Chapter 1

Installing NetWare 6

INSTALLING NETWARE FOR THE first time may give you pause. If you have never installed NetWare before, your anxiety about a new procedure is compounded by all your questions about NetWare particulars. If you have installed NetWare before, you may be concerned because NetWare 6 doesn't look much like NetWare 4.*x* or any other earlier version.

Although it may give you little comfort now, NetWare 6 is the easiest version of NetWare to install in the history of the product. It's shipped on a nice, shiny set of CD-ROMs. The older versions of NetWare took a bushel basket of floppy disks and constant attention to feed those same disks in mind-numbing repetition. Mistype or forget something with earlier NetWare? Start all over, and feed those flippin' floppies in one after another.

The new GUI (graphical user interface) installation screens are pretty but not necessarily faster or better than the earlier text screens. If you're used to NetWare 4.*x* or 3.*x*, be forewarned that you *need* a mouse for NetWare 6 installation.

The automated installation process has been improved over NetWare 4.*x*, especially if you're using a server equipped with Plug-and-Play capabilities. The installation routines more often understand the drivers for disks and network adapters, meaning that the installer (that's you) doesn't need to reenter driver information and parameters.

Do you have a dual-processor server? When Novell introduced SMP (Symmetrical Multi-Processor) support, the modified NetWare operating systems were licensed to the manufacturers. This allowed vendors to make minor modifications to support their particular hardware. NetWare 6 incorporates these improvements, so the software detects multiple processors during installation and adds the proper code.

You'll see the other improvements in NetWare 6 described in the appropriate places here and there throughout the book. However, in many cases, what went for version 5.*x* will also apply to version 6.

This chapter will cover the following topics:

- Preparing your server machine
- Preparing for installation
- Running the installation program
- Removing NDS

Preparing Your Server Machine

Before you jump into installing NetWare 6 on your server, you need to get that machine ready. You don't want to start the installation process, only to find that you don't have enough hard disk space or RAM. We'll cover the server requirements and components, but first, let's look at an essential part of server preparation: protecting your server.

Protecting Your Server

Personal computers today are built to run in an office environment. No special air-conditioning, raised floors, or expensive fire-dampening foam is needed. Even if you buy a superserver cluster of servers all crammed into a 19-inch rack, an office environment is fine. So why should we make a big deal out of the physical space for your server?

The biggest reason to lock up your server is security. The first part of any security program is to limit accessibility to what you are protecting. What people can't see, they don't try to steal or vandalize. Why do you think the police always tell you to lock packages in your car trunk, rather than leaving them in the back seat? Out of sight—out of their hands.

Mischief is possible from the file server. From a worst-case angle, a malcontent with access to your server could reformat the server hard disk. Even if the malcontent happened to forget a DOS bootable disk, he or she could still cause trouble, because the tools to format and partition the PC hard disk are included with the NetWare installation utilities. The NetWare partition on the disk can be erased even more quickly, which does just as much damage to your network. Either way, you have a long day ahead of you, and your tape backup procedures will be severely tested.

Separate from actual harmful intent to your server, accidents happen more often to equipment out in the open. If your server is on a table, the table will get knocked over. Someone will "borrow" the monitor or the keyboard. Someone will spill coffee directly into the chassis air holes. If bad things do happen, let them happen to someone else's computer; keep your server safe.

NOTE *One customer had five servers sitting together, and they went down every evening. No diagnostics cleared up this mystery until someone spent the night in the office. The cleaning crew unplugged one server for the vacuum cleaner (from the UPS), and the noise on the UPS sent the other servers into terminal weirdness from the electrical interference.*

PROTECTING YOUR SERVER FROM STATIC BUILDUP

Controlled environments are easier to make static-proof and generally safer for sensitive electronic equipment. Yes, this is contrary to the idea that the computers on every desk are safe, but they're really not. In the owner's manual of every computer is a warning about static electricity and how to avoid it. We all ignore that warning, with little consequence. However, since your file server may support dozens to hundreds of excitable people, crashing the server because of static buildup in the carpet will bring all those excitable people to an even higher level of agitation. Better to keep the server in a locked room with a tile floor than risk that one-in-a-million, server-killing, static discharge from the carpet and your wool sweater.

All PC repair manuals go into detail about wearing static wrist-straps while working on a computer. They will give directions for ways to slowly bleed static away from your server (ground

equipment through a one mega-ohm resistor). They also remind us to never open the chassis on a system with the power turned on. You wouldn't do anything so stupid, would you? Well, I did, once, by accident. Take it from me, unplugging an Ethernet board from a powered PC will fry that mother. . .board.

PROTECTING YOUR SERVER FROM POWER PROBLEMS

While you have the server in a locked room with tile floors, run dedicated power lines to that room. It's safest to run every network device from these dedicated lines, but that may not be possible. Propose a dedicated line for every network printer, server, and wiring device to scare your boss into providing a dedicated circuit, at least for your server.

Ground the server (or all these dedicated circuits) to an earth ground if at all possible. Weird things happen with a "floating ground," multiple grounds, and circuits that get cross-wired somehow. If your systems get flaky for no reason, an electrician may be a good person to call.

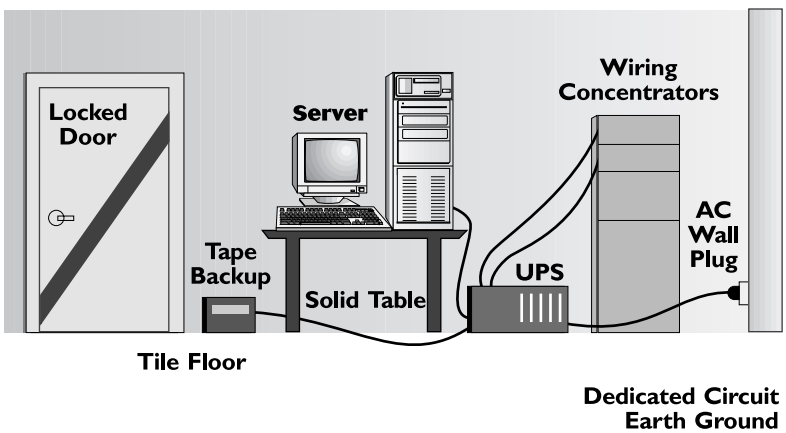
Always, always, always put the server on a UPS (uninterruptible power supply). There is no excuse for not doing so. UPS systems are cheap today, and many are smart enough to gently shut down your server. Few sites need to worry about power dropping out for more than a few seconds. Many sites do need to worry about power that has malformed signals and constant fluctuations. A good UPS will take care of these problems as well.

The UPS system works like this: A cable from the UPS connects to a server serial port. When a power blackout or brownout activates the UPS, the server software will communicate with the UPS over the connecting cable. When the UPS battery is in danger of being discharged completely, leaving the server without power, the monitoring software will take down the server so all files are closed properly.

All powered network devices, such as wiring concentrators, modems, communication servers, bridges, routers, and tape backup systems, should be on a UPS. Remember to plug the server console monitor into the UPS as well, unless you have memorized all the proper shutdown keystrokes. Figure 1.1 shows the setup for a properly protected server.

Repeat: There is no excuse for having a server without a UPS. None.

FIGURE 1.1
The properly protected server



Requirements for NetWare Servers

NetWare 6 operates on a wider range of server hardware and network peripherals than most other network operating systems. According to Novell, your server must meet these minimum requirements:

- A PC or PC-compatible with a Pentium II or better processor
- 256MB of RAM
- 512MB of RAM for servers running application servers such as WebSphere, NetWare Enterprise Web Server, or Apache Web Server
- 2.2GB hard disk space free (and unpartitioned)
- One (or more) network board(s) connected to a functioning network cabling system
- A 200MB DOS partition
- A CD-ROM drive that can read ISO 9660 formatted CD-ROMs (if you're installing from the CD-ROM and not from another server)
- A 3.5-inch disk drive
- A VGA monitor and video board (SVGA recommended)
- A keyboard
- A serial, PS/2, or USB mouse (optional, but *highly* desirable)

Technically, these elements will make a server. Practically, this server will be worthless for most networks. Your choice for server components should read like Table 1.1.

TABLE 1.1: OPTIMUM SERVER COMPONENTS

OPTION	RECOMMENDATION
CPU	Intel Pentium III or XEON (Pentium III 700MHz and up for multiprocessor machines)
RAM	512MB recommended; more is much better
Hard disk	4GB minimum, but more is better; in all but the smallest environments, start with at least a 20GB hard disk
DOS partition	200MB minimum, plus an amount of disk space equal to the machine's amount of RAM, for a possible core dump. A 512MB system would need 712MB (200MB+512MB) to follow this recommendation from Novell.
NIC	PCI bus-mastering 100BaseT
CD-ROM drive	24x speed
Monitor and video card	SVGA
Keyboard	Just about any cheap keyboard will do, since you'll use it rarely (if ever) after installation
Mouse	Serial, P/S2, or USB; it's nearly impossible to run ConsoleOne and other GUI utilities without a mouse

Each item in Table 1.1 is necessary, but choosing some items may demand critical decision-making skills. The items requiring some soul-searching depend on your needs for this server. Our goal in this section is to discern which options best fit your situation for each server you will install.

If your company is like most companies, there is a constant struggle between what is wanted and what is affordable. Every network administrator would love to have nothing but superservers with more RAM and hard disk space than the company's mainframe. However, budget constraints exist in every situation. You may be able to talk your boss into a superserver, but you must justify that expenditure.

The only way to justify expenditures for most bosses is to give clear pictures of the options, with the good and bad points of each option. Normally, the equation is simple: Here are the good points, and here are the bad points (usually price tags or required resources). Then you and your boss argue about the list of good and bad points for each portion of the server until some compromise is reached.

A question for you and your boss: What are the three most important functions for your planned server? The answers from you and your boss may be different. If so, problems will be your constant companion. Only when you and your boss are in agreement regarding the network will you both be happy with the choices you must make.

Living with Your Networking Decisions

The question "What are the three most important functions of *x*?" will reappear in various places throughout this book. If you are uncomfortable making decisions, I have one bit of advice: Get over it. Business management, and especially networking, is nothing but decisions regarding the conflict between goals and constraints.

Let me help take the fear out of decisions: Every single one you make will be wrong next year. By this, I mean that technology will change, and better options will appear. If you make the same decision next year as you made yesterday, you will be overlooking better options. Better equipment will be available, prices will be lower, or both, but things will change.

Don't beat yourself up over decisions made in the past that didn't work out as well as you hoped. No one can blame you if you had the right priorities at the time you made that decision. The only action you can be blamed for is not revisiting poor decisions as time makes more options available.

