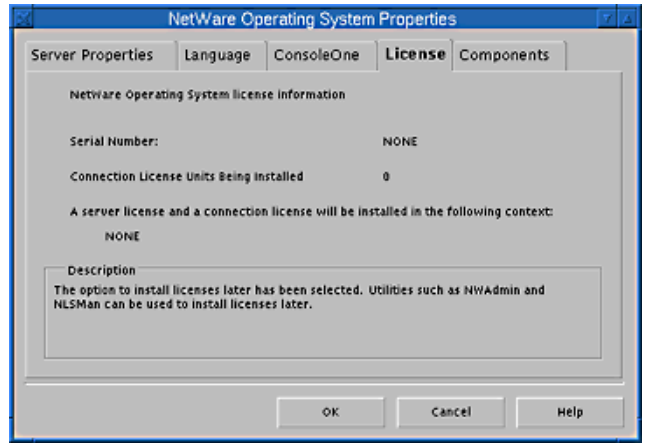



**Load ConsoleOne When Server Reboots**—Checking this box will launch Novell's ConsoleOne utility when the server loads.

## License

NetWare 5 licenses consist of a server license and a connection license. Connection licenses determine how many connections can be maintained. Licenses for additional NetWare 5 products might be provided as part of your installation or can be purchased from your NetWare reseller.

Licenses for servers and other products can be installed after installation using the NetWare Administrator utility or NLS Manager utility.




Note The License screen is for informational purposes only and cannot be modified.

Properties relating to licensing your NetWare server include the following.

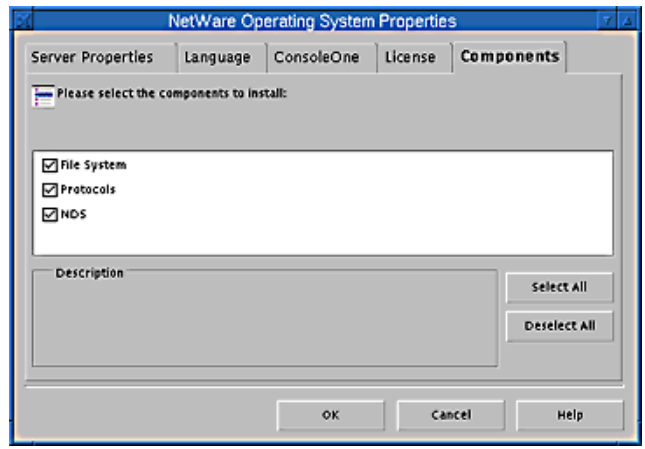
- **Serial Number**—A serial number uniquely identifies each license. Upgrades beyond NetWare 5 can require you to provide the license serial number. Serial numbers for licenses can also be viewed after installation using NetWare Admininstrator or NWCONFIG.

- **Connection License Units Being Installed**—Licenses are valid for a specific level of operation. For example, a license with one server and 100 connections allows a single server to have 100 users.

- **License Context**—License objects are placed in the same NDS context as the server.

## Components

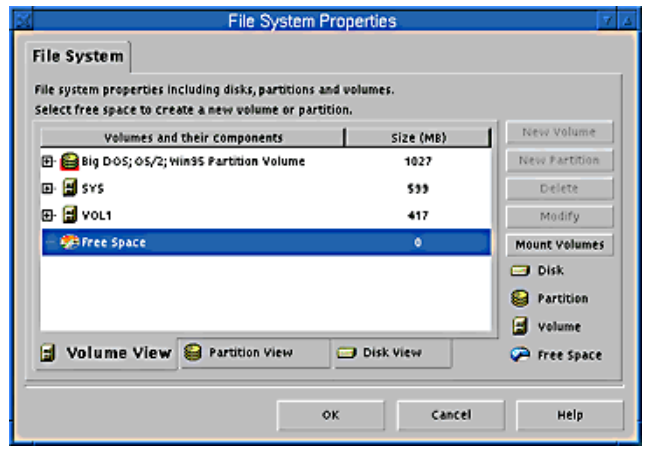
This tab lists the products and services that will be installed for each component.




Checking a box will add the entire component to the list of products and services to install. Unchecking a box removes the entire component from the list of products and services to be installed.

# File System Properties

The NetWare file system refers to the physical and logical aspects of storing files on storage devices such as a disk drive. The file system consists of partitions, volumes, and free space.




You can customize the NetWare file system by performing the following tasks:

- Viewing available free space
- Creating, modifying, and deleting partitions
- Creating, modifying, and deleting volumes
- Mounting volumes

## Working with Free Space

Free space represents space available on storage devices for creating partitions and volumes. The following types of free space can exist. Note that a given type of free space can display with a different name.

- **Free Space or Unpartitioned Free Space or Not Partitioned Free Space**—Space available to create a NetWare NSS partition or a NetWare partition.
- **Traditional Free Space or NetWare Partition Free Space**—Space available to create a traditional volume.

## Working with Partitions

Partitions subdivide a storage device. The following types of partitions can exist. Note that a given type of partition can display with more than one name.

- **Big DOS; OS/2*; Win95 partition (also called boot partition)**—Partitions formatted with DOS, such as the boot partition containing the files that load the NetWare operating system. These partitions *cannot* be modified or deleted.
- **System Configuration or Utility partition**—The partition containing the system setup information for the computer. This partition *cannot* be modified or deleted.
- **NetWare or NetWare Traditional partition**—The partition where traditional volumes can be created. NSS volumes *cannot* be created within this type of partition.
- **NetWare NSS partition**—The partition where NSS volumes can be created. Traditional volumes *cannot* be created within this type of partition.

### Create a Partition

Partitions can be created from any available free space. You can create traditional or NSS partitions. Traditional partitions can contain traditional volumes. NSS partitions can contain NSS volumes.

Hint

To create a traditional or NSS partition: Select Not Partitioned Free Space. Click New Partition. Accept the default size or set the size of the partition. Select the partition type. Set additional properties for the partition. Click OK to save and continue.

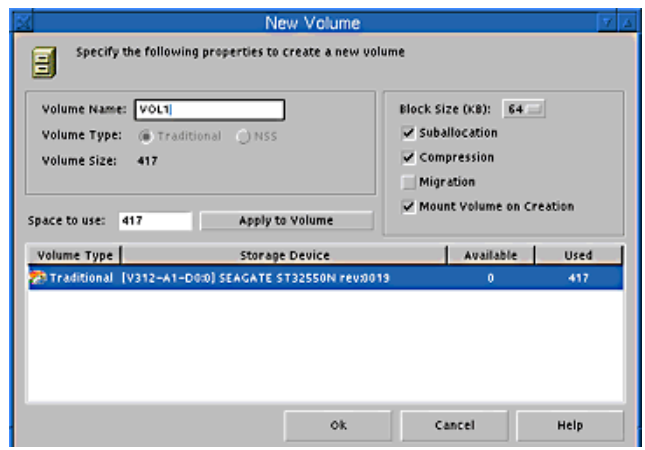
## Working with Volumes

Volumes subdivide a partition. Volumes are created within a partition. You can create two types of volumes:

- **Traditional volume**—Traditional volumes can be created within NetWare (or NetWare Traditional) partitions.
- **NSS volume**—NSS volumes can be created within NetWare NSS partitions.

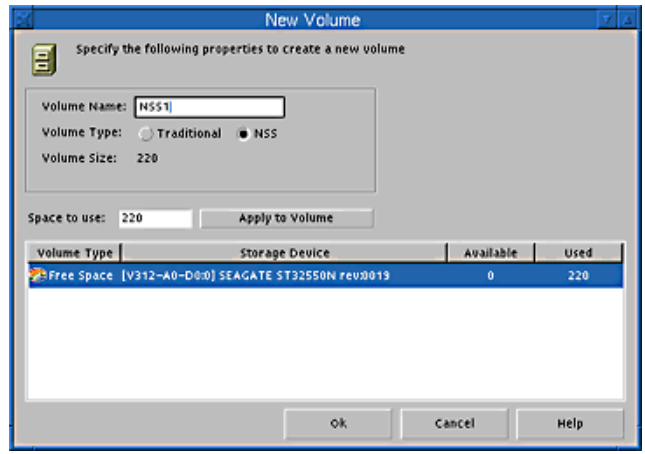
### Create a Volume

You can create volumes from traditional partitions or NSS partitions. An NSS volume can only be created in an NSS partition. A traditional volume can only be created in a traditional partition.



Hint To create a *traditional* volume: Select NetWare Partition or NetWare Traditional free space. Click New Volume. Name the volume. Accept the default size of the volume, or change the volume size by entering the amount of disk space. Click Apply to Volume. (If required, increase the size of the volume by selecting another free space. Click Apply to Volume.)

To increase the size of an existing volume: Select the volume to modify. Click Modify. Select an appropriate free space. Click Modify. Apply the default size of the selected volume, or change the volume size by entering the amount of disk space. Click Apply to Volume.




Hint To create an *NSS* volume: Select NetWare NSS free space. Click New Volume. Name the volume. Accept the default size of the volume, or change the volume size by entering the amount of disk space. Click Apply to Volume. (If required, increase the size of the volume by selecting another free space. Click Apply to Volume.)

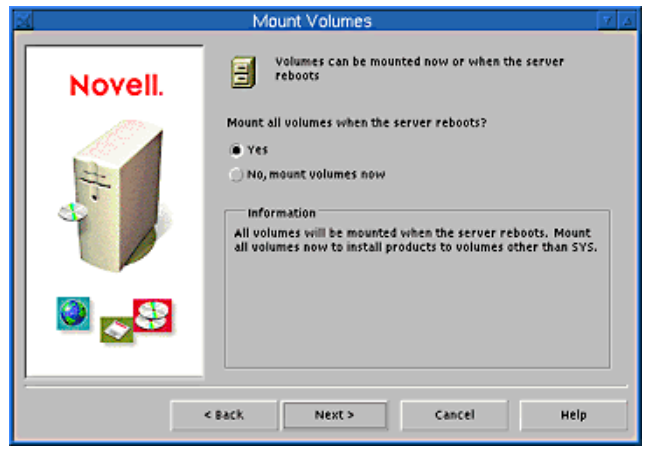
To increase the size of an existing volume: Select the volume to modify. Click Modify. Select an appropriate free space. Click Modify. Apply the default size of the selected volume, or change the volume size by entering the amount of disk space. Click Apply to Volume.

## Mount Volumes

In order for volumes to be accessed by NetWare, they must be mounted. Volumes can be mounted immediately or at the end of installation.

Note

Depending on their size, volumes can take a considerable amount of time to mount.

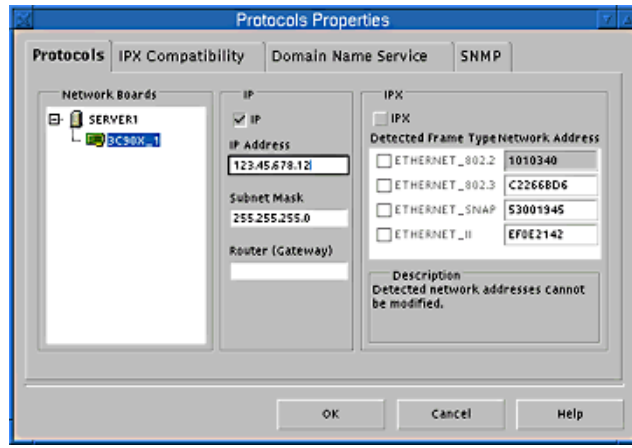



- **Mount Volumes Now**—You should mount volumes now if you plan to install additional products and services, such as documentation, on volumes *other* than volume Sys.

- **Mount Volumes after Installation Completes**—You can wait to mount volumes after the installation program completes, if you are installing products and services on volume Sys only.

# Network Protocols

NetWare 5 provides support for Internet Protocol (IP) and the Internetwork Packet Exchange™ (IPX™) protocol.




- **IPX Frame Types**—Although the basic installation selects the default IPX frame types for your network, you can decide which frame types the server will support.

  Each frame type that is used on the network is treated as a logical network segment and requires its own IPX network address—even though each frame type is using the same network board and physical cable segment.

Hint

To add IPX frame types: From the Protocols screen, check the box of the desired frame type. Enter the network address. Click OK.

- **Network Address**—An IPX network address is a hexadecimal number, one to eight digits (1 to FFFFFFFE), that identifies a specific network cable segment.

- **IP Address**—An IP address identifies each device on the network. The address consists of 32 bits, which are represented as decimal values separated by periods such as 123.45.67.89.

  If your server will connect to the Internet, you must obtain a unique IP address. For information on receiving an IP address, contact your Internet service provider (ISP).

- **Subnet Mask**—Subnet masks allow you to break up your network into smaller networks. Your network could have too many nodes or could be too geographically diverse to manage as a single network.

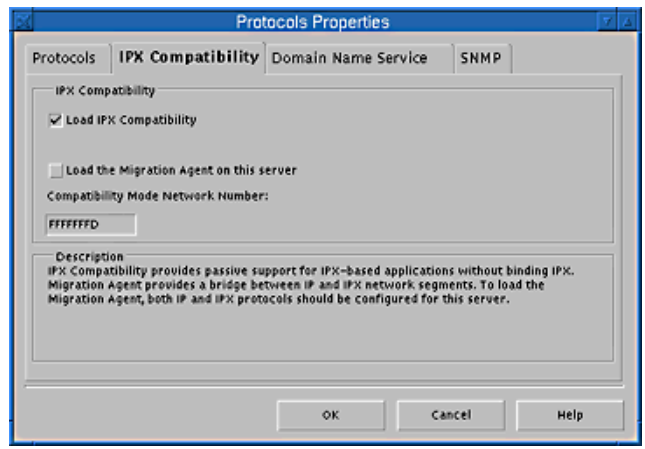
  Dividing your network into smaller networks allows the network routers to filter and reduce the network activity seen by any of the nodes. However, dividing your network and using several network addresses might not be appropriate on a large network that needs to appear to network administrators as a single network.

- **Router (Gateway)**—The router (gateway) is the address of the router that connects two different environments such as a LAN and the Internet.

  You can enter a specific router (gateway) address, or you can rely on the network to automatically find the nearest router. If you specify the address, remember that the router must exist on your network segment.

## IPX Compatibility

NetWare allows you to specify how the server will process packets using the protocols in your networking environment.



### IPX Compatibility

When checked, IPX Compatibility is enabled to provide support for applications requiring IPX. Although the server does not broadcast services using RIP and SAP, NetWare 5 will process any IPX request that arrives at the server.

### Compatibility Mode Network Number

**Compatibility Mode Network Number**—The eight-digit hexadecimal number that identifies the IPX compatibility mode network. It functions like a virtual IPX network number. All compatibility devices, such as clients, server, and Migration Agents, must use the same compatibility mode network number in order to communicate. The number must be unique from other numbers, such as the server ID number and the IPX network number. The default compatibility mode network number is FFFFFFFD.

### Migration Agent

NetWare 5 provides the ability to regulate IP and IPX protocols using a Migration Agent. A Migration Agent regulates the protocol function on different network segments. If Migration Agent is not enabled, packets will not be forwarded onto network segments communicating with a different protocol.

- **One network board**—If your server contains only a single network board, enabling Migration Agent causes IPX packets destined for other networks to be "tunneled" in IP packets.

- **Two network boards**—If your server contains two network boards, enabling Migration Agent causes the server to function as a gateway. The server functioning as a gateway filters or forwards the packets in each network environment.

  For example, a server acting as a Migration Agent can have one network board communicating with the IP network and another network board communicating with IPX.

  IPX requests destined to travel across the IP network are tunneled in an IP packet. IP packets destined to travel across the IPX network segment are tunneled in an IPX packet.

Separating the protocols on network segments reduces the traffic on both segments. IPX packets such as RIP and SAP are kept on the IPX segment, while IP packets remain on the IP segment.

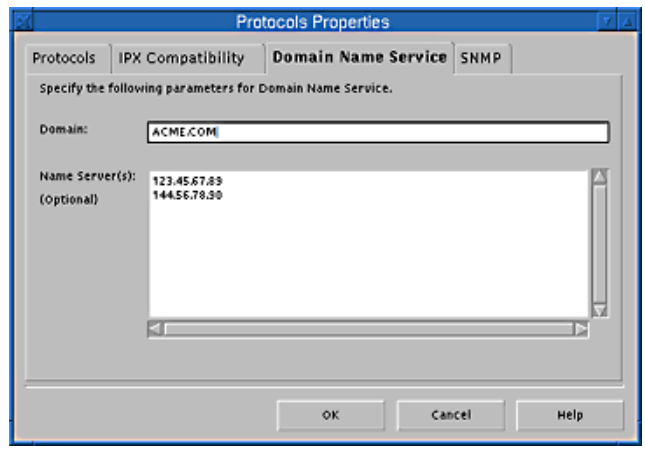
## Domain Name Service (DNS)

Domain Name Service (DNS) is the functionality that matches text names, such as novell.com, with numbers used by computers, such as 123.45.67.89.

If you have an existing domain naming system already installed on your network, enter the Domain Name and Name Server(s).

Note

If you want to install Novell's DNS on your network, you must return to the Summary screen and install Novell DNS/DHCP Services in Other Products and Services.




- **Domain Name**—Domain names divide the Internet into functional categories. The top level domains identify types of organizations such as commercial (com), educational (edu), government (gov), international entities (int), U.S. military agencies (mil), network providers (net), and other organizations (org).

  Domain names can also use two-letter country codes to specify geographical locations such as United States (us) or United Kingdom (uk).

Domain names are separated into individual levels with periods, such as sales.acme.com or acct.acme.ut.us.

- **Name Server(s)**—In addition to domain names, DNS manages domain name servers. A name server is a computer that translates names into IP addresses for other devices, such as workstations on the network. To obtain the name, NetWare 5 will search the IP address of each name server in the sequence entered into the Name Server field.

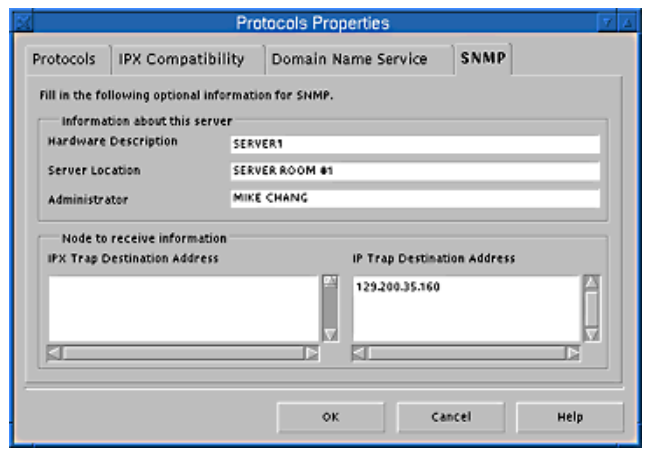
Hint

Enter the IP address of the name server(s).

## Simple Network Management Protocol (SNMP)

Network management utilities such as Novell's ManageWise® utility use Simple Network Management Protocol (SNMP) to record and communicate information about network devices. Using an SNMP-compatible utility, you can set and monitor threshold levels and specific events such as packets per second or error rates.

When an event occurs, information such as event type, hardware description, server name, server location, and network administrator name is recorded. The information is then sent to the destination address of the workstation running the SNMP-compatible management utility.

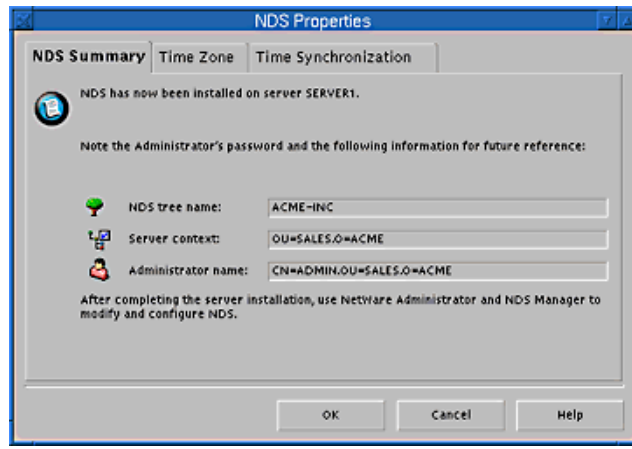


- **Information to be sent when an event occurs**—You can select to have any or all of this information recorded when an event occurs:
  - Server name
  - Hardware description
  - Server location
  - Administrator name
- **Where to send the SNMP information**—You can specify which devices will receive the information when an SNMP event occurs. Each device should be running an SNMP-compatible management utility such as the ManageWise utility. You can specify IPX and IP destination addresses of the devices to receive the information.
  - **IPX Trap Destination Address**—The device's IPX address representing the network and node number separated by a colon, such as 01010340:1233456789.
  - **IP Trap Destination Address**—The IP address of the destination device in standard notation, such as 123.45.67.89.

# NDS Properties

## NDS Summary

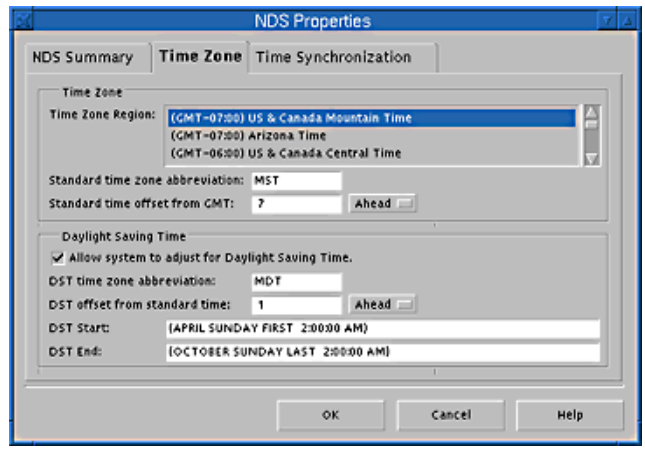
The NDS Summary lists the NDS tree name, server context, and administrator name and context.




Note The NDS Properties screen is for informational purposes only and cannot be modified.

## Time Zone

Although selecting the time zone will automatically configure the time zone properties, you might need to change some properties for your network environment.

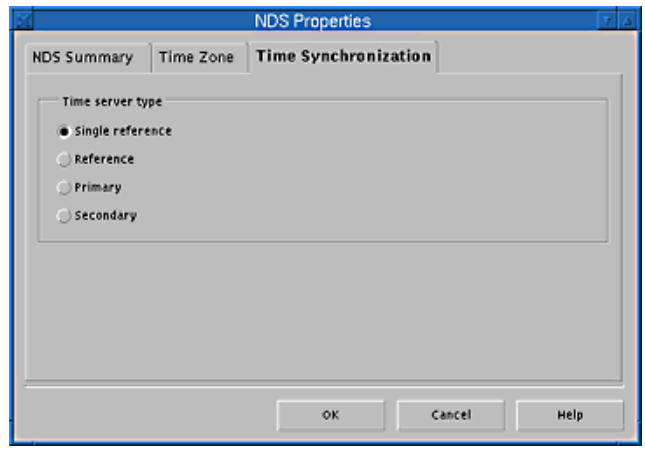



- **Time Zone Region**—the time zone where the server is located.
- **Standard Time Zone Abbreviation**—the abbreviation, used by NetWare, for the time zone where the server is located.
- **Standard Time Offset from GMT**—the difference, in number of hours, between Greenwich Mean Time (GMT), and the time zone where the server is located. GMT is equivalent to Universal Coordinated Time (UTC).
- **Allow System to Adjust for Daylight Saving Time**—indicates whether daylight saving time is in effect.
- **DST Time Zone Abbreviation**—the abbreviation, used by NetWare, for the daylight saving time zone where the server is located.
- **DST Offset from Standard Time**—the difference, in number of hours, between the standard time and daylight saving time.
- **DST Start and DST End**—the beginning and ending dates of daylight saving time.

## Time Synchronization

Specifying the type of time server synchronizes the reported time across the network. It also provides expiration dates and time stamps to establish the order of events taking place in NDS.

NetWare 5 distinguishes three types of time servers that provide network time: single reference, reference, and primary. All other servers are called secondary time servers because they receive their time from the time providers.




- **Single reference time server**—The first server in a network is automatically designated as a single reference time server. A single reference time server provides time to the entire network.
- **Primary time server**—A primary time server is responsible for determining and setting the network time. A primary time server will poll other primary and reference servers to determine the "average network time." The average network time is then distributed to other requesting servers.
- **Reference time server**—A network usually has only one reference time server. A reference time server provides a network time for all primary time servers to migrate to. It is used on larger networks where primary time servers are required.

Note

If more than one reference time server exists, each must be synchronized to the same external time source, such as an atomic clock.