Choosing the Hard Disk (Buy a Bigger One)

No one complains about too much storage space, whether we speak of closets, car trunks, or server hard disks. My friend David Strom has this recommendation for beginning NetWare administrators: Buy twice as much disk space as you think you'll ever need. Better yet, buy three times as much.

Today, three types of disk interfaces are suggested for servers: IDE, IDE Ultra DMA, and SCSI. Let's talk about IDE and SCSI, along with RAID systems.

NOTE *The big change in hard drive drivers is the end of support for* `.DSK`*-type drivers. NetWare 4 introduced the NetWare Peripheral Architecture (NPA or sometimes NWPA) but allowed both NPA-type and* `.DSK`*-type drivers. Beginning with NetWare 5.x, only NPA-type drivers are supported. Be careful when upgrading to ensure that your controller cards have NPA drivers available.*

IDE Disk Controllers and Drives

If you buy a PC with an installed hard disk, chances are it will be an IDE system. IDE controllers are usually located directly on the motherboard. Early versions of IDE controllers were limited to 525MB, but now drives up to many gigabytes are supported.

NetWare 6 support of IDE controllers is strong. The standard `IDEATA.HAM` driver included in the installation process works with almost all brands of IDE controllers. With the larger capacity available today, IDE drives are decent choices for servers. PCI (Peripheral Component Interconnect) IDE controllers now support 32-bit access, making disk performance even better. Novell also includes `.CDM` files for IDE hard drives (`IDEHD.CDM`) and CD-ROMs (`IDECD.CDM`).

SCSI Disk Interfaces and Drives

Another technology "borrowed" from the world of Unix hardware, SCSI adapters and drives are the choice for serious servers and large server disks. Technically, SCSI (pronounced "scuzzy") is an ANSI standard that details an I/O bus capable of supporting as many as seven devices.

The old-style SCSI adapters use a short, 50-pin connecting cable. The newer, faster SCSIs use a high-density 68-pin cable. IDE drives, in comparison, use a 40-pin cable. Since SCSI devices are "chained" together, a terminator must be used on the last device to anchor the chain. SCSI is a popular adapter for CD-ROM drive connections. This popularity helps make SCSI devices more affordable.

The high-performance needs of Unix workstations and servers are advancing the performance of SCSI devices every day. SCSI-2, Fast SCSI, Wide SCSI, Fast and Wide SCSI, and Ultra2 SCSI-3 are improvements being advanced by various parties. The world of SCSI is also being pushed to support longer cable lengths to make disk clusters more convenient.

SCSI works better for servers than IDE because SCSI drives have more flexibility and more throughput, and SCSI taxes the CPU much less than IDE.

RAID Disk Systems

Coming into popularity in the 1990s, *RAID* (redundant array of inexpensive disks, although some references now say *independent* rather than *inexpensive*) uses several disks to replace the storage capacity of a single disk. The advantage of RAID is fault tolerance. This means that one disk can die, but because the information is spread across all disks, no data is lost. How the data is spread determines the RAID level of a disk system. The levels range from 1 to 5, but RAID levels 1, 4, and 5 are generally used for servers, with RAID levels 1 and 5 the most popular.

The best RAID systems allow bad disks to be replaced without downing the server, thus maintaining server uptime for users despite what is ordinarily a catastrophic failure. This technology is called *hot swapping*. Some vendors build cabinets with multiple power supplies and cooling fans to emphasize the fault-tolerant nature of RAID.

However, two warning notes are attached to this rosy scenario:

- RAID systems do not, in any way, make a tape backup obsolete. Although a RAID disk system will continue if one drive goes bad, catastrophic (multiple disk) failures can occur. More important, tape backup is most often used to replace files accidentally deleted. If you delete a file on a RAID disk system, the system will happily delete the file, no matter how many disks hold part of that file.

- Reconstruction of a RAID system is not transparent. As the new disk in the system is populated to take the place of the failed drive, your server will be involved. The performance for clients will drop drastically.

Despite the warnings, RAID systems perform better in critical systems than any single drive available. No system is perfect, but RAID is a step in the right direction. These systems will become more commonplace as prices settle and companies realize the value of the data on their server disks.

Choosing the Server's NIC

Whether your network runs Ethernet, Token Ring, or something else, the NIC (network interface card) in your server must carry the largest load. Each client talks to one system: the server. The NIC for the server is no place to save money.

Get the fastest PCI network board you can. PCI now supports 64-bit data paths at 133MHz. Unless your network supports few people, get a 100BaseT interface board for every server and your tape backup system. Gigabit Ethernet price drops make this technology affordable, especially for a backbone connecting server to server.

Early advice was to add several NICs in each server to handle higher network traffic loads. Now that switched Ethernet and Token Ring are available, my advice is to avoid multiple NICs. When you add the second network adapter in the server, the operating system turns on the software necessary to route traffic between the two (or more) network segments. This means that each and every packet coming to each network adapter must be examined and routed to either the server itself or to another network adapter. This overhead actually tends to slow server processing of packets in heavy network traffic situations. If at all possible, do not use your server as a local router for your network segments. Figure 1.2 shows the possible and preferred setups.

To paraphrase the old adage, put all your eggs in one basket, and then really watch that basket. Put a stout network adapter in your server, and make sure it has been certified by Novell. Make doubly sure the card has the proper driver not just for NetWare, but for NetWare servers.

The NetWare operating system supports about 50 LAN drivers right out of the box. You can add drivers for any other interface card during installation by using the vendor's configuration diskette.

One more suggestion: Check your NIC vendor for new server drivers now and then. You can improve your server's performance by upgrading your drivers, and vendors regularly supply new driver files.

Choosing the Server's CD-ROM Drive

What's important about your CD-ROM drive is not the drive itself, but the controller card that sits in the server. Since SCSI is an accepted standard, a NetWare-supported card in the server can easily run any new CD-ROM drive. So NetWare doesn't care about the drive, just the controller.

More than 20 drivers for various SCSI adapters are included in the NetWare installation program. Vendors can supply their own Novell-certified drivers with their own SCSI cards. Because NetWare servers are big business, most SCSI board manufacturers provide Novell drivers.

IDE CD-ROM support started in NetWare 5. However, the performance isn't better than with SCSI drives, so there's little reason to go out of your way to get an IDE drive and controller if you are already using SCSI. On the other hand, if you are using IDE, there is nothing wrong with using an IDE CD-ROM.

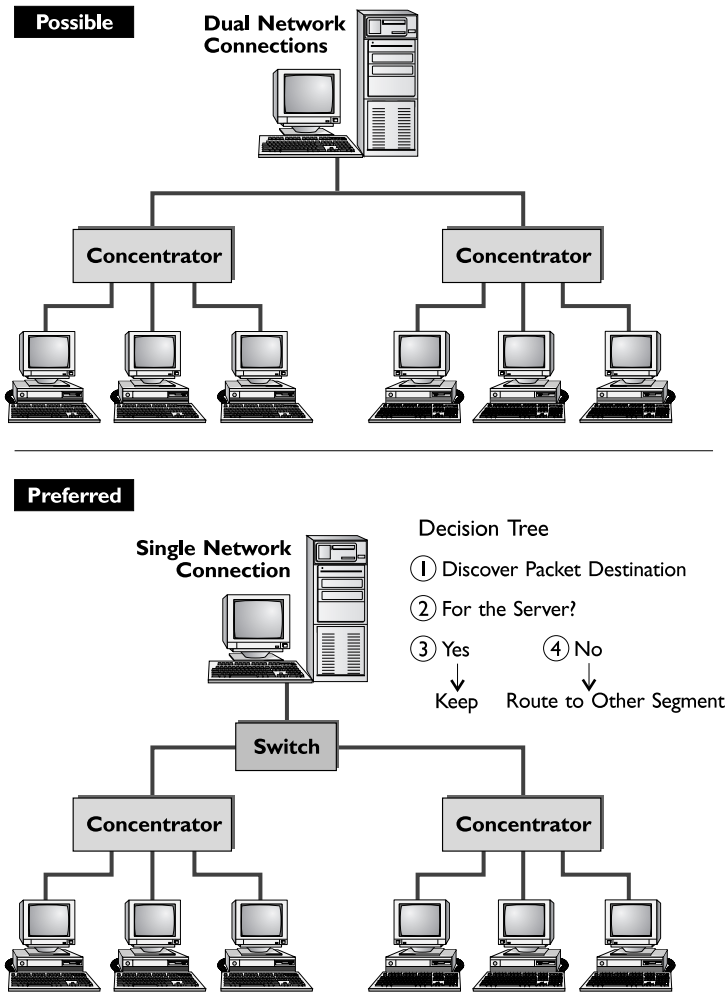


FIGURE 1.2
Handling high network traffic levels

If you plan to use your CD-ROM drive as a NetWare volume after the server is installed, get at least a 24x drive. If you're not going to use the CD-ROM drive as a volume, its speed makes little difference. Here's one place you can save some money, though the installation will take longer. Just make sure that the interface card for the CD-ROM drive doesn't interfere with the network adapter and disk controller.

WARNING *There have been problems with some SCSI adapters when running both the hard disk and the CD-ROM drive from the same adapter. During installation, the adapter may become unstable and lock up the console keyboard. If that happens, take all the SCSI references out of your* `CONFIG.SYS` *file that boots your server under DOS before restarting the installation process. Then load the proper SCSI driver supplied by NetWare to load the CD-ROM as a NetWare volume, and use that volume as the installation files' source.*

Choosing the Server's Monitor

This used to be another easy choice—any VGA video board and low-end monitor would work fine on your server. Now that NetWare uses a GUI on the server, the video card and monitor are more important. Choose one that is on Novell's approved list, or at least a name-brand card.

Once installation is complete, server console operations are done infrequently. All normal console operations can be performed across the network using the `RCONSOLE.EXE`, ConsoleOne program, or NetWare Remote Manager (browser-based and cool).

Preparing for NetWare 6 Installation

Now that you've prepared the hardware, it's time to prepare for the actual installation. After you've finished this chapter, you'll have your server installed (or at least you will have read about installing it). Plan to spend about an hour or so for the installation. That's the bad news. The good news is that most of that time will be spent copying files to your server, requiring no intervention or effort on your part.

Of course, the "few-minute install" works best when you take the approach of the cooking shows on TV. You should have all the necessary ingredients (information) at hand. You should have a working oven (server) all preheated and ready to go (properly configured with the correct disk drives and NICs). And you should know the recipe, which means that you should read over the entire installation process once or twice to understand where you're heading with each step.

Your first step is to get a pad and pencil. Write down every ID number, IP address, or any other identifying nomenclature on worksheets. Whatever you don't write down, you'll need in a panic later. Protect yourself and write everything down now.

Also, keep a pad and pencil beside the server during installation. Every time you must make a choice and every time the installation program provides a randomly generated number for you, write it down. Save that paper, because you will forget the information. With luck, you won't need to refer to this information, or at least you won't lose the paper.

Booting Your Server from the Hard Disk

With a brand-new server PC, there may be nothing on the hard disk. Novell and I *strongly* recommend that you create a DOS partition of 200MB or so and boot the server from the hard disk.

If there are files on the hard disk (as is often the case with systems bought from retail outlets eager to add "value" by adding strange software of all types), all those files will be erased. When you run FDISK (and rework your DOS partition), everything on your hard disk will be deleted. Has this PC been backed up? If not, do a backup now if there is the smallest chance you or someone else will one day want any of the files.

To boot your server from the hard disk, there must be a DOS partition. Novell recommends 200MB for the partition. This allows enough room for all DOS files, the `NWSERVER` directory for the NetWare files, and a little space for other server utilities.

NOTE *Upgraders from previous versions please note: It is no longer possible to boot from a floppy drive. You must boot from the hard drive now.*

On a clean system, you may want to try booting from the CD-ROM and letting NetWare handle all the DOS partition setup. It works pretty well now, and all new servers support booting from the CD-ROM drive. (Check the system BIOS setup parameters to make sure that booting from the CD-ROM drive is enabled.) If this doesn't work, or you prefer using a floppy, keep reading.

With a configured and working PC, you will need to use `FDISK.EXE` to make the adjustments to your disk partitions. It's painful to press the Y key to say, "Yes, completely wipe the disk contents, never to be seen again," even when you know there is nothing valuable on the disk. I suppose you need to accidentally erase a disk or two before you become paranoid about partitioning a disk. If you haven't wiped away valuable files, you haven't been playing with computers long enough.

Follow these steps to prepare the hard disk of your future server:

1. Boot the system from a DR-DOS or MS-DOS 3.3 or later floppy disk or your server installation license diskette (better). *Do not* use DOS from a Windows system; NetWare depends on the included Caldera DOS.
2. Run `FDISK.EXE`.
3. Delete the existing DOS partition and any others you may find.
4. Create a DOS partition using 200MB or more of disk space.
5. Set the new partition as the active partition.
6. Exit `FDISK.EXE` by pressing Esc.
7. Format the small DOS partition (type **`FORMAT C: /S`**) from the server installation floppy.
8. Create the `CONFIG.SYS` file on the new hard drive with the following two lines. (You can, if you prefer, simply copy the server installation floppy to the hard drive, but be sure to place these two statements on the hard drive's version of the file.)

   ```
   FILES=50
   BUFFERS=30
   ```

9. Reboot the system and boot from the hard disk to verify the previous steps.
10. If the CD-ROM drive will be used for installation, copy and verify that CD-ROM drivers initialize the drive. If a network connection is needed for installation, copy and verify that NIC drivers connect to the network. If you have an existing network, ensure that you can see and connect to a server.

Before you begin installation, make sure that you know the settings for all the NICs in your machine, as well as the necessary names and passwords. Also, if you are installing into an existing NetWare 4.*x* or 5.*x* system, you should know the design of your NDS eDirectory tree. Knowing the administrator password goes without saying, right?

TIP *I prefer letting the installation program modify the* `AUTOEXEC.BAT` *program so that the NetWare server starts every time the system is booted. If something happens to stop the server, such as a power failure, it's nice that the server can restart without someone typing a command or two. You'll see where you can choose this option a bit later in this chapter, when we get to running the INSTALL batch file program.*

Use the CD-ROM driver files you saved from the hard disk and placed on the installation boot floppy before you wiped the server hard disk. If your CD-ROM drive supports bootable CDs, life will be slightly easier during the NetWare installation process.

If a network connection is necessary for installation, copy the minimum client files needed from a working network client. You don't need a full-featured client. You can probably use a DOS Shell (NETX) client if you have one; you can definitely use the DOS Requester (VLM) or Client 32 for DOS client. (See Novell's Web site for more information about DOS-based clients.)

Setting Up Your Installation Files

If you are installing your first NetWare server, you have no choice about where your server installation files are located. They must be loaded into a CD-ROM drive on your server.

If you are installing your second or seventeenth NetWare server, your installation files can come from the CD-ROM drive on the server or from a remote server across the network. Installing from a remote server requires an existing network and a server with space for the installation files or the NetWare 6 CD mounted as a NetWare volume.

There is little difference in the actual installation between loading your network operating system from a CD-ROM drive in the server or from another server three floors away. Most of the installation time is spent watching a seemingly endless list of filenames zoom by. After answering a few questions at the beginning and in the middle, you have little to do during the installation of NetWare 6.

Preparing the Network with *NWDEPLOY.EXE*

If your network contains more than three other NetWare servers, particularly if those servers haven't had all the NDS patches applied regularly, use the `NWDEPLOY.EXE` program found on the NetWare 6 operating system CD before starting the server installation. `NWDEPLOY.EXE` updates NDS and a few other little details. If you don't do it, you may catch yourself chasing hard-to-catch weird problems. Go ahead and run the utility, unless you have a completely up-to-date network.

NOTE *You don't want to run a mixed network of NetWare 6, 5.x, and 3.x or 4.1x servers if you can help it, although this is fully supported (with NDS eDirectory). See the online documentation for mixed network operating system issues and procedures.*

Installing from a Server-Based CD-ROM

IN A HURRY 1.1: INSTALL NETWARE FROM AN INTERNAL CD-ROM DRIVE

1. Install and configure a CD-ROM drive on the target server.
2. Boot the server-to-be, loading only DOS and the CD-ROM drivers.
3. Make the CD-ROM drive, with the NetWare 6 operating system CD loaded, your current drive.
4. Type `INSTALL` in the root directory (unless your bootable CD-ROM drive takes care of this for you).
5. Skip to the section about running INSTALL ("Running the Installation Program").

The server-to-be machine must be functioning properly as a DOS system before it can be a server. Test the CD-ROM drive initialization files by rebooting the system, loading only DOS and the CD-ROM startup drivers. These files are all you need for your server installation boot disk. If all is well, you can make your CD-ROM drive (normally drive D:) your active directory and scan the CD just as you can your hard disk. Now you can start the NetWare 6 installation process with confidence.

NetWare 6 does a good job of configuring the CD-ROM drive and starting the process automatically. With any luck and a fairly new server, you can let the CD-ROM boot process take care of all these details. Save yourself some trouble. Unless you're installing a bunch of servers, use the internal CD-ROM method started by booting from the CD-ROM.

After you switch to your CD-ROM drive, you will see the batch file `INSTALL.BAT`. You now can skip ahead to the "Running the Installation Program" section of this chapter.

Installing from a Remote Server across the Network

The fastest way to install NetWare may be to use a remote NetWare server as your installation source. You can install from a NetWare volume (the fastest choice here) or from a remote CD mounted as a NetWare volume. Even if this is the first NetWare 6 server you are installing, a remote server can be the source of all the installation files, saving you time and aggravation, if you have another NetWare 3 or 4 server available.

HOW CAN A NETWORK BE FASTER THAN A CD-ROM?

If you're new to networking in general or NetWare in particular, you may wonder why transferring files from another PC over the network is faster than reading an internal CD-ROM drive. How can you send information through a bunch of network cabling, involve two different servers, and worry about other network traffic during your file transfer, yet still believe it's faster than an internal CD-ROM drive?

PCI bus-master network cards running at 100Mbps move buckets o' bits quickly. Internal CD-ROM drives, although getting faster, are almost always based on IDE hard drive controller chips. They are just not as fast as network cards.

The next boost of performance comes with the file caching that NetWare does. Even when reading a fast CD-ROM drive, NetWare reads file blocks beyond the information needed to fill the current request. The file stays in the cache of the source NetWare server, so many of the file requests by the target server will be serviced by server RAM rather than by the server CD-ROM drive. If you have copied the installation CD onto the server hard drive, the performance boost by file caching is even more pronounced. Server hard drives are much faster than the fastest CD-ROM drive.

The moral of this story is simple: Install from a remote server if practical. If not, you may have a chance to read three magazine articles rather than two during the installation.

INSTALLING FROM A NETWARE VOLUME

This is probably the first NetWare 6 server you are installing into your network. I base that assumption on your attention to the installation chapter. Since you're reading this section about running the

installation process across the network, I assume that you already have a NetWare server or servers available. NetWare 6 is actually fairly simple to install, so as a good NetWare administrator, you probably won't need instructions more than the first time or two.

Copying the Installation Files from the CD-ROM

The easy way to get the installation files from the CD-ROM drive to the NetWare server is by copying everything from a workstation with a CD-ROM drive. There are more than 4000 files and directories that collectively use almost all the space on the operating system CD, so make sure that you have room on your target server before you start. If you add the clients and documentation CDs, the totals balloon to more than 9500 files and about 975MB of space. The copying process will take quite a while, so start at lunchtime or the end of the day.

Here are the requirements for making a copy of the NetWare 6 operating system CD on a different NetWare server:

- An existing NetWare server with appropriate disk space available
- The target server configured as a NetWare workstation, with at least 2.2GB of free, unpartitioned space available
- A workstation with a CD-ROM drive that can read ISO 9660-formatted CDs (almost all CD-ROM drives can read this format)
- A functioning network supporting all three machines

Follow these steps to make the copy:

1. Log in to the host server with proper rights to create a subdirectory.
2. Change to the root directory of the NetWare volume (not SYS:, unless you will have plenty of disk space available after copying the CD to the server).
3. Type **`MD NETWARE6`** (or give it a more descriptive name, such as **`NW6OPSYS`**).
4. Type **`CD NETWARE6`** (or whatever you named the directory).
5. Type **`NCOPY D: /S /E /V`** (assuming D: is the CD-ROM drive).

NOTE *The switch options on the NCOPY command are /S for subdirectory, /E for empty directories, and /V to verify. Use NCOPY rather than XCOPY so that all the NetWare attributes on the files are copied properly.*

Setting Up the Target Server as a Workstation

Once the files from the CD-ROM drive are copied on your host server, you can begin installation. The target server must load the files necessary to log in to the host server. This requires loading the NetWare client software appropriate for the workstation.

Log in to the host server as SUPERVISOR (for NetWare 3), as Admin (if it's a NetWare 4 server or above) or as another user with all rights. Map a drive from your workstation—er, server-to-be—to the directory on the host server containing the NetWare 6 files. Change to that drive and type **`INSTALL`**. You can now skip ahead to the "Running the Installation Program" section of this chapter.

INSTALLING FROM A REMOTE CD-ROM

For those of you with existing NetWare servers already containing CD-ROM drives, your job is simple. Place the NetWare 6 operating system CD in the drive and mount the new volume; any NetWare client can now reference that volume.