- **Secondary time server**—By default, all servers except the first server are designated as secondary time servers. A secondary time server relies on other sources such as a single reference time server to provide them with network time. A secondary time server can get the network time from another secondary time server or from a single reference, reference, or primary time server.

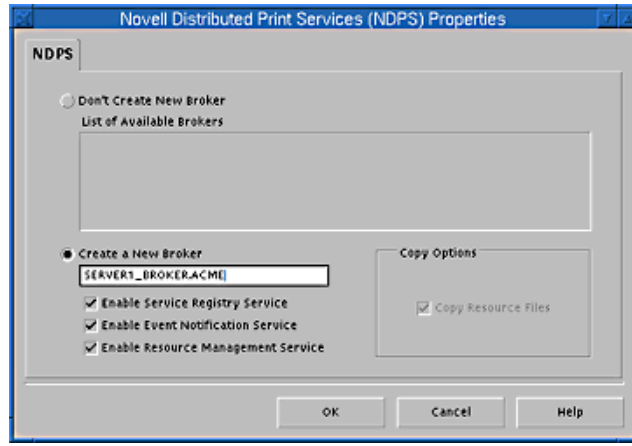

If the network has fewer than 30 servers, use the default installation settings of a single reference time server and secondary time servers. If the network has more than 30 servers, you might need to customize the environment using different types of time servers.

## Novell Distributed Print Services (NDPS)

NDPS is installed by default on each NetWare 5 server you install. An NDPS resource database (in the sys:ndps\resdir directory) used by the NDPS Resource Management Service (RMS) is copied automatically to that server. The RMS is a central repository for network resources and services. It contains printer drivers, banners, printer definition (NPD) files, and possibly fonts.

If you select to customize NDPS, you will be asked whether you want want to create a new Broker object on this server and whether you want the different brokered services enabled. In general, you will want these services, including the resource database for the Resource Management Service, available for each Broker that you create.

If disk space is an issue on a specific server and you do not intend to create a Broker object on that server, be sure the Copy Resource Files box is not checked. This will save approximately 60 MB of disk space on that server.




## Don’t Create New Broker

If Don’t Create New Broker is selected, no NDPS Broker is created during the installation process. Just below this button is a scrollable list of available Brokers, if any are found. Available Brokers are shown in the list if any of the following conditions are met:

- A loaded Broker was found within the server’s tree.
- A Broker name was found in the server’s autoexec.ncf file.
- A Broker was running on this server at the time NDPS was installed.

Note

If a “local Broker” is found (one meeting either of the last two conditions above), Don’t Create New Broker is automatically highlighted and Create New Broker is unavailable for selection. If you want to create a new Broker on a server where a local Broker already exists, use NetWare Administrator to create one after the installation is complete.

## Create New Broker

If Create New Broker is selected, an NDPS Broker is created and given the name shown in the edit field directly below this button. A default Broker name is displayed initially in this field. Include the full NDS context when changing the default Broker Name.

- **Enable Service Registry Service**—If this box is checked, the NDPS Service Registry Service is enabled and loaded when the Broker is loaded on the server. This service is used to locate printers and other NDPS services on the network.

- **Enable Event Notification Service**—If this box is checked, the NDPS Event Notification Service is enabled and loaded when the Broker is loaded on the server. This service is used to notify users of printer and job events.

- **Enable Resource Management Service**—If this box is checked, the NDPS Resource Management Service is enabled and loaded when the Broker is loaded on the server. This service allows access to common resources such as printer drivers, banner files, and NPD files.


If no other Brokers are available in the tree where the server resides, these services must be enabled for NDPS to function properly.

## Copy Options

If Copy Resource Files is selected, then the NDPS Resource Management Database is copied to this server during installation of NDPS. You can choose not to install it on this server, but a valid NDPS Resource Management Database must be available somewhere else to make NDPS fully functional.


If you choose not to install the NDPS Resource Management Database on this server now, you can put it on the server later if you wish.

# Additional Products and Services

Additional products and services can be customized. To customize other products and services, complete the following steps.


1. **From the Product Customization screen, select the additional product and service to be customized.**
2. **Click Properties.**
3. **Select the appropriate tab for your customization requirements.**
4. **Customize how the product and service will be installed.**
5. **Click OK.**

chapter 6

# Upgrading an Existing Server to NetWare 5

The NetWare® 5 installation program can be used to upgrade an existing NetWare 3.1*x* or NetWare 4.1*x* server. This chapter describes how to upgrade an existing NetWare server to NetWare 5™.

The upgrade process includes the following tasks:

- Meet system and software requirements
- Prepare the network for a NetWare 5 server
- Prepare the computer for the server upgrade
- Begin the installation
- Select the platform support module and storage adapter
- Select the storage device and network board
- Create additional volumes (if required)
- Select and install networking protocols
- Set the server time zone (if required)
- Set up NDS™, the Novell® directory technology (if required)
- License the NetWare 5 server
- Select other networking products to install
- Customize your NetWare 5 server upgrade

During the upgrade program, the server is upgraded to NetWare 5 by automating the following tasks:

- Device drivers and LAN drivers for the NetWare 5 operating system are loaded. Outdated drivers are matched with and replaced by new drivers included with NetWare 5.
- NDS is installed or upgraded, depending on which NetWare version you are upgrading.
- NetWare 5 information is added to the autoexec.ncf and startup.ncf files.
- The NetWare 5 files are copied to the server.
- Novell Distributed Print Services™ (NDPS™) is installed.


Upgrading from NetWare 3.1*x* will disable queue-based printing. To enable printing, you should install and set up NDPS.

# Meet System and Software Requirements

## System Requirements

To upgrade to NetWare 5, you must meet the following minimum system requirements:


- ❑ A server-class PC with a Pentium* or higher processor.
- ❑ NetWare 4.1*x* or NetWare 3.1*x* must be installed.
- ❑ A VGA or higher resolution display adapter (SVGA recommended).
- ❑ 35 MB of available disk space on the DOS partition.
- ❑ 450 MB of available disk space on volume Sys.
- ❑ 64 MB of RAM (128 MB recommended to run Java*-based applications).
- ❑ One or more network boards.

- ❏ A CD-ROM drive that can read ISO 9660-formatted CD-ROM disks. Computers with bootable CD-ROM drives must fully support the El Torito specification.

A PS/2* or serial mouse is recommended, but not required.


The system requirements listed above are minumum requirements. You can optimize the server performance by increasing the amount of server memory, disk space, and other components.

## Software Requirements

Before installing, make sure that you have the following software and information:


- ❏ DOS CD-ROM drivers.
- ❏ NetWare 5 Operating System CD-ROM.
- ❏ NetWare 5 License diskette.
- ❏ Novell Client™ for DOS and Windows 3.1*x* (optional, for upgrading from a network).
- ❏ An IP address (optional, if the server will connect to the Internet). For information on receiving an IP address, contact your Internet service provider (ISP).
- ❏ Network board and storage device properties, such as the interrupt and port address. For more information, contact your computer hardware manufacturer.

Next, you should prepare the network to receive a NetWare 5 server. If this server is not being integrated into an existing network, you can skip to “Prepare the Server for the NetWare 5 Upgrade” on page 172.

# Prepare the Network for a NetWare 5 Server

When you introduce a NetWare 5 server into an existing environment containing NetWare 4.1*x* servers, you must update the servers in the existing networking environment before installing a NetWare 5 server into the network.


A network consisting of NetWare 3.1*x* servers does not need to be updated.

To prepare the network for a NetWare 5 server, you must

- Update to NDS 5.99 or higher.

  NDS 5.99 is available on the NetWare 5 Operating System CD-ROM.

- Install Novell Licensing Services.


Instructions for updating NDS, installing Novell Licensing Services, and meeting other update requirements are located in \products\411_upg\411_upg.txt on the NetWare 5 Operating System CD-ROM.

# Prepare the Server for the NetWare 5 Upgrade

Preparing your existing server for the NetWare 5 operating system involves the following:

- Backing up the NetWare server files
- Notifying users to log out of the server
- Verifying a valid boot partition
- Accessing the upgrade program

## Back Up the NetWare Server Files

Make at least one backup of your NetWare server files, including files on the DOS partition. Do not attempt an upgrade without a backup.

## Verify a Valid Boot Partition

Your NetWare server uses a DOS partition to start the computer and load NetWare. Many of the existing NetWare startup files will be replaced with new NetWare 5 files. In addition, the boot partition must have 35 MB of available space to accommodate new NetWare 5 files.


If the boot partition does not have 35 MB of available space, you cannot upgrade the server. You must create a new boot partition and install a new server. For more information, see Chapter 4, “Installing a NetWare 5 Server,” on page 103.

## Access the Installation Files

NetWare 5 can be upgraded from the server’s local CD-ROM or from the installation files located on the network. Before you can access the NetWare 5 installation program, you must complete the following steps.

- Install the DOS CD-ROM driver (to access the CD-ROM drive).
- Install Novell Client™ software (conditional, if upgrading using installation files located on a network).


1. **Install the DOS CD-ROM driver for your CD-ROM device onto the boot partition. DOS CD-ROM drivers are provided by the CD-ROM manufacturer.**


Make sure that the logical filename of your CD-ROM drive (specified in the CONFIG.SYS and AUTOEXEC.BAT files) is not CDROM or CDINST.

2. **Make sure that the CONFIG.SYS file contains the following commands: `FILES=40` and `BUFFERS=30`**
3. **(Conditional) If you are upgrading from files located on a network, install the Novell Client for DOS and Windows 3.1*x* software located on the Z.E.N.works™ CD-ROM. For more information, see Chapter 8, “Installing Novell Clients,” on page 209.**

After installing and accessing the CD-ROM drive, you can begin the upgrade by inserting the NetWare 5 CD-ROM or by accessing the installation program on the network drive.

# Begin the Installation Program

To begin the installation program, complete the following steps.


1. **Insert the NetWare 5 Operating System CD-ROM, or log in to the network and access the installation files on the network.**

2. **At the CD-ROM drive or network drive prompt, type `INSTALL`.**

## Navigating in the Character-Based Screens

The initial screens of the installation program display in text-based mode. Auto-detected and default settings appear on each screen.

You can accept the detected and default settings, or you can modify the settings to meet the needs of your networking environment.


To continue the installation with the standard settings: Use the arrow key to highlight Continue in the Options box. Press Enter.

To modify the settings: Use the arrow key to highlight Modify in the Options box. Press Enter. Highlight the field to be modified. Press Enter. Select or enter the appropriate value.

Some screens require additional keystrokes in order to navigate through the interface. Information about screen navigation appears at the bottom of each screen.

## Select the Type of Installation and Regional Settings

To select the type of installation and select regional settings, you must

- Select the language and accept the License Agreement.
- Select the type of installation.
- Select the mouse and video type.

### Select the Language and Accept the License Agreement

The installation program is available in several languages. You can install other language options, such as the language for the operating system or for users, later during the installation program.

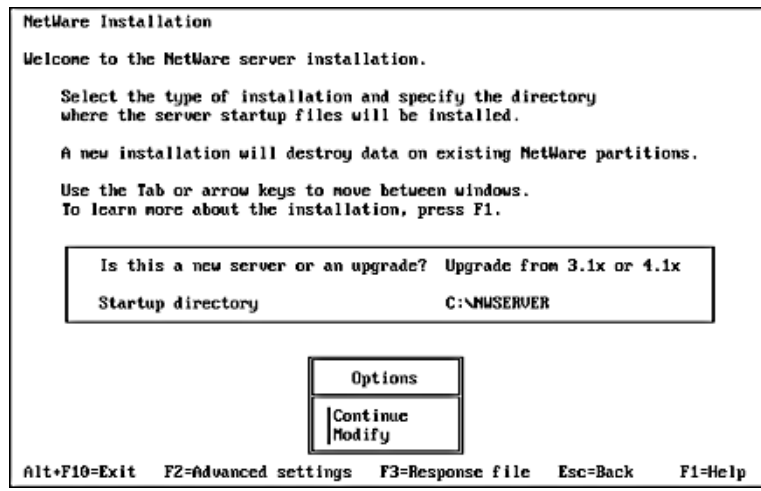
Accepting the License Agreement means that you have read and you accept terms and conditions contained in the License Agreement.

Hint Press F10 to accept the License Agreement.

### Select the Type of Installation

The NetWare installation program guides you through a basic server upgrade. You can also customize the server upgrade to include more advanced options.

The installation program can upgrade an existing NetWare 3.1*x* or NetWare 4.1*x* server, or create a new server.




Hint To select the type of installation: In the Options box, select Modify. Select Type of Installation. Select Upgrade. Return to the Options box to continue.