Once again, the server-to-be must be configured as a workstation. Log in from the target server as SUPERVISOR (for NetWare 3), Admin (for NetWare 4), or any other account that has rights to the CD volume, and make a connection (in other words, map a drive) to the CD volume. Follow these steps to mount the NetWare 6 operating system CD on a remote server:

1. Dismount the current CD (if any) by typing either **DISMOUNT *volume-name*** if you are using NetWare 6 or **CD DISMOUNT *volume-name*** if you are using NetWare 3 or 4. Then remove the disk.
2. Place the NetWare 6 operating system CD in the drive.
3. Type **CD MOUNT NW6** if you are using NetWare 3 or 4, or load the **CDINST.NLM** module and then type **MOUNT NW6** if you are using NetWare 5.*x*.
4. From the workstation/server-to-be, log in to the host server as SUPERVISOR (for NetWare 3), Admin (for NetWare 4 or 5), or another user with rights to the volume.
5. Map a drive letter to the CD volume by typing **MAP N:= *host_server*\NW6**. (Note that you can use any drive letter; I just like to use N: to remind myself it is the NetWare CD.)
6. Type **INSTALL**.

This procedure brings you to the same point in the installation process as if the CD were inside the target server's CD-ROM drive. You can now continue to the next section.

Running the Installation Program

Many things in life force a choice—you can make it powerful or you can make it easy, but not both. NetWare changed the rules starting with version 5. You now have an industrial-strength, enterprise operating system with a relatively easy-to-use GUI to guide you through installation. NetWare 6 installation provides some big advantages, including the following:

- With the CD-ROM, you spend only a few minutes at the computer—the installation program automatically does the rest.
- You can easily correct all installation mistakes.
- You can easily make any changes you think of during or immediately after installation.
- The installation program is GUI-based, so you have point-and-click access to most options.

Let's take each item and squelch any remaining nervousness on your part. Since there are no floppies to feed during installation, you can actually install a new server with only a few minutes of your time spent at the keyboard. It will probably take you longer, at least the first time, because you will read all the help screens and peruse every word on each screen. If you're a typical NetWare administrator, you also won't collect all the necessary data beforehand, so you'll need to look up some information. That will take additional time.

Later installations will take less time because you will know the answers to the questions that appear during installation. Let me also offer hope for those of you installing from slow (less than 8*x*) CD-ROMs: You can easily install the second (and third, fourth, and so on) NetWare 6 server in your network by copying information from the first server. If you have a slow CD-ROM, you will need it only twice: once to install the first system, and the second time to load all the installation files onto the server hard disk for easy future installations.

Any time you make a mistake during installation, you can correct that mistake with little trouble. With the new graphical NetWare administration tools, you can easily correct common installation mistakes, such as typos (there is no spelling checker in the installation program). The installation program offers you several chances to stop and start all over. You have opportunities at every section to go back and redo any piece of that section. You can also run a separate installation program in text mode (`NWCONFIG.NLM`) at any time to fix any mistake or installation confusion.

Starting the Installation

Start the installation process by putting the NetWare 6 operating system CD into the CD-ROM drive and rebooting the system. The installation program will start automatically. If that doesn't work, go through these extra steps:

1. Boot DOS on the PC (without memory managers or other resident programs).
2. Load the CD-ROM drive or network client drivers (as needed).
3. Type **`INSTALL`** to start the batch file.

It may seem odd, but your PC technically becomes a server the minute the `SERVER.EXE` program starts. This program is the NetWare kernel. Of course, loading the `SERVER.EXE` program without any of the disk drivers and LAN connection software makes a useless server. As it sits now, the server can't communicate with anyone or anything else across the network or even with its own internal hard drives. These details are configured during the installation process. If you are loading the system from a remote server, the installation program will know which LAN drivers are being used. You will have the option to verify the drivers and accept them for the new server.

The First Choices

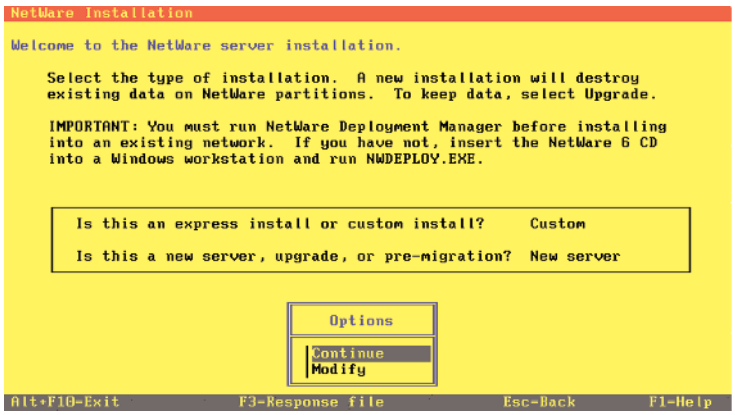
The first screen you see (after a possible question about whether you have an IDE or SCSI CD-ROM drive) is a fairly standard license screen. After you have read it, press F10 to move on. (No arguing about licensing is allowed here, so just accept it.)

NOTE *If you leave the computer idle on some screens for more than a few minutes, NetWare may automatically blank the screen for you. Don't be alarmed. Just press the Shift key to get it back.*

If your server contains a valid boot partition and/or NetWare partitions, you may see a screen asking if you wish to keep the boot partition or wipe the disk and start over. On a clean system, let NetWare wipe the disk and organize things to suit itself. NetWare will try to maintain your other partitions and files if you decide to keep them, but never, ever, ever start an installation procedure without backing up the target system twice and verifying both backups.

While the questions are backwards in Figure 1.3, they're both important. Choose between Express or Custom installation to trust NetWare or make some decisions yourself, respectively. Select Express and then Continue. (I picked Custom to go through all the installation screens). You'll see the details on the next screen. If you don't like what you read about Express installation, go back and choose Custom.

FIGURE 1.3
The first fork in the installation road



The second question is easy to answer—new, upgrade, or soon to be upgraded (pre-migration)? For now, select the New Server choice. (See Appendix A for information about upgrading options.)

Notice the important message in the second paragraph. With NetWare 6, Novell provides a Deployment Manager to get NDS up to spec before installing a new server in the network. I mentioned this earlier (in the "Preparing the Network with `NWDEPLOY.EXE`" section), but you probably skipped over it in your hurry to start installing the new server.

TIP *If you have set up Windows computers in the past, you may have heard of the* `MSBATCH.INF` *file (for 95/98) or unattended installation files (for NT/2000). These allow you to set some or all of the options needed for an installation, so no user input is needed when the operating system is installed. NetWare 6 offers the same capability. For large installations, you can simply create the response file and let relatively untrained people set up servers at other locations without knowing the intricacies of server installations, NDS, and so on. If this sounds like something you could use, refer to the online documentation.*

You may not see many of the next screens discussed if you picked the Express option. Just skip ahead to the section about the screen you have on your computer. You're not missing anything exciting, just the option to change server and NetWare details.

Server Settings

The Server Settings screen, shown in Figure 1.4, used to be an Advanced Settings dialog box, which you needed to press a function key to access. With NetWare 6, it appears as part of the normal Custom installation routine. Isn't it good that screens can work hard and get promoted?

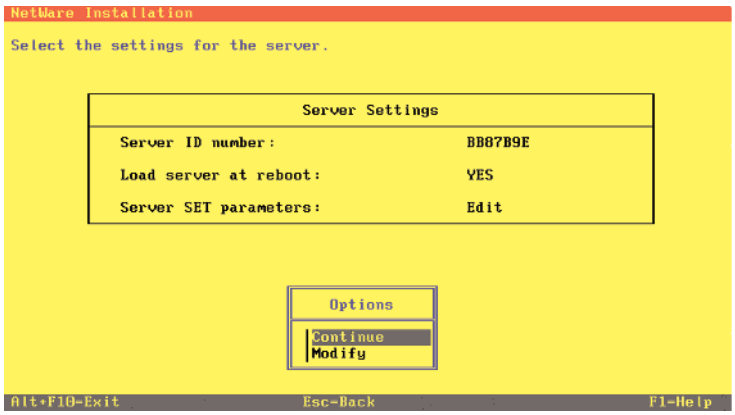


FIGURE 1.4
Server ID, load, and SET parameter settings

The server ID number makes no difference unless you're in a highly structured environment, where routers pass data only from listed addresses or a descriptive numbering scheme is used. If you do not require a special number, let NetWare generate the semi-random number for the server ID. In rare cases, you may need this number, so write it down. You're supposed to have a pad and pencil beside the server during installation, remember? You will have no chance to change this number after the installation concludes.

The second question on this screen has been the topic of much discussion over the years. Novell has changed the default on this from Yes to No and back with almost every version. I set it to Yes. The server should automatically restart after a power failure, a critical error, or whatever, without me (or potentially an end user) needing to get involved. Anyway, the default is now Yes, Automatically Start NetWare with Each Reboot. The choice is yours; start the debate.

The final setting is Server Set Parameters. The purpose of this option is to allow you to enter any SET parameters needed for the server to boot properly. (SET parameters are covered in Chapter 8 and Appendix B.) These parameters will then be stored in `STARTUP.NCF`, which is similar in purpose to a PC's `CONFIG.SYS` file, in that specific server parameters can be set when the server first boots. You will not normally need to enter SET parameters here, but if you do, be sure to spell them correctly. If you don't, NetWare will not recognize them and will ignore them, negating the setting you were trying to make.

Regional Settings

The next screen presents regional settings with defaults that you will probably be using. You can use this screen to set your country code. See your DOS manual (you still have a DOS manual, don't you? Oh well . . .), under the heading COUNTRY.SYS for more information about this setting.

In addition, you can modify the code page you will be using. For more information on code pages, see DOS Help under MODE.

The last setting on this screen allows you to change your keyboard type for many countries. If you are installing in the United States in English, simply choose Continue to move on.

Mouse Type and Video Mode

After you choose your regional settings, you can select your video and mouse settings. Now that NetWare 6 has a GUI-based installation (coming up after the file-copy process), it only makes sense to have mouse support as well. You don't need to have a mouse for the installation, but it makes the process much easier. (Have you ever used Windows without a mouse?)

NetWare 6 supports the PS/2-style mouse, the serial mouse on COM1 or COM2, and the USB mouse. I believe that you absolutely must have a mouse on the server, if only for the installation. You may choose to leave it there if you will be using the GUI on the server for additional administrative tasks after installation. Leave the setting on Auto.

NetWare's video support is simple: Super VGA Plug and Play, Super VGA 800 × 600, or Super VGA 640 × 480. Most basic video cards will work, and you can change GUI settings in the GUI.

File Copy (First of Many)

Fetch coffee during the first file-copy break. Several times, the installation process waits for files to be shuttled between the CD and the DOS partition (this time) or the temporary installation directories and the actual NetWare file structure (later on).

You can sit and watch the NetWare installation pre-copy process if you wish. The scrolling filenames give you a better idea of what's going on than the GUI file-copy screens later.

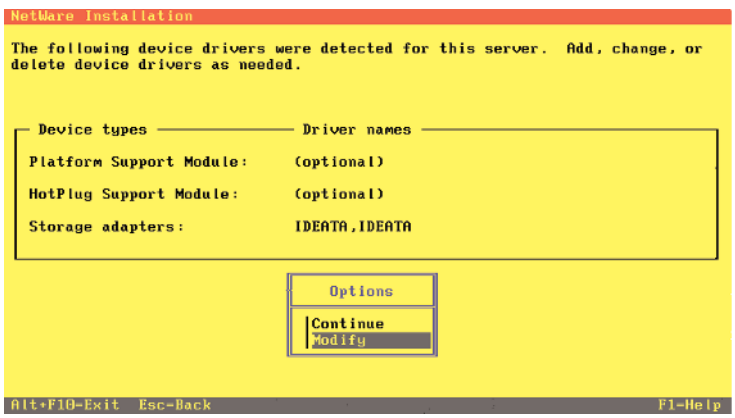
Device Drivers

Without drivers, NetWare can't speak to any hardware component. Because the NetWare software is a server, there are two main types of drivers that need to be loaded: disk and network. Novell has split driver selection between these two broad categories, with some other options on both screens. Let's begin by looking at storage drivers.

PSM, HotPlug, and Storage Adapters

The next screen takes a few minutes to appear, as many driver files are copied. It allows you to choose a Platform Support Module (PSM), a PCI HotPlug Support Module, and the storage adapters that you will be using. This screen is shown in Figure 1.5.

FIGURE 1.5
PSM, HotPlug, and storage adapter options



NetWare has gotten quite good at discovering all the hardware inside your server. Let NetWare try first, and add the details yourself only if you have disks with special drivers supplied by your hardware vendor.

PSM

A *PSM* is a hardware abstraction layer used when you have certain hardware installed. The system will check the hardware settings to detect which PSM is needed, if any. If you have a server with certain proprietary hardware installed (such as Compaq, Dell, or IBM), the drivers will certainly be there when you need them. A name-brand server will often include special CDs with special drivers. If your computer came with CDs like this, keep them handy during installation.

HotPlug Support Module

The second item on this screen is the HotPlug Support Module. Here, you can choose (if NetWare doesn't detect it for you automatically) the module you need to load to support HotPlug. *HotPlug* technology allows you to unplug storage and NICs while the server continues running and replace them as needed. This great benefit keeps the server up when a card needs to be replaced. Rather than shut down the entire server, you can simply remove the card and put in the new one.

Storage Adapters

The third item that NetWare will attempt to detect and display for your approval or modification is the choice of storage adapters. NetWare needs to know what type of disk and disk controller are in the server. A large number of controller definitions come with NetWare. New drivers certified by Novell are available through technical support channels, such as Novell's Web site or your dealer.

Vendors that add NetWare support for disk controllers include the proper drivers on a disk or their Web site. The installation program allows you to add vendor drivers to your system. To modify the list, choose Modify, select Storage Adapters, and press Enter. In the dialog box that appears, shown in Figure 1.6, you can use a standard NetWare convention: Press the Insert key to add something or open a pick list (a list of options available at that point). In this case, pressing the Insert key will display a list of drivers that ship with the product. Press Insert a second time to open a window that asks the source drive of the new driver. Place the disk in the server's floppy drive, and the installation program will pick up the driver and save it on the server.

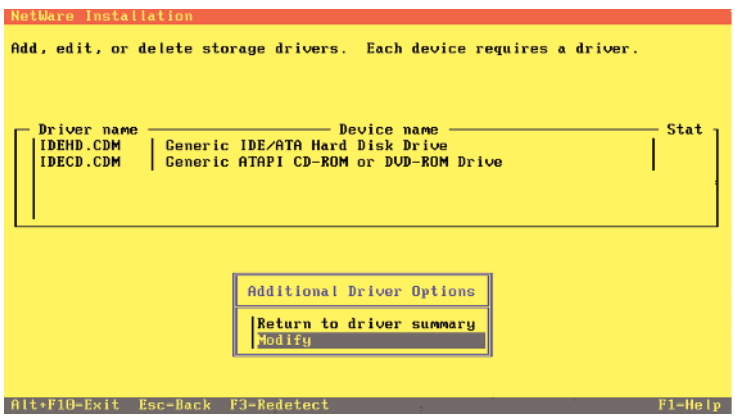


FIGURE 1.6
Add, edit, or delete storage drivers as needed.

You can modify the properties of a driver by selecting it and pressing Enter. If NetWare incorrectly detects a driver, simply select it and press Delete. When you're finished making changes, choose Return to Driver Summary.

Mandatory starting in NetWare 5.*x* are NWPA (NetWare Peripheral Architecture) drivers. They replace the drivers with the `.DSK` extension used in previous versions. The DSK drivers were *monolithic* drivers, which meant that a single driver controlled the disk controller and all devices attached to that disk controller.

NWPA drivers continue with Novell's move toward modularity in the operating system. Rather than a single driver that controls all devices, NWPA drivers are in two parts: HAMs and CDMs. HAM (Host Adapter Module) drivers control the interaction between the NetWare operating system and the physical host adapter plugged into the server bus. These drivers use the extension `.HAM`. There will be one HAM driver for each adapter. CDM (Custom Device Module) drivers control the devices connected to the host adapters. There may be multiple CDM drivers for a single host adapter, since each device connected to the host adapter must have a specific driver. Table 1.2 shows the details. NWPA uses the Media Manager as the storage management layer of the NetWare 6 operating system, providing a storage management interface between applications and storage device drivers.

TABLE 1.2: NWPA DISK DRIVERS, HAMS, AND CDMS

SERVER ARCHITECTURE	CONTROLLER	HAM TO LOAD	CDM TO LOAD
ISA, EISA	AT, IDE (ATA)	`IDEATA.HAM`	`IDEHD.CDM` (for hard disk) or `IDECD.CDM` (for CD-ROMs)
SCSI	Adaptec 1540 and others	`AHA154x.HAM`	`SCSIHD.CDM` (hard disk), `SCSICD.CDM` (CD-ROM), or others depending on the device

New drivers will show up first with the devices they control. Remember to use the Insert key to redirect the installation program to look for new driver files in the floppy drive.

After selecting the adapter driver, you have the chance to verify the parameters for that driver. Any changes to adapter settings should be made here. Once the parameters are set, you can repeat the process for any number of additional drivers.

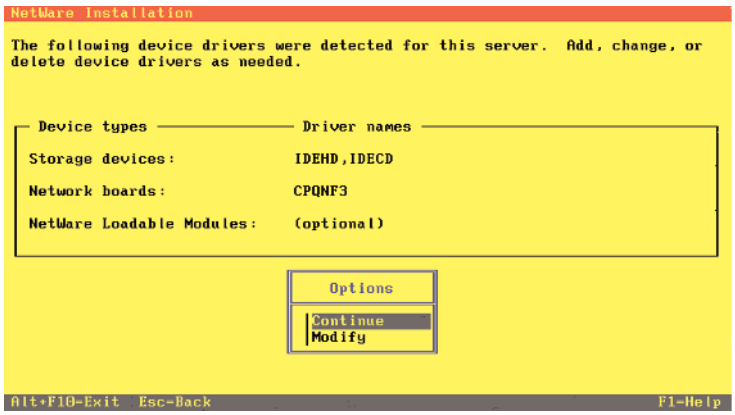
WARNING *Beware of problems upgrading old disk drivers. The DSK drivers are not supported. You will need to find equivalent HAM drivers for your devices before you upgrade.*

When you continue past the storage adapter screen, you will be presented with a screen on which you can confirm the NetWare storage devices and network cards that were found. (The storage device drivers are the `.CDM` files I just discussed.)

NICS, STORAGE DEVICES, AND NLMS

Like disk controllers, NICs need a driver. Network adapter drivers have `.LAN` as their filename extension. The next step in the installation process is choosing and configuring this LAN driver, as well as setting storage devices and NLMs (NetWare Loadable Modules). Figure 1.7 shows this screen.

FIGURE 1.7
Storage device, network board, and NLM selections



Network Boards

You must have at least one network adapter in the server for it to communicate with network clients and other servers. You may have multiple LAN adapters in a server. They may all be the same type of adapter, such as Ethernet, or you may have four different topologies represented. It's possible to have Ethernet, Token Ring, FDDI, and WAN connectors in one server (possible, but not likely or practical). NetWare 6 updated the TCP/IP stack to allow two network cards to share the same subnet and gateway.

NetWare commands great respect among network adapter vendors because of the large market share. Novell supplies many drivers as part of the installation process. One interface card will probably have different drivers for use in a NetWare client or a NetWare server. Make sure that you verify that your NIC vendor provides a driver for more than just "NetWare." If it goes into the server, the vendor must provide a server (LAN) driver.

Once again, you can load drivers not detected or supplied with NetWare by choosing Modify, selecting Network Boards, and pressing Enter. In the dialog box that appears, you can select any card, press Enter, and modify that card's properties. You should do this for all of your cards to ensure that NetWare is using the proper settings to interface with each card.

You need to verify, or change if necessary, the following attributes:

Is the card an ISA card? Set this to Yes if it is a legacy (in other words not Plug and Play) ISA card; otherwise, choose No. You're not installing NetWare 6 on a server so old it needs an ISA network card, are you? Shame.

Interrupt number Verify (and change if necessary) the number (IRQ) to make sure that the actual settings on the card match those here.

Port value Verify (and change if necessary) the port used to access the card. Again, it must match those set on the card.

NOTE *The IRQ and port parameters are usually supplied in hexadecimal. Be sure that you enter the parameter in the correct format and that you know the values for these two settings in both hexadecimal and decimal.*

When you have finished, choose Return to Driver List, and then repeat this process for all remaining NICs. When you have finished reviewing all of the interface cards, choose Return to Driver Summary.

Storage Devices

Back at the summary screen, you'll notice the Storage Devices choice. A reasonable question at this point is, "What's the difference between a storage device and a storage driver?" Recall from our discussion in the previous section (and Table 1.2) that there are now two components you need to load: an `.HAM` file and a `.CDM` file. You have already chosen the `.HAM` file on the previous screen. Here is where you choose the `.CDM` file. Remember that these drivers are for the various devices (hard drives, CD-ROMs, and so forth) that you have attached to your storage adapter. NetWare will usually detect them for you and have this list filled in correctly here, but you could modify these drivers if necessary.

NLMs

The last thing that you can specify here is any NLMs that are needed for the server to boot. Typically, none are needed, but if you have special hardware, the drivers for it can be loaded here.