- **Upgrade**—If you are upgrading an existing server from a previous version of NetWare, select Upgrade from NetWare 3.1*x* or 4.1*x*. Upgrading retains all your server data such as files, directory structures, partitions, and volumes.

- **New Server**—If you are performing a new server installation, see Chapter 4, “Installing a NetWare 5 Server,” on page 103.

- **Startup Directory**—The startup directory is the directory on the boot partition that contains the existing NetWare server files, such as server.exe. Upgrading will update the files in the startup directory.

Although default settings work for most configurations, you can also specify advanced settings such as reboot options and SET parameters.

### Advanced Settings

The Type of Installation screen allows you to change the default settings to settings specific to your networking environment. You can change the following settings.

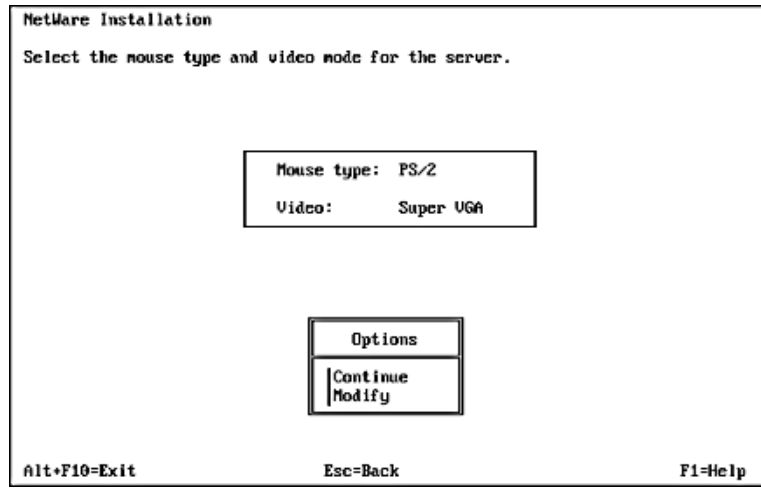
- **Load Server at Reboot**—Select No if you do not want the autoexec.bat and config.sys files to contain the commands to automatically load the server operating system when the computer reboots. If the field is Yes, the old autoexec.bat and config.sys files are renamed and saved with a .00*x* extension.

- **Server SET Parameters**—You might need to modify the SET parameters for some device drivers, such as for network boards and storage devices, in order to complete the upgrade. SET parameters are saved to the startup.ncf file.


Press F2 for advanced settings.

### Select the Mouse and Video Type

Note The mouse type and video type are not auto-detected by the installation program. You must select the settings for the computer.



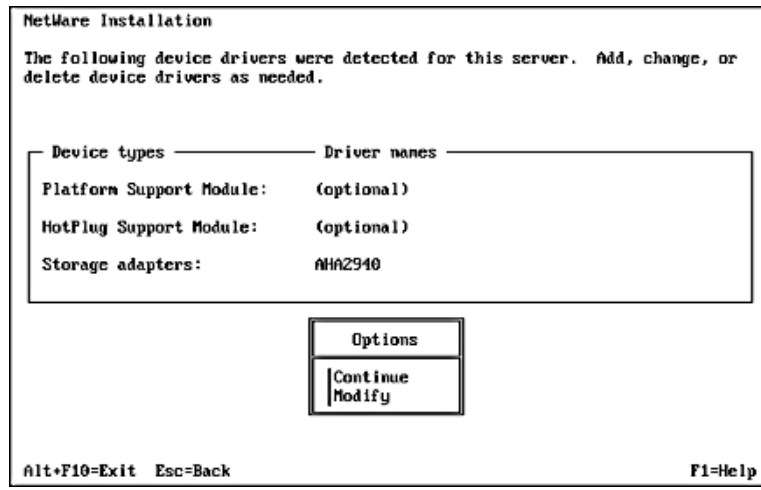

- **Mouse Type**—Choose a mouse type, if available on the server. The installation program supports PS/2 or serial mouse types, but a mouse is not required.

- **Video Type**—The NetWare installation program is optimized to display with video display hardware that is VESA 2 compliant. Choose Standard VGA only if your video board does not support 256 colors.

# Select a Platform Support Module and Storage Adapter

To select a platform support module and storage adapter, you must

- Select a platform support module (if required)
- Select a PCI Hot Plug module (if required)
- Select and configure a storage adapter




Hint

To *add* a driver: In the Options box, select Modify. Select the driver and press Enter. Press Insert to select from a list of drivers provided with NetWare. Press Insert again to install a driver from diskette.

To *delete* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to delete and press Delete.

To *modify* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to modify and press Enter. Select the property to modify.

## Select a Platform Support Module (If Required)

A platform support module (PSM) provides increased performance for multi-processor computers and some specific hardware configurations.

The installation program can auto-detect a PSM. If the installation program does not detect a PSM driver, your computer does not need one.


If a PSM driver is detected on a computer without PSM support, you can allow the driver to load without adversely affecting performance.

## Select a PCI Hot Plug Module (If Required)

Computers that support PCI Hot Plug technology allow storage adapters and network boards to be inserted and removed while the computer is on.

If the installation program does not detect a PCI Hot Plug support module, your computer probably does not support the PCI Hot Plug technology.

## Select a Storage Adapter

A storage adapter is the adapter that plugs into the computer and provides a link between the computer and one or more storage devices. The storage adapter requires a software driver called a *host adapter module* (HAM) to communicate with the computer (host). Storage devices require a separate driver called a *custom device module* (CDM).


.DSK drivers are no longer supported. Instead, NetWare uses the enhanced capability of NetWare Peripheral Architecture™ (NWPA). NWPA requires a HAM and a CDM.

Because a single adapter can control more than one type of storage device, your computer can require only a single HAM, even though it can have more than one type of storage device—and therefore multiple CDMs.

The installation program auto-detects many types of storage adapters, such as IDE and SCSI adapters. If your storage adapter is not detected, choose the appropriate driver from the list of available drivers provided with NetWare 5 or add a new driver from a diskette. You can obtain HAMs from the storage adapter manufacturer.

### Edit the Properties of the Storage Adapter (If Required)

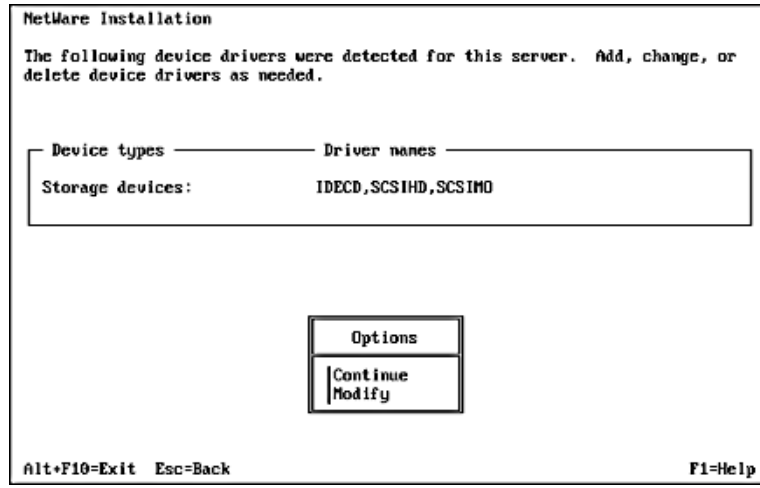
The storage adapter must be installed and configured correctly. Properties such as interrupt, port value, and slot must not conflict with any other device in the computer. If you need specific storage adapter properties, contact the storage adapter manufacturer.

## Select a Storage Device

Storage devices such as hard disks, CD-ROMs, and tape devices require a software driver to communicate with the storage adapter. The software driver for the storage device is called a custom device module (CDM). Each type of storage device requires a CDM.

The installation program auto-detects many types of storage devices such as IDE drives, SCSI drives, CD-ROM drives, and tape drives. If your storage device is not detected, choose the appropriate driver from the list of available drivers provided with NetWare 5 or add a new driver from a diskette. CDMs can be obtained from the storage device manufacturer.

You must select the drivers for the storage devices in the server.




Hint

To *add* a driver: In the Options box, select Modify. Select the driver and press Enter. Press Insert to select from a list of drivers provided with NetWare. Press Insert again to install a driver from diskette.

To *delete* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to delete and press Delete.

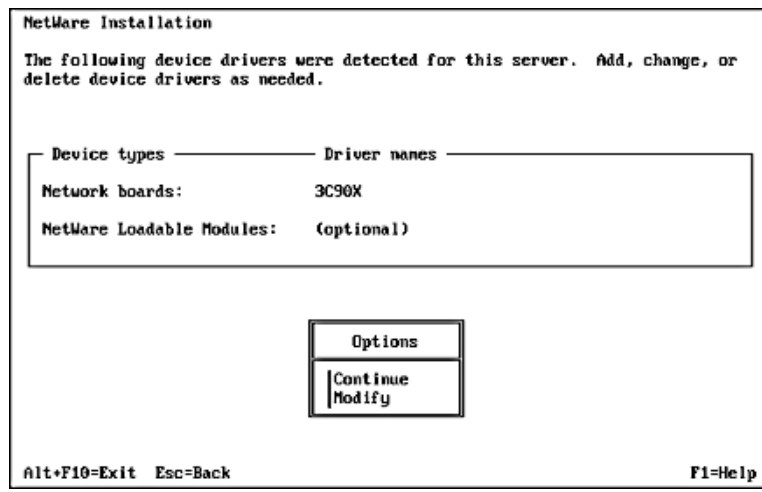
To *modify* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to modify and press Enter. Select the property to modify.

# Select a Network Board

You must select a network board. You can also select an NLM™ program to load, if required.

Network boards, such as the Novell NE3200™ board, require a software driver in order to communicate with the network. The software driver for a network board is called a *LAN driver*.

The installation program autodetects many types of network boards. If your network board is not detected, choose the driver for the network board from the list provided with NetWare 5 or add a new driver from a diskette. You can obtain LAN drivers from the network board manufacturer.




To *add* a driver: In the Options box, select Modify. Select the driver and press Enter. Press Insert to select from a list of drivers provided with NetWare. Press Insert again to install a driver from diskette.

To *delete* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to delete and press Delete.

To *modify* a driver: In the Options box, select Modify. Select the driver and press Enter. Select the driver to modify and press Enter. Select the property to modify.

## Edit the Properties of the Network Board (If Required)

The network board must be installed and configured correctly. Properties such as interrupt, port value, and slot must not conflict with any other device in the computer. If you need specific network board properties, contact the network board manufacturer.

## Load a NetWare Loadable Module (If Required)

Some server and network configurations require you to load a NetWare Loadable Module™ (NLM) before completing the server upgrade. For example, you can load route.nlm for upgrading in a token ring environment.

# Navigating in the Graphical Screens

Although a mouse is recommended, you can use the keyboard commands in Table 6-1 to navigate through the installation program. Use the arrow keys on the numeric keypad for cursor movements.


NumLock (number lock) must be on in order for cursor movements to be enabled on the keypad.

**Table 6-1**
**Graphical Keyboard Actions**

| Keystroke | Action |
|---|---|
| Tab | Move focus to next element |
| Shift+Tab | Move focus to previous element |
| Enter | Select |
| Up-arrow (keypad 8) | Move cursor up |
| Down-arrow (keypad 2) | Move cursor down |
| Right-arrow (keypad 6) | Move cursor right |
| Left-arrow (keypad 4) | Move cursor left |
| Hold Shift while pressing keypad | Accelerate cursor movement |
| Keypad 5 | Select or click an object |
| Keypad 0 | Lock a selected object (for dragging) |
| Keypad . (period) | Unlock a selected object (to drop) |
| Keypad + (plus) | Double-click an object |
| Alt+F7 | Move to next window |
| Alt+F8 | Move to previous window |

# Create Additional Volumes (If Required)

The server should already have one or more NetWare partitions and volumes and one volume named Sys.

Note

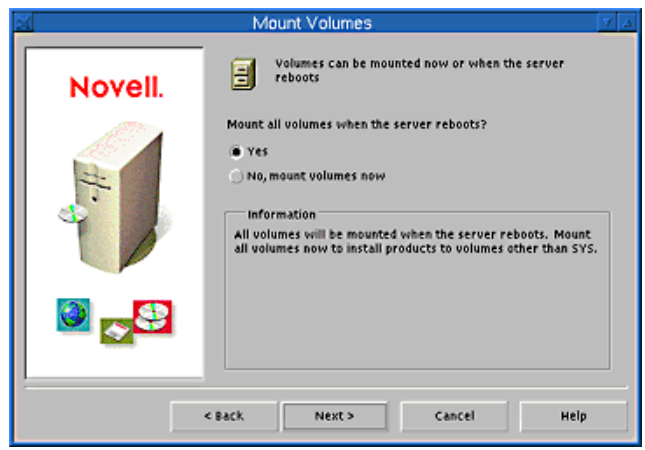
If you have available space on a storage device, you will be prompted to create additional volumes now. For more information, see “Install the NetWare Server File System” on page 124.

## Mount Volumes (If Required)

In order for volumes to be accessed by NetWare, they must be mounted. Volumes can be mounted immediately or at the end of the upgrade.

Note

Depending on their size, volumes can take a considerable amount of time to mount.



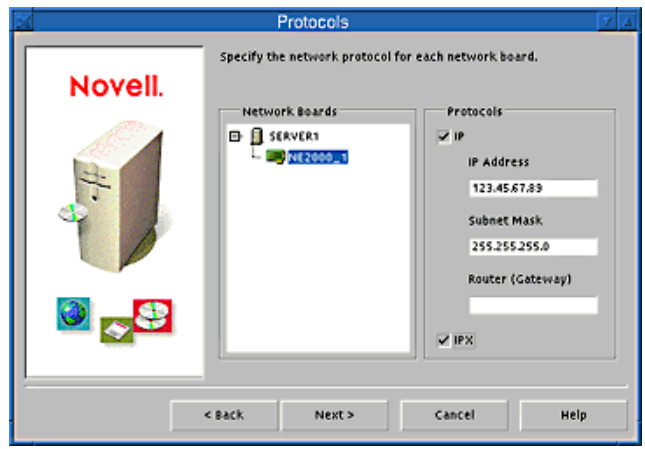

- **Mount Volumes Now**—You should mount volumes now if you plan to install additional products and services, such as documentation, on volumes *other* than volume Sys.
- **Mount Volumes after Installation Completes**—You can wait to mount volumes after the installation program completes, if you are installing products and services on volume Sys only.

# Install Networking Protocols

NetWare 5 can process IP network packets and traditional IPX™ packets. You cannot remove IPX with the installation program, but you can add the IP protocol.

- Add Internet Protocol (IP)
- Retain Internetwork Packet Exchange™ (IPX) only

Protocols are assigned to network boards. Both protocols can be assigned to a single network board, which allows the server to communicate using IP and IPX.




Hint To install IP: Click a network board. Check the IP check box. Enter the required IP information.

## Add Internet Protocol (IP)

If you have network clients or applications that require IP, you can add it. Both IP and IPX protocols can be bound to a single network board. When added, the server will process IP requests using IP. The server will continue to broadcast and reply to IPX requests using IPX.

Internet protocol (IP) allows your network to share data with other IP networks, including the Internet. Using IP requires a unique IP address, a subnet, and a router or gateway address.

- **IP Address**—An IP address identifies each device on the network. The address consists of 32 bits, which are represented as decimal values separated by periods, such as 123.45.67.89.

  If your server will connect to the Internet, you must obtain a unique IP address. For information on receiving an IP address, contact your Internet service provider (ISP).

- **Subnet Mask**—Subnet masks allow you to break up your network into smaller networks. Your network could have too many nodes or could be too geographically dispersed to manage as a single network.

  Dividing your network into smaller networks allows the network routers to filter and reduce the network activity seen by any of the nodes. However, dividing your network and using several network addresses might not be appropriate on a large network that needs to appear to network administrators as a single network.

- **Router (Gateway)**—The router (gateway) is the address of the router that connects two different environments, such as a LAN and the Internet.

  You can enter a specific router (gateway) address, or you can rely on the network to automatically find the nearest router. If you specify the address, remember that the router must exist on your network segment.

Installing IP will automatically bind to the Ethernet_II frame type.

### Internetwork Packet Exchange (IPX) Only

Novell's traditional protocol, Internetwork Packet Exchange (IPX), will allow you to continue using IPX-based applications. If only IPX is installed on your server, it will actively process IPX packets and ignore packets using other protocols, such as IP.

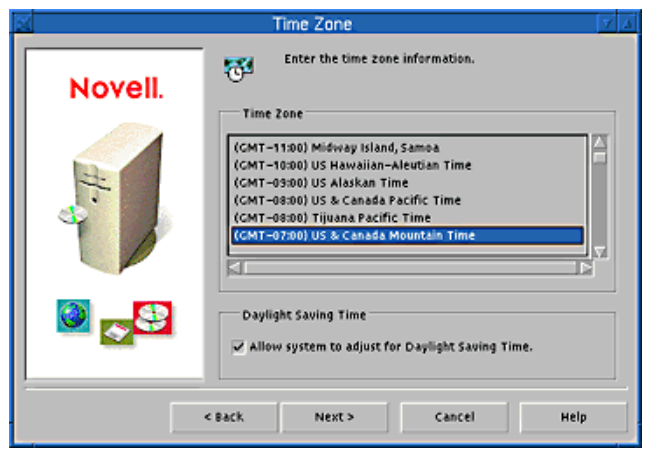
During the upgrade, existing IPX frame types will be detected. The installation program will detect one of the following conditions:

- **A single IPX frame type**—If a single frame type is detected, it will be installed.
- **Multiple IPX frame types**—If detected, you will be prompted to choose the frame types you want to install.
- **No IPX frame types**—If no frame types are detected, Ethernet_802.2 will be installed by default.

## Set the Server Time Zone (If Required)

Note If you are upgrading a NetWare 3.1*x* server, you will be prompted to choose the server's time zone.

The server time and time zone settings are used to synchronize network events. Advanced time synchronization settings can be set during the Customize section of the installation.



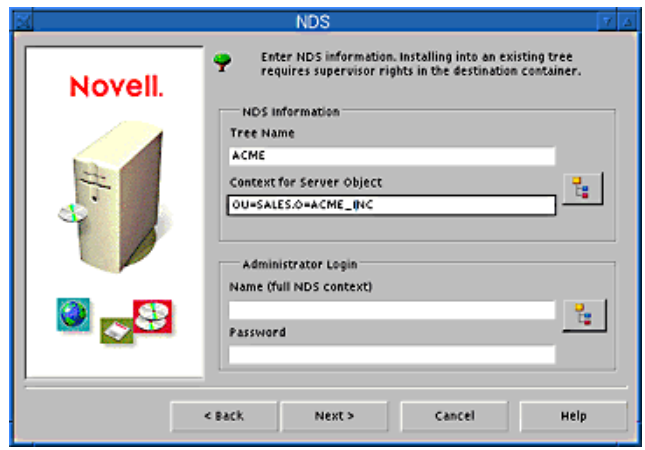
# Set Up NDS, Novell's Directory Technology (If Required)

NDS, Novell's directory technology, provides global access to all networking resources. NDS allows users with the proper access rights to log in to the network and view and access network resources.

Network resources such as servers and printers are presented hierarchically in an NDS tree. Users log in to the NDS tree with a single login name and password instead of logging in to specific servers.

## Upgrading a Server with NDS

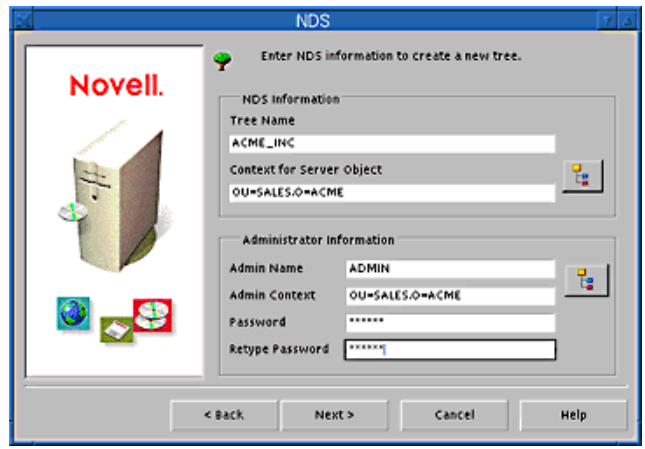
If you are upgrading a server that already has NDS installed, the server will remain in the same container after being upgraded. You will be prompted for the username and password of a user with Supervisor rights in the server's container object.




Note If this is the first NetWare 5 server to be installed into an NDS tree with NetWare 4.1*x* servers, you will be prompted to modify the schema. When prompted, you must provide the administrator name and password for the entire NDS tree. Modifying the NDS schema requires Supervisor rights at the root of the existing NDS tree.

## Upgrading a Server without NDS

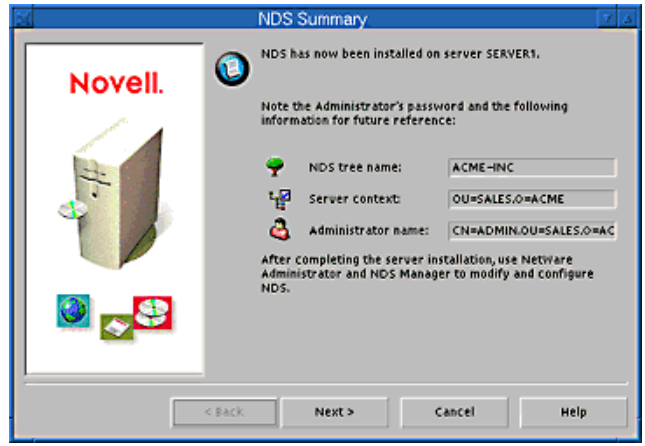
If you are upgrading a server that does not already have NDS installed, you will be prompted to set up NDS.




For more information, see “Set Up NDS, Novell’s Directory Technology” on page 132. After setting up NDS, proceed to “License the NetWare Server” below.

## Summary

You have created a new NDS tree or upgraded the server in an existing NDS tree. The NetWare Server object and Volume objects will be updated in the original NDS container or created in the container you specified.




If you have created a new NDS tree, a user (default name ADMIN) with Supervisor rights to the NDS tree will be created in the same NDS container as the NetWare Server object.

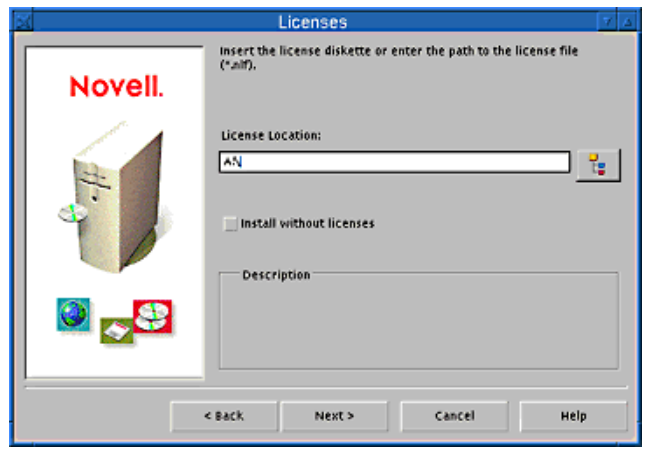
Important

Record the administrator password and other relevant information before proceeding.

# License the NetWare Server

NetWare 5 must have a valid license in order to function as a server. You can install the license from the NetWare 5 License diskette or browse to a directory that contains NetWare 5 licenses.

**Install without Licenses**—Although the server can be installed without a license, the unlicensed server will allow only two user connections. After installation, you can use the NetWare Administrator utility to install licenses.



# Install Other Networking Products

After completing the NetWare server portion of the upgrade, you can select other networking products to install. Other networking products provide enhanced functionality to NetWare 5, such as network management and Internet access.


Hint To install a product: Check the check box next to the product to be installed.

Although you can choose which products to install, installing the products that are already selected by default will ensure that you receive the features recommended for NetWare.

# Customize the NetWare 5 Installation

You can customize the installation of many products for your networking environment.

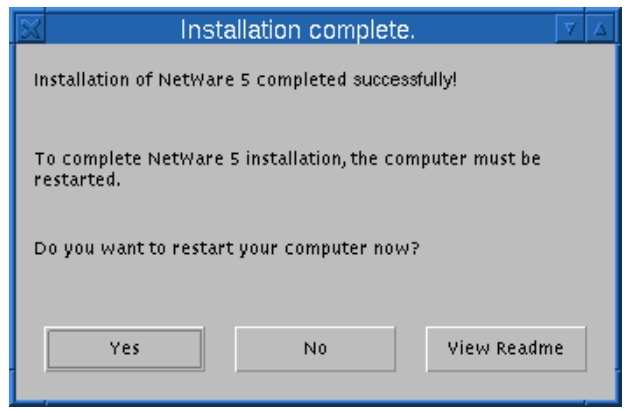

Hint To customize products and components: From the Summary screen, click Customize. Select the product to customize. Click Properties. Modify the product as required. Click OK.