When you have finished with the settings on this screen, choose Continue.

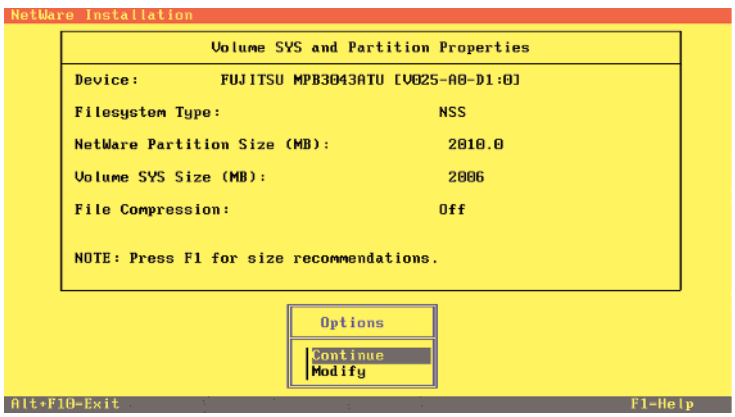
SYS: Volume and Partition Properties

Now that you have loaded the disk drivers, you can configure the SYS: volume. The rest of the partitions and volumes will be created later in the process. You can select the device you are interested in, change the size of the NetWare partition and SYS: volume, and so forth. As you can see in Figure 1.8, Novell presents a lot of information in a simple, well-designed manner, with defaults that greatly simplify the installation process.

The only thing that you need to know to create the SYS: volume is that it must be at least 2GB, and preferably 4GB or more. The smallest size the installation program will allow you to choose is 2006MB, because NetWare took half the disk for a 2GB SYS: volume (the minimum size Novell will happily tolerate for SYS: is 2GB). (It's a good thing disks keep getting cheaper.) My recommendation: 4GB for SYS: and put everything else on other volumes.

FIGURE 1.8

Configure the SYS: Volume and Partition



To repeat, for those of you who have multiple disks or desire multiple volumes, these choices are made later in the installation process. Here, we are just getting the SYS: volume set up.

NetWare 6 decided the SYS: volume will be an NSS volume, which wasn't even possible earlier, but is now the default.

NSS, THE NEW FILESYSTEM

The biggest change in the filesystem in NetWare 5 and 6 is the addition of NSS (Novell Storage Services), a 64-bit filesystem with many advantages over the traditional 32-bit filesystem. Table 1.3 summarizes the differences between the two filesystems. More details about NSS are in Chapter 14 (well worth reading).

TABLE 1.3: THE TRADITIONAL FILESYSTEM VERSUS NSS

FEATURE	TRADITIONAL	NSS
Character format	ASCII double-byte	Unicode (the international standard)
Time to mount a volume	Up to several minutes (depending on volume size)	Typically, only seconds
Utility used to repair damaged volumes	VREPAIR	Ongoing JOURNALING filesystem controls
Ability to access DOS partitions on the NetWare server	N/A	Accessible; treated as a standard NSS volume (load DOSFAT.NSS)
Time to repair a volume	Up to several hours (depending on volume size)	From a few seconds to a few minutes (depending on volume size)
Memory required	Increases with volume size	1MB or less for any size volume
Maximum file size	4GB	8TB (8192GB)
Maximum number of files per volume	16 million (with one namespace), 8 million (with two namespaces), 4 million (with three namespaces), etc.	8 trillion files per volume, with any number of namespaces
Volume limitations	64 volumes, 32 segments per volume, 1TB total volume size	Unlimited volumes, no limit on segments per volume, 8TB (8192GB) total volume size
Open files per server	100,000	1,000,000

NetWare 6 now allows the SYS: volume to be an NSS volume. Earlier limitations have been removed from NSS volumes, so go along with NetWare's recommendation and create SYS: on an NSS volume.

Remote Server Login

If you are installing from a local CD-ROM drive, you can skip right to the "NetWare File-Copy Process" section. If you are installing NetWare from a remote server, you'll be prompted to log in once again.

During the installation of network drivers, the connection to the remote server is broken. Reestablishing the connection takes just your login name (on the host server, not the server you are installing) and the password. This step is a necessary security precaution. Under no circumstances do you want someone to be able to connect to and take files from your system without going through security.

NetWare File-Copy Process

Now it's time for the installation program to copy NetWare files. Notice the information in the main window. If you are installing from an internal CD-ROM drive, the source may be drive D: rather than the name of a remote server and volume.

This process will take a while, so be patient. The installation program will copy many, many files to your SYS: volume, and several times during the process it will tell you that control has been passed to another NLM. It expands compressed files just copied from the CD. Also, at this point, the installation program copies the files needed to set up the GUI for the GUI installation portion of the installation process.

When the process is almost finished, it will tell you that it is "Launching NetWare 6 Installation Wizard!" You are now entering the world of the GUI installation. Welcome, I think.

The Age of the GUI Has Arrived

From now until you finish the installation, you will be using the GUI to answer all the questions needed to set up your server. You probably can figure out how to get around in this new environment.

You can, of course, use the mouse if you have one. This is the preferred (and simplest) method. However, the GUI allows you to use the standard keyboard-navigation techniques. (You will die of boredom, so get a mouse.) You can use the Tab key to move between fields, the spacebar to check or uncheck boxes, and the Enter key to perform the highlighted action (for the buttons on the bottom of the screen). Choose Next to move to the next dialog box, Back to go to the previous dialog box, Cancel to end the installation process, or Help for information about the current dialog box.

Server Naming

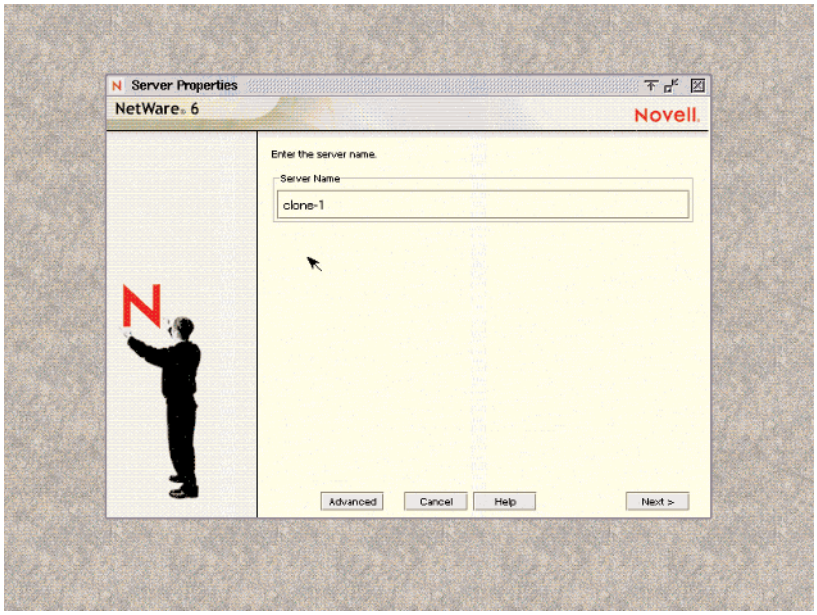
The first question you will be asked in the GUI, as you can see in Figure 1.9, is what you would like to name your server. It's generally recommended that you choose a short, easily typed name.

With NetWare 6, there are few places a user will need to type the server name. In almost all Windows utilities, the names of all available servers are shown in a pick list. Choosing a server entails either moving the highlight bar or clicking. There is rarely typing involved.

NOTE *In earlier versions of NetWare, the default name was FS1. This resulted in thousands of servers named FS1.*

You can change the name of the server later, but that may create a bit of work if you have referenced the server's SYS: volume (or any other volume, for that matter) in login scripts. Rather than go to that trouble, you can just provide an alias for the volume or reference certain directories with a simple directory map name. We'll get to aliases, directory maps, and login scripts later (in Chapters 5 and 9). I mention them now just to let you know that naming a server is less restrictive than it used to be. That said, choose carefully to save yourself many headaches later.

FIGURE 1.9
The age of the GUI has arrived, and it begins with the prompt for a server name.



The official naming instructions are 2 to 47 alphanumeric characters, plus the hyphen and underscore. No spaces are allowed; use the underscore or hyphen instead. And go with the urge to use meaningful names for your servers. It's tough to tell your CEO his main server is BETTY_BOOP. Choose a name that means something to your users, like SALES1, 4_FLOOR, or EMAIL1. Most users do not interact with the file server but with the volumes on that server, as in SALES1_SYS or EMAIL1_GROUPWISE.

Filesystem Configuration

In the Configure File System dialog box, you can set up the filesystem any way you like. As shown in Figure 1.10, you will see all the partitions you created, including their types and sizes, the SYS: volume, and any free or unpartitioned space you have on any drives. You can delete existing partitions, create new partitions and volumes, and edit the settings of your SYS: volume (in a limited way) and all the other volumes you choose to create at this point.

Although you can create and modify volumes here, I much prefer to wait. Later on (in Chapter 8), we'll delve deeply into NSS volumes, storage pools, partitions, and other fun disk stuff.

I recommend that you accept the SYS: volume details as decided by the installation program and continue to get your new server up and running. Configuring disks can wait for a while.

Protocol Selection

The next task at hand is to select the protocol or protocols that you want to use in your network, as shown in Figure 1.11. You can choose IP, IPX, or both. New networks will likely use just TCP/IP. If that's the case on your network, don't choose IPX. If you have existing NetWare servers and clients still using IPX, obviously you need to check that protocol as well.

FIGURE 1.10
Checking the filesystem

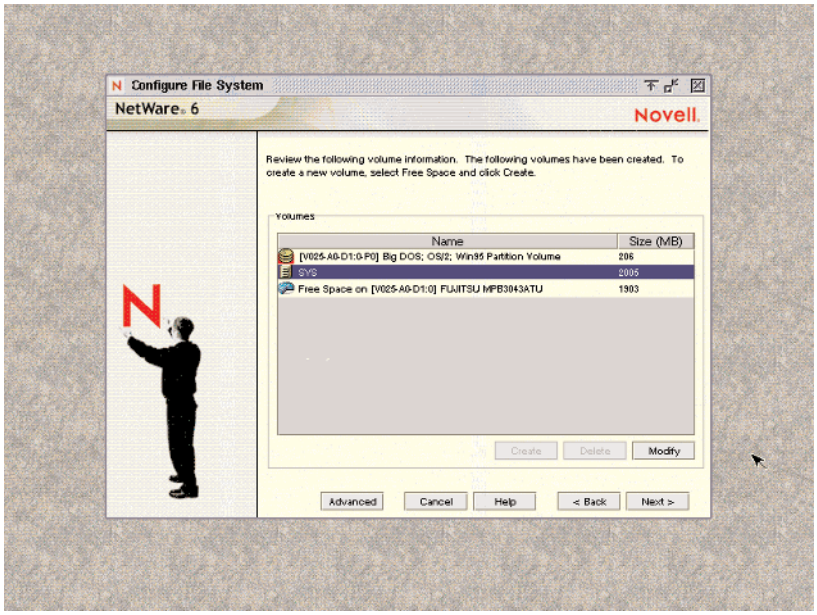
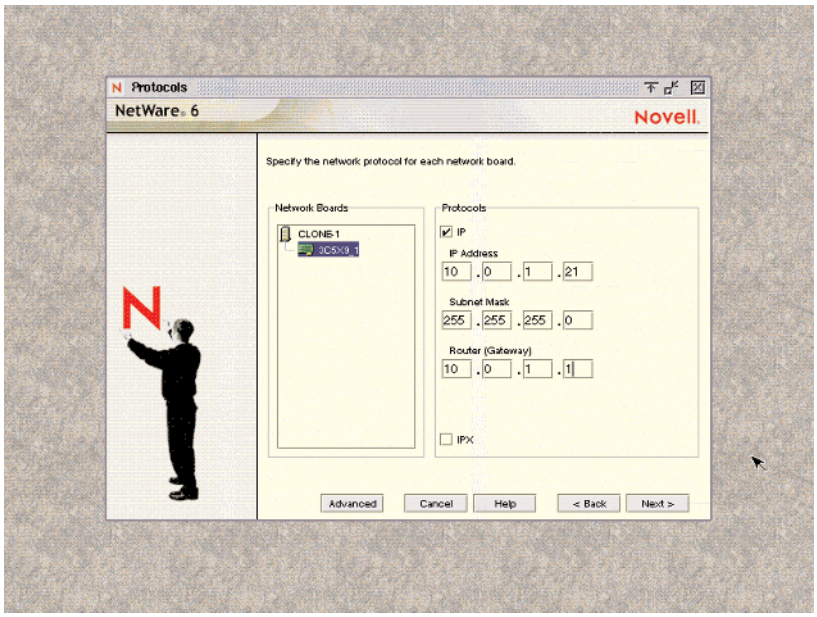


FIGURE 1.11
The Protocols dialog box with a NIC selected



When you choose IP, you will need to fill in the IP Address, Subnet Mask, and Router (Gateway) settings for this node. The Router setting is optional, but you will need to fill it in unless there are no routers in your network. If you are not sure what these are, *do not make up an address* and type it in. If you do, you will have many problems, because wrong addresses will likely play havoc with your network. You can add IP support later. You'll find more information about TCP/IP in Chapter 11.

If you want to use IPX, NetWare will automatically detect the IPX frame type(s) on your network. If it can't detect any, it will default to installing support for the Ethernet_802.2 frame type (as all versions of NetWare since 3.12 have done). If you don't want all these frame types to be bound, at the end of the installation you will be given a chance (when you choose Customize on the Summary screen) to choose the ones you want and/or to set the addresses of each. Or do it now with the Advanced button in the Protocols dialog box.

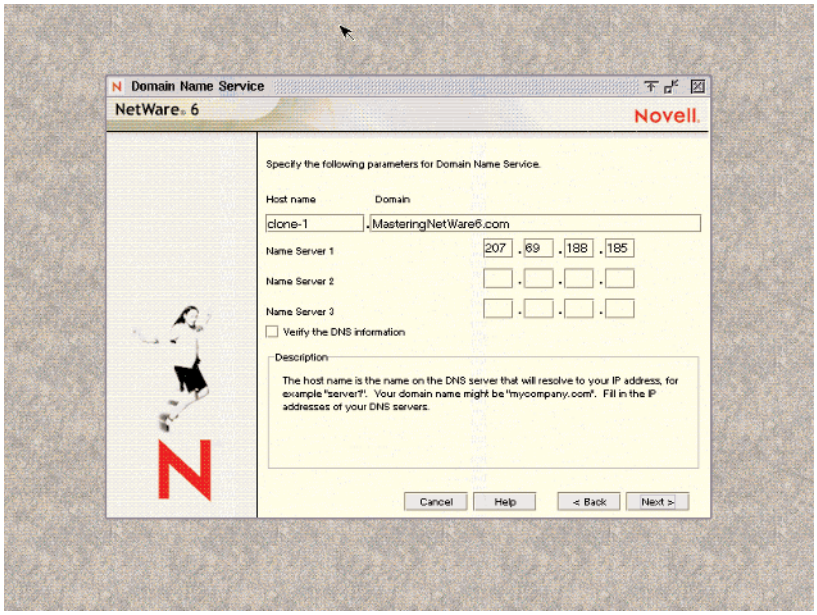
After you click Next, the installation will take a few seconds to check for duplicate server names and IP addresses. Remember, these names must be unique network-wide. If there is a duplicate, you will get an error message and will need to choose another name.

Domain Name Service Setup

Earlier versions of NetWare, including 5.1, didn't ask about DNS (Domain Name System) until later. But Internet access has become so commonplace, and Novell has made NetWare 6 such a powerful Internet application server, that DNS configuration is now a critical part of the installation process.

Figure 1.12 shows the information for a test server. Only one name server is listed, but at least two are recommended for redundancy. Unfortunately, my ISP lists multiple name servers on the same subnet, so broken links kill my DNS, no matter how many name servers I list.

FIGURE 1.12
DNS details

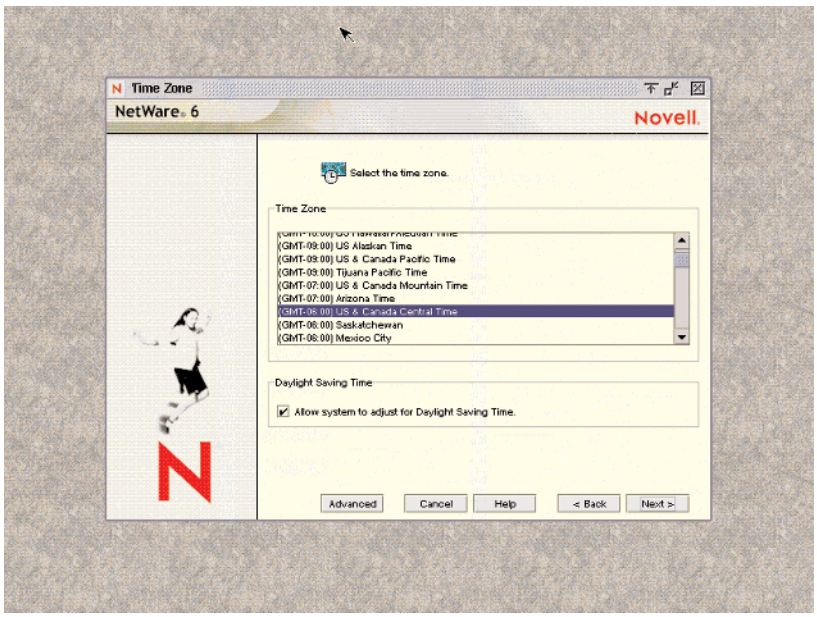


Don't ask to verify the DNS information right now, or your server will start looking for the DNS servers during installation. Set this later to make sure that the NetWare server can find the name server and check for listed entries.

Time Zone Selection

The next installation task is to choose a time zone for the server site. Figure 1.13 shows the dialog box that will appear. You can choose from 54 time zone settings, covering 29 time zones (some are in half-hour increments).

FIGURE 1.13
Choosing your time zone



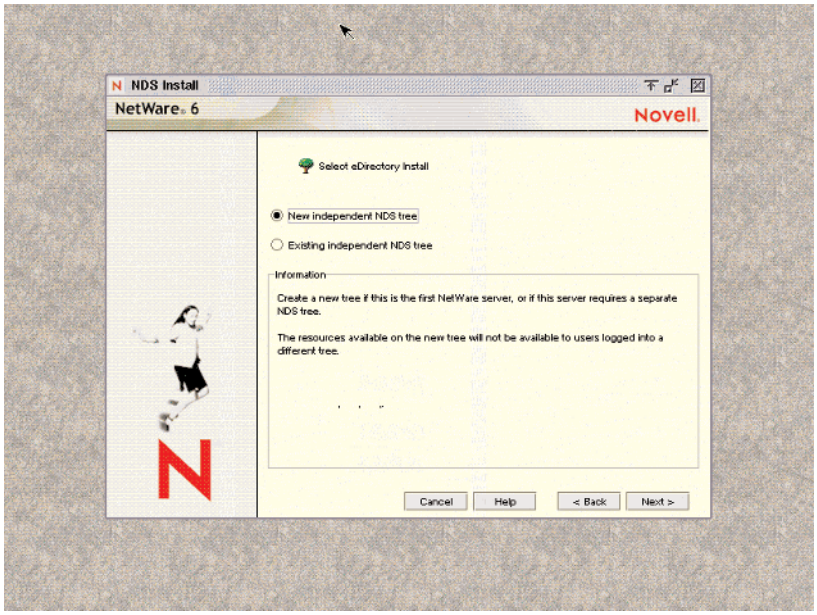
NetWare engineers made a Daylight Saving Time (DST) adjustment automatic in NetWare several versions ago. Check this box if DST applies to your location. Novell made defaults for each time zone. If most places in your time zone support it, it's checked; if not, it isn't checked.

NOTE *When DST comes and goes, the local time will be affected, but the time that NetWare uses internally will remain the same.*

NDS eDirectory Installation

The next question you will be asked is if you want to use an existing NDS (Novell Directory Services) eDirectory tree or create a new tree. Figure 1.14 shows the dialog box where you must make this important choice. I'll assume that you are creating the first server in the tree; hence, you will need to choose New Independent NDS Tree. If you already have a tree (or trees), you can skip to the "Installing a Server in an Existing NetWare 6 Network" section. Notice that Novell now prefers the name *eDirectory* to *NDS*, although they tend to mash them together (as I did in this paragraph).

FIGURE 1.14
A very important fork in the installation process—create a new tree or use an existing one?



Before continuing with creating your NDS tree, there are some things you need to know about NDS. This installation isn't difficult. However, your choices here will shape what your NDS tree will look like. Read through this section before you install NDS, and if you have further questions, refer to Chapter 2 before you continue.

Before you begin, scan these brief definitions of the NDS terms you'll be seeing:

Tree The hierarchical organization of the network. Like a directory structure for a hard disk, an NDS eDirectory tree has a single root with multiple branches (directories) containing other directories and/or files (other branches and/or leaf nodes).

Container An object that can hold or contain other objects. The Tree (a special container), Country, Organization, and Organizational Unit objects are containers.

Organization A high-level container just below the Country level (if used) or the [Root] of the Tree and just above the Organizational Unit. There must be at least one Organization object in every NDS eDirectory tree.