For more information on customizing the installation, see Chapter 5, “Customizing the Server Installation,” on page 143.

# Complete the Server Upgrade

The basic server upgrade is now complete. Depending on which additional products you are installing, you might be prompted to insert additional CD-ROMs.


Hint From the Summary screen, click Finish to begin installing NetWare 5 and additional products. After all files are copied, the server must be rebooted in order for the settings to take effect.




Hint After the files are copied, click Yes to reboot the server.

NetWare 5 is automatically loaded when the computer reboots, or you can load it manually.


To load the server manually: Reboot the server by clicking Yes. Change to the startup directory containing the NetWare server files (c:\nwserver). Enter **SERVER**.


If you have upgraded a NetWare 3.1*x* server, you should run DSREPAIR from the server console before logging in.

You can now log in to the network.

chapter 7

# Moving Bindery Objects and Files to NDS

## Overview

This chapter explains how to use the Novell® Upgrade Wizard to copy your NetWare® 3.1*x* or NetWare 3.2 server bindery and file system "across-the-wire" (via the network) and place them in a desired location in an existing NDS™ tree.

Upgrading across-the-wire (frequently referred to as a "migration") using the Novell Upgrade Wizard includes

- Copying the NetWare 3.1*x* or NetWare 3.2 server bindery and upgrading the individual bindery objects to NDS objects in the NDS tree.
- Moving the contents of individual volumes on the NetWare 3.1*x* or NetWare 3.2 server to existing volumes in the NDS tree.

The process involves the following steps:

1. Installing the utility
2. Preparing for the migration
3. Launching the utility
4. Preparing a project
5. Moving objects in the Project Window
6. Verifying that objects and files can be upgraded as specified
7. Migrating across-the-wire

# Installing the Novell Upgrade Wizard

The Novell Upgrade Wizard is *not* installed during the installation of NetWare 5™. You must therefore install it on the workstation you plan to use during the migration.


1. **At the workstation where you will be running the Novell Upgrade Wizard, insert the NetWare 5 Operating System CD-ROM into the CD-ROM drive.**

2. **Locate the self-extracting executable at the following path:**

   \products\upgrdwzd\upgrdwzd.exe

3. **Execute the self-extracting file by typing `upgrdwzd` and then following the prompts.**

# Preparing for the Migration

You must complete several tasks before you can use the Novell Upgrade Wizard. Each is discussed below.


- ❑ Perform a system backup.

- ❑ Always back up the NDS database and the volumes to which the NetWare 3.1*x* or NetWare 3.2 file system will be migrated. This measure protects against possible file loss or corruption during the migration.

- ❑ Verify workstation system requirements.

  You can run the Novell Upgrade Wizard from either a Windows* 95* or Windows NT* workstation.

  For Windows 95, upgrade to Novell Client for Windows 95 version 2.2 or later.


You can find the client version by choosing Start > Settings > Control Panel and then double-clicking Network, choosing Novell NetWare Client, then clicking the Properties button. The Novell Client page appears with the client version at the bottom. If this procedure did not access the client version number for you, your client must be upgraded.

You can get a free client upgrade at http://www.novell.com/novellsw/brands.html

For Windows NT, upgrade your client to Novell Client for Windows NT version 4.11 or higher.


You can find the client version on the title bar of the Login dialog.

You can get a free client upgrade at http://www.novell.com/novellsw/brands.html

❑ Verify that you have sufficient rights.

You must have Supervisor or equivalent rights to both the NetWare 3.1*x* or 3.2 and NetWare 5 servers. If you are not authenticating to the NDS tree as user Admin, you must have Console Operator rights granted to you.

❑ Disable SAP filtering (conditional).

You should ensure that SAP filtering is disabled on each server involved in the migration. If SAP filtering cannot be disabled, you should ensure that the default server (preferred server) for the client is on the same LAN segment as the other servers you are migrating to and from.

❑ Update NLM™ programs on the NetWare 3.1*x* server.

For the Novell Upgrade Wizard to work properly, some NLM programs may need to be updated with more recent versions. Working versions of these NLM programs are found in the products\nw3x subdirectory in the location where you installed the Novell Upgrade Wizard. For example, if you installed using the default path, the NLM programs are in c:\program files\upgrade\products\nw3x

❑ Unload NLM programs on the NetWare 3.1*x* or NetWare 3.2 server.

Unload the following NLM programs in the order indicated:

- Tsa311.nlm or tsa312.nlm
- Smdr.nlm
- Smdr31x.nlm
- Spxs.nlm
- Tli.nlm
- After311.nlm
- Clib.nlm
- A3112.nlm
- Streams.nlm


Some NLM programs require you to unload additional interdependent NLM programs. If doing so becomes too cumbersome or impossible, you can reboot your server. When the server is rebooted, the previously copied NLM programs are loaded.

If the server's autoexec.ncf file includes a LOAD command for tsa311.nlm or tsa312.nlm, the NLM loads automatically and you do not need to load it manually as documented below.

❑ Load the new tsa311.nlm or tsa312.nlm (conditional).

The tsa311.nlm or tsa312.nlm must be loaded on the NetWare 3.1*x* or NetWare 3.2 server prior to the migration. If you did not reboot after updating the NLM programs, load tsa311.nlm or tsa312.nlm manually. Doing so loads all of the updated NLM programs that you copied earlier.

❑ Load and add name spaces (conditional).

If any volumes you are going to migrate contain files with non-DOS, Windows 95, Windows NT, or OS/2* naming conventions, you must load the appropriate name spaces on the destination volumes on the NetWare 5 server and then add the name spaces to the volume prior to the migration.

The NFS* name space is loaded through nfs.nam.

The Macintosh* name space is loaded through mac.nam.

- ❑ Determine what objects to migrate.

  The Novell Upgrade Wizard allows you to migrate the entire NetWare 3.1*x* or 3.2 bindery and/or the contents of the individual NetWare 3.1*x* or 3.2 volumes.

  In most cases, you will want to migrate both the bindery and the contents of the server volumes. However, there may be occasions where you want to only migrate the bindery (for example, to quickly add users in an NDS tree) or the contents of an individual volume.

- ❑ Have the users log out of the NetWare 3.1*x* or NetWare 3.2 server.

  Any files that are open on the NetWare 3.1*x* or NetWare 3.2 server during the migration will not be migrated.

# Launching the Novell Upgrade Wizard

**Procedure**

1. **Click the Windows 95 or Windows NT Start menu.**

2. **Select Programs > Novell > Novell Upgrade Wizard.**

   Once the utility is launched, the Startup dialog box appears, ready for you to create a new project.

## Creating a Project

A project is a model that you use to place NetWare 3.1*x* or NetWare 3.2 objects in the NDS tree. You must create and complete a project before you can migrate the bindery and file system.

**Procedure**

1. **In the Startup dialog box, select the Create New Upgrade Project option and click OK.**

   A wizard is launched. The first page of the wizard asks you to indicate the name and location of the new project.

2. **Type a project name and use the Browse button to indicate the location where you want the project saved. Then click Next.**

   A new page appears, asking you to indicate the NetWare 3.1*x* or NetWare 3.2 server you're migrating (the source) and the NDS tree you're migrating to (the destination).

3. **Use the two drop-down list boxes to indicate the source server and destination tree.**

   3a. **If the desired source server and/or destination tree are not displayed, use the server button or tree button to log in to a server or NDS tree.**

   3b. **Once you have indicated the source server and NDS tree, click Next.**

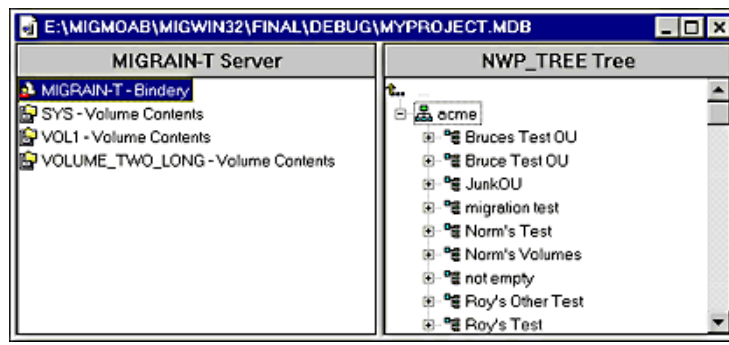
   A new wizard page appears, displaying information about the utility's database.

4. **Click Create to create the upgrade project.**

# Moving Objects in the Project Window

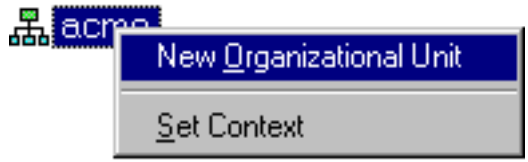
The indicated source server and destination tree are displayed in the Project Window, where bindery objects and volume data from the source server can be dragged and dropped to desired locations in the NDS tree. A sample project window is shown below.

**Figure 7-1**
**Sample Project Window**



### Creating Subordinate Objects (Conditional)

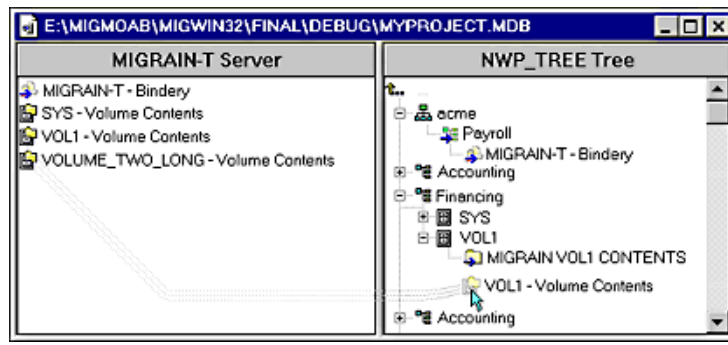
Before dragging and dropping the bindery or volume data, first determine where in the destination tree you want each to be copied. If the desired container (for the bindery) or folder (for the volume data) does not already exist in the NDS tree, right-click the "parent" (container for the bindery, folder or volume for the volume data) and create and name the new container or folder.




### Dragging and Dropping Objects

Click and drag the bindery or Volume objects from the Source area to the desired location in the Destination area.

**Figure 7-2**
**Sample Project Window with Dragged and Dropped Objects**



# Verifying that Objects and Files Can Be Migrated

Once the bindery and volumes have been moved to the Destination area, you should verify that the migration can proceed as indicated in the Project Window. The verification process checks for object conflicts, sufficient NDS and file system rights, disk space limitations, and a variety of other criteria that could impede the migration.

### Procedure


1. **From the toolbar, click the Verification button, or select Project > Verify.**

   A new wizard is launched. The first wizard page gives an overview of how the verification works.

2. **Click Next.**

   A new page appears, allowing you to indicate whether you would like to migrate your print information, and if so, to which volume.

3. **Choose whether to migrate your print information.**

   3a. **If you do not want to migrate the print information, uncheck the check box at the top of the page.**

   The box is checked by default.

   3b. **If you want to migrate the print information, select the desired volume in the tree browser and click Next.**

   A new page appears, allowing you to apply an existing Template object to all users being migrated.

4. **Decide whether to apply a Template object.**

   4a. **If you do not want to apply a Template object, uncheck the check box at the top of the page.**

   4b. **If you want to apply a Template object locate and select the desired Template object and click Next.**

   A new page appears, giving you the option to create a Template object. You can then apply this template when you set up new users in the NDS tree.

5. **If you want to create a User template, check the box and enter a name for the template, then click Next.**

   A new page appears, allowing you to indicate how you want to address all occurrences of duplicate filenames between a volume on the source server and a volume or directory in the destination NDS tree.

6. **Choose one of the options on the page and click Next.**

   A new page appears, prompting you for the password to the source server and destination tree.

7. **Enter the passwords and click Next.**

   A new wizard page lets you indicate the type of verification that is to be performed. Check boxes let you indicate what categories are verified.

8. **Indicate what you want verified by placing check marks in the appropriate check boxes, then click Next.**

   After running the verification, a wizard page appears, showing any found naming conflicts between same-type objects.

9. **Correct naming conflicts between same type objects.**

   To correct the naming conflicts you can

   - Let the wizard rename the object automatically.
   - Choose not to migrate the object.
   - Merge the objects and maintain the bindery properties.
   - Merge the objects and maintain the NDS properties.

   If no naming conflicts are found, the list box in the wizard page is blank.

10. **Click a bindery object in the list box and select an appropriate option to resolve the conflict.**

    Repeat this step for each conflict listed and then click Next.


If you do not select a conflict resolution option, the object will, by default, be renamed.

A new wizard page appears, showing any found naming conflicts between different type objects, or items that cannot be merged. These include print forms, print devices, and print configurations.

**11. Correct naming conflicts between different type objects.**

To correct the naming conflicts you can

- Let the wizard rename the object automatically.
- Choose not to upgrade the object.

If no naming conflicts are found, the list box in the wizard page is blank.

**12. Click a bindery object in the list box and select an appropriate option to resolve the conflict.**

Repeat this step for each conflict listed, then click Next.


If you do not select a conflict resolution option, the object will, by default, be renamed.

A new wizard page appears, displaying any errors and warnings that were encountered during the verification process (with the exception of naming conflicts).

If no errors or warnings are detected in the verification, the list box is blank.

**13. Resolve all errors before continuing. Click Next to continue.**

A verification summary page appears with the results of the verification.

**14. Read through the text and click Finish.**

# Migrating Across-the-Wire

With the Project Window and verification completed, and all conflicts, warnings, and errors addressed, you are ready to migrate the bindery and file system across-the-wire.

### Procedure


1. **From the toolbar, click the Upgrade button, or select Project > Upgrade.**

   A new wizard is launched. The first wizard page gives an overview of how the upgrade works.

2. **Click Next.**


From this point, the upgrade repeats Steps 3 through 14 under “Verifying that Objects and Files Can Be Migrated” on page 204. One exception is that the Finish button in Step 14 is now an Upgrade button.

Any conflicts that were shown previously (during the verification) but were not corrected are indicated by a check through the icon, indicating that the conflict has already been seen.

If you have corrected all of the errors, you can begin the migration by clicking the Upgrade button.

The wizard first copies the contents of the bindery and then the file system, according to where you dragged objects in the Project Window.

A progress bar indicates the relative percentage of objects that have been upgraded and those yet to be upgraded.

You can stop the migration by clicking Stop. A dialog box appears, asking you to confirm your choice. If you still want to stop the migration, click Yes. The migration is terminated. All NetWare 3.1*x* or NetWare 3.2 server bindery and file contents copied to that point, however, remain in their destinations in the NDS tree until you delete them manually.

# Post-Migration Procedures

Following the migration, you should perform any applicable post migration procedures. These include:

- Modifying login scripts
- Modifying your print configuration
- Checking migrated user information
- Checking migrated file information
- Checking third-party applications
- Moving individual objects to different locations in the NDS tree

For more information on post upgrade procedures or any of the information in this document, refer to the online help in the Novell Upgrade Wizard.

chapter 8

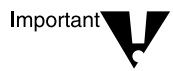
# Installing Novell Clients

The Novell® Client™ software provides access to Novell networks from workstations that use a variety of operating systems. This chapter explains how to install the client software from CD-ROM on one workstation as well as one method of installing the client software across the network (other methods are explained fully in the online documentation.)

## Preparing to Install the Client Software

Before installing the client software, make sure the client workstations have sufficient resources and the required software. The complete hardware and software setup for client workstations might require you to complete one or more of the following tasks:

- Check for a valid network connection
- Checking client workstation requirements




Novell Client for Windows* 95* and Novell Client for Windows NT* require long filename support. This is included on all NetWare 5™ servers. If users will connect to NetWare 3™ and NetWare 4™ servers, you must install and load the appropriate name spaces. See Novell Client for Windows NT > Setting Up > Preparing to Install > Preparing Servers in the online documentation available on the Documentation CD-ROM or on the Z.E.N.works™ CD-ROM.

### Checking for a Valid Network Connection

To check for a valid network connection from a Windows 95 or Windows NT workstation, complete the following steps.


1. **Open Network Neighborhood.**
2. **Check that the networks you expect to see actually appear in the Network Neighborhood window.**

Note If you have never installed a client or created a network connection, you might not have access to Network Neighborhood. Therefore, you must install the client software from CD-ROM. See “Installing Clients from CD-ROM” on page 212.

## Preparing Client Workstations

### Checking Client Workstation Requirements

There are certain client workstation requirements to be met before installing or upgrading Novell Client software:

- Workstation hardware and software

| Platform | Hardware | Software |
|---|---|---|
| Windows 95 | ◆ 486 processor or better<br>◆ Minimum 28 MB free disk space<br>◆ Minimum 16 MB RAM | ◆ Windows 95<br>◆ Windows 95 CD-ROM or the Windows .cab files. |
| Windows NT | ◆ Minimum hardware requirements of Windows NT 4.0 | ◆ Windows NT 4.0 |
| DOS and Windows 3.1*x* | ◆ 386 processor or better<br>◆ Minimum 15 MB free disk space<br>◆ Minimum 8 MB RAM<br>◆ A memory manager | One of the following operating systems:<br>◆ Novell DOS™ 7<br>◆ MS-DOS* 5.*x* or 6.*x*<br>◆ PC-DOS 5.*x*, 6.*x*, or 7.0<br>◆ Windows 3.1*x* or Windows for Workgroups 3.11 |

- The network board

  Novell Client for Windows NT and Novell Client for Windows 95 support Network Driver Interface Specification™ (NDIS™) drivers. For information about installing the network board, refer to the board manufacturer's instructions.


Open Data-Link Interface™ (ODI™) drivers are not installed on Windows 95 or Windows NT. If you are upgrading an older version of the client and you have ODI drivers currently installed, these drivers are still supported. If you are installing for the first time, NDIS drivers will be installed. If you do not already have the necessary NDIS driver, you might need to obtain it from the Windows 95 CD-ROM or from the network board manufacturer.

Novell Client for DOS and Windows 3.1*x* supports ODI drivers. For information about installing the network board, refer to the board manufacturer's instructions.

## Incompatibilities

### Windows 95

The following network components are not compatible with Novell Client for Windows 95:

- Microsoft* Client for NetWare networks
- Microsoft file and printer sharing for NetWare networks
- Microsoft Service for Novell Directory Services™ (NDS™) software
- Novell NetWare workstation shell 3.*x* (NETX)
- Novell NetWare workstation shell 4.0 and later (VLM™) clients
- Novell Internetwork Packet Exchange™ (IPX™) ODI protocol (the 16-bit module for the NETX and VLM clients)

These network components conflict with Novell Client for Windows 95. If any of these network components are installed, the client installation program detects the conflict and removes the conflicting network components.

#### Windows NT

Read the Novell Client for Windows NT readme file, winnt.txt, for up-to-date information about software incompatibilities.

#### DOS and Windows 3.1*x*

There are no known incompatibilities.

# Installing Clients from CD-ROM

If you plan to install the Novell® Client™ software on a small number of workstations, or if the workstations are not yet connected to a network, installing from the Z.E.N.works™ CD-ROM works best.


If you plan to install the Novell Client on several workstations on the network, consider using one of several network installation options. A network installation can upgrade existing client software or install new client software.

One network installation method is explained in this chapter (“Installing Clients from the Network” on page 214). Additional network installation options and specific information about each platform are available in the online documentation found on the Documentation CD-ROM or on the Z.E.N.works CD-ROM.

## Installing Clients from Windows

The Novell Client Setup utility helps you install Novell Client software on Windows-based workstations. When you use this utility, you can select the client you want to install from a list of available clients. Administrative options are also available.

To install from a local CD-ROM drive, complete the following steps.


1. **Insert the Z.E.N.works CD-ROM.**

   If the Novell Client Setup utility does not automatically launch, run winsetup.exe from the root of the CD-ROM.

2. **Click a language for the installation.**

3. **Click a platform for the installation.**

4. **Click the software to install.**

   This starts the installation utility for that software.

5. **Follow the on-screen instructions.**

   For help during the installation, refer to the online help that accompanies the software.

## Installing Clients from DOS

The DOS-based installation installs the necessary files for Novell Client for DOS and Windows 3.1*x* files and allows you to select from several optional utilities.


If you previously installed the client software in Windows and you are using multiple location profiles, you should update using the Windows installation. Location profiles maintain information about your working environment for each location you work in, or for each networking environment in a location.

The DOS installation does not support Novell Dial-up Services or Locations and it disables previously installed versions of the Locations Manager.

To install from a local CD-ROM drive, complete the following steps.


1. **Insert the Z.E.N.works CD-ROM.**

2. **From a DOS prompt, switch to the drive where the Z.E.N.works CD-ROM is located.**

3. **Change to the Products\Doswin32 directory, and then enter `install`.**

4. **Press Enter to accept the License Agreement.**

5. **Select the options you want to install on the workstation.**

6. **Press** F10 **to continue.**

   To return to the previous screen or to cancel the installation, press Esc at any time before Install begins copying files.

7. **Configure the options you are installing.**

   Depending on the options you have chosen, various configuration screens appear. Use the arrow keys to move to a new field and press Enter to edit the field.

8. **Press** F10 **to save your changes and continue.**

9. **Depending on the type of network board you have installed in the workstation, select the 16-bit or 32-bit LAN driver type.**

10. **Review the Installation Configuration Summary and make necessary changes by using the arrow keys to move to a new field and pressing Enter to edit the field.**

11. **Press** F10 **to continue.**

    Install copies the appropriate files to your workstation and sets up the workstation to run the Novell Client software.

12. **Exit Install by pressing Enter to return to DOS or by pressing** Ctrl+Alt+Del **to reboot the workstation.**

    The Novell Client for DOS and Windows 3.1*x* software does not load until the workstation restarts.

## Installing Clients from the Network

If you plan to install the Novell® Client™ software on multiple workstations, you can install from the network by copying files to the server and modifying the login script. One network installation method is explained here.


There are additional network installation options that might better suit your networking environment. You should evaluate these methods before deciding which is best for you. See “Other Network Installation Options” on page 224.

Even if your network has workstations on multiple platforms, you can install and upgrade the client software on all platforms when users log in. The process requires five tasks:

- Create a folder on the NetWare server.
- Copy Novell Client files and other required files to this folder (workstations can then read the files during login).
- Grant rights to the new folder.
- Create or update the appropriate configuration file (install.cfg, setup.ini, nwsetup.ini, or unattended.txt file) for each platform-specific client.
- Create or modify the appropriate login script.

Let users know in advance about the upgrade so they understand what is happening and why their working environment is changing.

## Create a Folder


1. **Log in to a server as Admin or as a user with Admin equivalence.**

   You need rights to copy files to a network folder that all users can access. You also need rights to modify login scripts.

2. **Create a folder.**

   For example, create a client folder in the sys: public network folder.

   sys:\public\client.

## Copy Files


1. **From the Products directory on the Z.E.N.works™ CD-ROM, copy the Winnt, Win95, Doswin32, and Adm32 directories to the new folder.**

   If you are installing the client in only one language or your network does not have enough space to accommodate multiple language directories, you can delete the language directories you do not need from the NLS directory under each client directory. To ensure that you have all necessary files, copy the entire client directory and then delete only the extra language directories.

2. **(Conditional) If you are installing the Novell Client for Windows 95, copy Windows 95 .cab files to the Win95 directory.**

   The files are on the Microsoft Windows 95 CD (and Upgrade CD) in the Win95 folder.

3. **(Conditional) If you are installing the Novell Client for DOS and Windows 3.1*x* and you will be using the DOS installation utility (install.exe), create a Log directory in the new folder.**

   The login script executes commands that create a log file in the Log directory. The log file indicates if the client update was successful.

## Grant Rights


1. **Create a Group object called Client in the NDS tree.**

2. **Place into that group users whose workstations need to be installed or upgraded.**

3. **Make sure that the group has Read and File Scan rights to the new folder you created.**


If you created the new folder in Sys:Public, the new folder should have Read and File Scan rights already associated with it, but you should make sure that these rights have not been changed.

You can grant rights by using NetWare® Administrator.

## Update Configuration Files


If you are using the default settings to install the clients, you do not have to create or modify the configuration files. You can bypass this process and proceed to “Create or Modify the Login Script” on page 220.

Each platform-specific installation utility reads a configuration file in order to get information such as where to copy drivers during installation and what is the most recent version number. This file must be placed in the same folder as the installation utility.

| Platform | Configuration File |
|---|---|
| Windows 95 | Nwsetup.ini and a Novell Install Manager-generated text file |
| Windows NT | Novell Install Manager-generated text file |
| Windows 3.1*x* | Setup.ini |
| DOS | Install.cfg |

### Updating Windows 95 and Windows NT Configuration Files

You can use Novell Client Install Manager, a GUI-based utility, to configure the client properties. This method eliminates your having to configure each workstation manually. Once you have created the configuration file with Install Manager, use the /U command line parameter in the login script to call the configuration file and set the properties.

To create a configuration file using Novell Client Install Manager, complete the following steps.


1. **Start the Novell Client Install Manager (nciman.exe).**

   For Windows 95, the Install Manager is located on the in the Sys:Public\Client\Win95\Ibm_*language*\Admin directory you copied to the server.

   For Windows NT, the Install Manager is located on the in the Sys:Public\Client\WinNT\I386\Admin directory you copied to the server.

2. **Do one of the following:**

   - For Windows 95, click File > New File > Windows 95 to create a new file.
   - For Windows NT, click File > New File > Windows NT to create a new file.

3. **Modify the installation options as needed.**

   **3a. In the Installation options list box, double-click the configuration option you want to modify.**

   **3b. In the property pages, set the parameters and then click OK.**

   The values you set appear in the right list box.

   **3c. (Conditional) If you change properties for Novell Client for Windows NT or Windows 95 and intend to use the configuration file created with Novell Client Install Manager to upgrade existing client software, you must change the major or minor version parameter. If you are installing for the first time, proceed to step 4.**

   The client is updated only if the version numbers have changed. If the version numbers have not changed, even if parameters have been changed in the configuration file, the client and the new properties will not be changed.

   For Novell Client for Windows NT, change the version number with Novell Client Install manager by clicking Installation > Client and increasing the major or minor parameter by one or more.

   For Novell Client for Windows 95, you must change the version number in the nwsetup.ini file. Open nwsetup.ini and search for the ClientVersion section. The version number consists of four numbers, each separated by a decimal point (for example, 2.5.0.0). The third number is the major version number; the fourth number is the minor version number. Increase either number by one to install a new version.


You can set up one workstation the way you want all of the workstations set up, and then use Novell Client Install Manager to import the settings from that workstation's registry and save them to the configuration file you use during the installation. Once you set up the workstation, click File > Open Registry to import the settings into Novell Client Install Manager.

4. **Click File > Save.**

   You can save the file with any filename you want to use. For example, you could rename the file unatt_95.txt.

5. **Copy this file to one of the following directories:**

   - Sys:Public\Client\Win95\Ibm_*language* directory (for Windows 95)
   - Sys:Public\Client\WinNT\I386 directory (for Windows NT)

This file is then used in conjunction with the /U command line parameter in the login script to call the configuration file and set the properties during installation.

### Updating DOS and Windows 3.1*x* Configuration Files

You can control the Windows-based install program (setup.exe) by modifying the setup.ini file, and you can control the DOS-based install program (install.exe) by modifying the install.cfg file. However, the defaults work fine for most installations.

Detailed instructions can be found in the online documentation under Novell Client for DOS and Windows 3.1x > Setting Up > Preparing to Install > Modifying the Setup.ini File and Novell Client for DOS and Windows 3.1x > Setting Up > Preparing to Install > Modifying the Install.cfg File. Sample configuration files are also provided in the online documentation.

## Create or Modify the Login Script

You need to modify login scripts for users whose workstations will be upgraded.

- To upgrade specific users' workstations, modify those users' login scripts. You can do this with NetWare Administrator.
- To upgrade workstations for users in a container, modify that container's login script. You can do this with NetWare Administrator.
- To upgrade workstations for users in a profile, modify that profile login script. You can do this with NetWare Administrator.
- To upgrade a workstation running bindery-based client software (such as Microsoft Client for NetWare Networks that ships with Windows 95), edit the system login script (sys:public\net$log.dat). You can do this with NetWare Administrator.

### Creating or Modifying a Login Script with NetWare Administrator


To create or modify a login script with NetWare Administrator, complete the following steps.

1. **Start Netware Administrator.**
2. **Using the browser, select the object whose login script you want to create or modify.**
3. **Click Object > Details.**
4. **Click the Login Script page.**
5. **Enter the login script commands and information into the login script text box.**

   For a sample of the login script commands you need to add to the scripts, see "Sample Login Script" on page 222. This sample login script is also available in a text file called inst_log.txt on the CD-ROM in the Novdocs directory.

Important

Make sure you edit the sample login script to match the server names, directory paths, and specifications of your network.

For additional information on all login script commands, see Login Script Commands or Using Login Script Commands in the online help or in the online documentation.

6. **To save the login script and close the Details dialog box, click OK.**

   If the login script you just created was a container or user login script, you're finished and the client software will be installed or updated the next time the users log in.

   If the login script you just created was for a Profile object, continue with Step 7.

7. **(Profile login scripts only) Using the browser, select the User object that needs to use the profile login script.**

8. **Click Object > Details.**

9. **Click the Login Script page.**

10. **Enter the name of the Profile object in the Default Profile field located under the login script text box.**

11. **To save the Profile object name and close the Details dialog box, click OK.**

    Now you must add the User object as a trustee of the Profile Object.

12. **Using the browser, select the Profile object.**

13. **Click Object > Trustees of This Object > Add Trustee.**

14. **Enter the name of the User object that uses this Profile object.**

15. **Make sure the Browse object right and the Read property right are checked, and then click OK to assign these rights to the User object.**

    The User object is now a trustee of the Profile object and has the rights necessary to run the profile login script. Repeat these steps for all additional users who need to use this script.

### Sample Login Script

If you are using this sample script to replace the Microsoft Client with the Novell Client for Windows 95, some user intervention is necessary. Due to Microsoft's limited scripting capabilities, users must close an open DOS box before the workstation is rebooted and the installation is completed.

If you are installing the Novell Client for Windows 95 on a new workstation or are upgrading an existing client, no user intervention is necessary.

This is not an issue for Windows NT.


In this sample, the information that is necessary to the script is represented in all capital letters. The information you should customize for your network is in lowercase letters.

Some lines in this sample have been artificially divided to accommodate the printed page. These artificial breaks should be removed when the script is placed in the user's login script. See the sample login script available in a text file called inst_log.txt on the CD-ROM in the Novdocs directory for a script that does not contain artificial line breaks.

**Example 8-1**

```
REM *****  Windows NT SECTION  *****
IF <os> = "Windows_NT" THEN BEGIN
   WRITE "Updating the Novell Client for Windows NT."
   #\\server1\sys\public\client\WINNT\i386\setupnw.exe /acu /u:unatt_nt.txt
   EXIT
END

REM *****  Windows 95 SECTION  *****
IF <winbootdir> <> "" THEN BEGIN
   WRITE "Updating the Novell Client for Windows 95."
    IF OS_VERSION="V7.00" THEN BEGIN
       #\\server1\sys\public\client\win95\ibm_enu\setup.exe /acu /
      u:\\server1\sys\public\client\win95\ibm_enu\unatt_95.txt
   ELSE
      @\\server1\sys\public\client\win95\ibm_enu\setup.exe /acu /
      u:\\server1\sys\public\client\win95\ibm_enu\unatt_95.txt
```

**Example 8-1**

```
       EXIT
    END
    EXIT
EXIT

REM *****  DOS/WIN SECTION  *****
IF OS = "MSDOS" THEN BEGIN
     IF PLATFORM <> "WIN" THEN BEGIN
       WRITE " Updating the Novell Client for DOS and Windows 3.1x with the
       DOS install."
       MAP y:=\\server1\sys\public\client\
       #y:ADM32\IBM_ENU\DOS_ACU\NWDETECT.EXE CLIENT32_VERSION 2.5.0
       IF ERROR_LEVEL = "1" THEN BEGIN
          #y:DOSWIN32\INSTALL.EXE
          IF ERROR_LEVEL = "0" THEN BEGIN
             #y:ADM32\IBM_ENU\DOS_ACU\NWSTAMP.EXE CLIENT32_VERSION 2.5.0
             #y:ADM32\IBM_ENU\DOS_ACU\NWLOG.EXE /F Z:\DOSLOG\DOSACU.LOG
             #y:ADM32\IBM_ENU\DOS_ACU\REBOOT.COM
          ELSE
             WRITE "Error running installation (%ERROR_LEVEL). Contact your
             network administrator"
             #y:ADM32\IBM_ENU\DOS_ACU\NWLOG.EXE /F Z:\DOSLOG\FAILED.LOG
          END
       ELSE
          WRITE "The Novell Client for DOS and Windows 3.1x was up-to-date."
       END
       EXIT
    ELSE
       WRITE " Updating the Novell Client for DOS and Windows 3.1x with the
       Windows install."
       MAP y:=\\server1\sys\public\client\
          @y:doswin32\nls\english\setup.exe /acu
       EXIT
    END
END
WRITE "OS %OS not supported by ACU"
WRITE ""
```

## What Users See

If this is an new client software installation or if it is an upgrade from older client software, the software is installed or upgraded when users log in and then restart the workstation. Users might see system messages as their workstations are upgraded, depending on how you set up the installation.

If workstations already have current client software, the client login runs as usual.

# Other Network Installation Options

There are additional network installation options that might better suit your networking environment. You should evaluate these methods before deciding which is best for you. The following information gives a brief overview of the other network installation methods and information on where to find complete documentation about them.

## Installing with Z.E.N.works

Z.E.N.works™, or Zero Effort Networking, is an integrated set of products for managing workstations and user desktops while reducing the total cost of ownership.

Z.E.N.works includes Application Launcher, a component which lets you distribute applications such as the client software to workstations and manage those applications as objects in the NDS™ tree. Users do not need to worry about workstation configurations, drives, ports, command line parameters, application source directories, or whether they have the latest upgrade. You, as the administrator, manage such issues easily and centrally from NetWare Administrator.

For more information, see Z.E.N.works Overview in the online documentation.


In order to use Z.E.N.works, you must manage your network from a 32-bit workstation, such as Windows 95 or Windows NT. Not all of Z.E.N.works application and desktop management features are available on a Windows 3.1*x* workstation.

## Additional Windows 95 Installation Options

You can use the following methods to install Novell Client for Windows 95 software:

- MSBATCH

  Use this option to install and configure Novell® Client™ for Windows 95 without your having to be present. This process saves a great deal of time, especially if you need to install the software on multiple workstations. For more information, see Novell Client for Windows 95 > Setting Up > MSBATCH Install in the online documentation.

- Automatic Client Upgrade (ACU)

  Use this option to automatically upgrade multiple workstations from the Microsoft Client for NetWare Networks to Novell Client for Windows 95. For more information, see Novell Client for Windows 95 > Setting Up > ACU Install in the online documentation.

## Additional Windows NT Installation Options

You can use any of the following methods to install Novell Client for Windows NT software:

- Unattended install

  Use this option to install and configure Novell Client for Windows NT without having to be present. This feature saves a great deal of time, especially if you need to install the software on multiple workstations.

  By preconfiguring installation options with Novell Client Install Manager, you can install both Windows NT and Novell Client for Windows NT, or Novell Client for Windows NT by itself, on one or more workstations over the network. For more information, see Novell Client for Windows NT > Setting Up > Installing Novell Client > Unattended Install of Novell Client in the online documentation.

- Automatic Client Upgrade

  Use this option to automatically upgrade multiple workstations from the Microsoft Client for NetWare® Networks to Novell Client for Windows NT. For more information, see Novell Client for Windows NT > Setting Up > Installing Novell Client > Automatic Client Upgrade in the online documentation.

- Windows NT Network control panel

  Use this option if you want to use the Network control panel to install Novell Client for Windows NT as you would other services. For more information, see Novell Client for Windows NT > Setting Up > Installing Novell Client > Installing from the Network Control Panel in the online documentation.

## Additional DOS and Windows 3.1*x* Installation Options

There are two additional network installation methods for installing the Novell Client for DOS and Windows 3.1*x*:

- Automatic Client Upgrade

  Use this option to set up and standardize the installation process. During installation, ACU automatically configures each workstation's client settings, thus virtually eliminating the need to configure individual workstations. For more information, see Novell Client for DOS and Windows 3.1*x* > Setting Up > Installing with ACU in the online documentation.

- User-Initiated Installation

  Use this option to set up an installation procedure with little or no user intervention. Once users are notified of the installation procedure, they can begin installing whenever it is convenient. For more information, see Novell Client for DOS and Windows 3.1x > Setting Up > Installing from the Network in the online documentation.

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