Organizational Unit The smallest container, below Organization. This container is not required, but it's often used for better management of workgroups, departments, or project teams.

Context A way to describe the position of an object within containers in an NDS eDirectory tree. The context is a position reference point, similar to a user's home directory being a reference point in a filesystem tree.

Admin A User object created during NetWare 6 installation, similar to the SUPERVISOR in NetWare 3.*x*. Admin has the rights to create and manage all objects in the newly installed NDS eDirectory tree.

Leaf objects Objects that don't contain any other objects. Leaf objects include users, printers, servers, server volumes, and the like. Leaf objects are effectively the bindery contents from NetWare 3.*x*.

WHAT YOU NEED TO KNOW

To install NDS on a NetWare 6 server, you need to know the following:

- The name of your NDS eDirectory tree
- Your company (Organization) name
- Any company divisions (Organizational Units) (optional)
- The NDS location for the server (the default Organization or Organizational Unit)
- The password for your Admin user (or provide the password for new installations)

You'll need this information whether you are creating a brand-new NetWare 6 network or plugging this server into an existing NDS tree. The process is remarkably similar in either case.

When you're installing your first NetWare 6 server, you must create an NDS tree and the context for the server being installed. For your subsequent servers, you must decide where in the existing NDS tree they should live.

When you're installing a new server in an existing NDS network, you can still create new NDS trees, Organizations, and Organizational Units during installation. The installation process will offer you the choice of installing the server into an existing context or creating a new context.

Although the best time to fix a mistake is immediately, if you make a mistake during server installation, it's not going to cause you any long-term trouble. If you later decide you don't like the name for a particular Organization or Organizational Unit, you can change it—no big deal.

Figure 1.15 shows four NDS tree arrangements. Each Organization or Organizational Unit is a context. The first illustration, with only a single Organization containing leaf objects, re-creates a classic NetWare 3 network. During NDS installation, you can create as many Organizations and Organizational Units as you desire.

NDS TREE NAMING

Since this is your first NetWare 6 server, you need to give your NDS tree a name and create it. Figure 1.16 shows the dialog box where NDS is configured, including where the tree name is entered. Here are the NDS tree-naming rules:

- Must be unique across all connected networks
- May use letters A–Z
- May use numbers 0–9
- May use a hyphen (-)
- May use an underscore (_)
- May be any length, as long as the complete context name does not exceed 255 characters

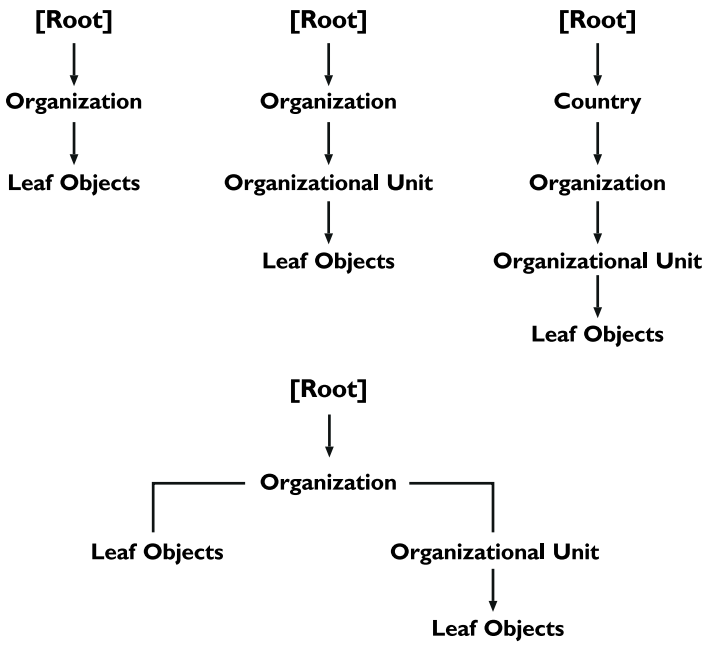


FIGURE 1.15
NDS tree examples, from simple to less simple

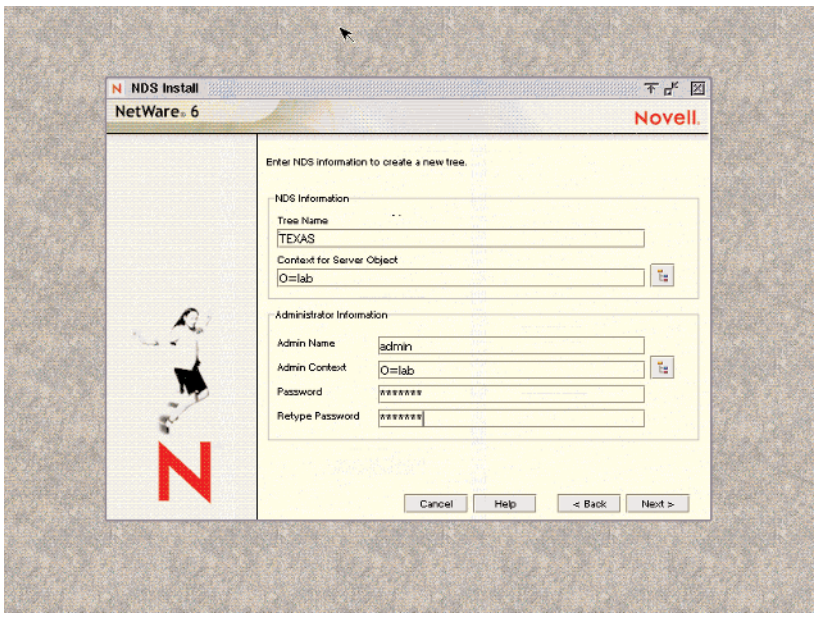


FIGURE 1.16
Entering your tree name, the context for your server and Admin user, the name of your Admin user, and the initial password for that user

There's no reason to give a long, descriptive name to the tree, because the Tree and [Root] objects are always implied (not shown) when listing contexts. This is not a problem, since Novell recommends only a single NDS tree per organization, and the client usually uses only one tree at a time.

NDS trees aren't easily renamed. Trees can be merged, but this is a more advanced topic. Pick a unique name.

The Server's Context

You must tell the server its location in the NDS tree. Every server is installed into a context, so the first server must define its own context. The server can change contexts later, but go ahead and get it right the first time.

As you can see in Figure 1.16, we have chosen a name for our new NDS tree, Texas, and set the server's context to O=Lab. The only default user for this new NDS tree is Admin (although the name can be changed at this point), the manager of the entire newly created tree. Notice also that the Admin user account's context is the same as the server context; this also represents a change from the past, where the Admin account was installed near the top of the tree. One more thing to notice in Figure 1.16: Any time a context is needed, the Browse buttons to the right of the text boxes allow you to graphically choose (and/or create) the desired context.

Organization and Organizational Unit Naming

To finish the installation, you need at least one Organization name. Organizational Unit names are optional, both during installation and when your network is up and running. The NDS dialog box displays the Context for Server Object text box and the location in the tree. Next to the text box is a Browse button, where you can graphically create the structure of your tree. Click it and then select Add to create a new container.

You can choose only a Country or Organization as your top-level container. (For a discussion on container types, see Chapter 2.) Typically, you will begin with an Organization.

The Organization name can be the same as the name you gave the NDS tree itself, but that might be confusing to some users later. That's why the lab network tree has the name Texas and the Organization is named Lab (with the Organization reflecting a department). You could also give both the tree and Organization the company name without duplicating the name exactly by using a common naming standard: *TopLevelOrganization*_Tree. For example, if this is the Acme Company's network, you might want to call the tree Acme_Tree and the top-level Organization Acme.

The Organization name you type in and save will appear in the Context for Server Object field.

As you install your first server, keep in mind that this information pertains to more than just this particular server; you are creating a basic NDS framework. Maybe only one server is involved right now, but your network may contain many more servers over time.

Each field can contain a maximum of 64 characters. Legal characters in this section are A–Z and a–z (uppercase and lowercase), along with 0–9 and the underscore (_) character. The limit for the total server context name is 255 characters.

THE ADMIN PASSWORD

Passwords are an art in themselves, and your company may have guidelines set already. If not, and you need to make up a password here, try to follow these guidelines:

- It should contain at least five characters.
- It should include both letters and numbers.
- It is not case sensitive.
- It is not the name of a loved one or your birthday.
- Do not tape the password to your monitor, desk, or any other place near the computer. (Yes, people still do that.)

Select the Password field, type your password, select Retype Password, and retype the password for verification. Remember, someone logging in as Admin has full run of your network. Please use a decent password. Notice that the password appears on the display as all asterisks, so type carefully.

One final note before we move on: Once you click Next, you're committed. The installation program will create the NDS structure you have chosen, and there is no going back (although changes can be made after the installation is complete).

FOR YOUR INFORMATION: ALL THE DETAILS IN ONE SCREEN

After you click Next, the installation program will verify that the tree name is unique, and then it will create the structure you just set up in the previous dialog box. The tendency of network administrators to be distracted during installation and forget vital information is well known at Novell. Remember the pad and pencil you're supposed to have beside you during the installation process? Well, go find it, because you do need to write down the information shown in the summary screen. All this information is easy to forget while NetWare 6 is still new.

The only information you don't have on-screen that you will need is the password for Admin. Jot that down now while you're thinking of it (but please don't leave it next to the server).

You can now skip ahead to the section concerning the NetWare License information.

Server Installation in an Existing NetWare 6 Network

There are some differences between installing the first server and adding a second, third, fourth, and so on server into an existing NetWare 6 network. Some of the differences are obvious, but others are not. For example, when installing a second or third server, you may want to add another container for that server by creating another Organizational Unit. These added pieces require a few more decisions during installation, but nothing serious.

As soon as you begin the NDS installation, you must decide whether to include the new server in an existing NDS tree or to create a new tree. To install it into an existing tree, simply choose Existing Independent NDS Tree and click Next.

In the next dialog box, you need to fill in a username and password with the appropriate rights to install this new server in the tree (specifically, the Create right to the selected context, as explained in Chapter 7). This is another security feature—you wouldn't want just anybody to be able to install a server and replicate data or NDS information anywhere.

To choose your tree, click the Browse button to the right of the text box that prompts you for your tree name. NetWare will then compile a list of all known trees and ask you to select one. You can select an existing tree or choose Not Listed (the other buttons allow you to add, delete, or edit the context for your server). Choosing Not Listed displays another dialog box that asks you to enter the tree name and the target server's TCP/IP address or its server ID.

Once you choose your tree, you can then set the server's context, as described in the previous section. When you're finished, a dialog box with summary information appears. You'll notice that it is a little bit different from the one that appears when you create a new tree; this one shows only the tree name and context.

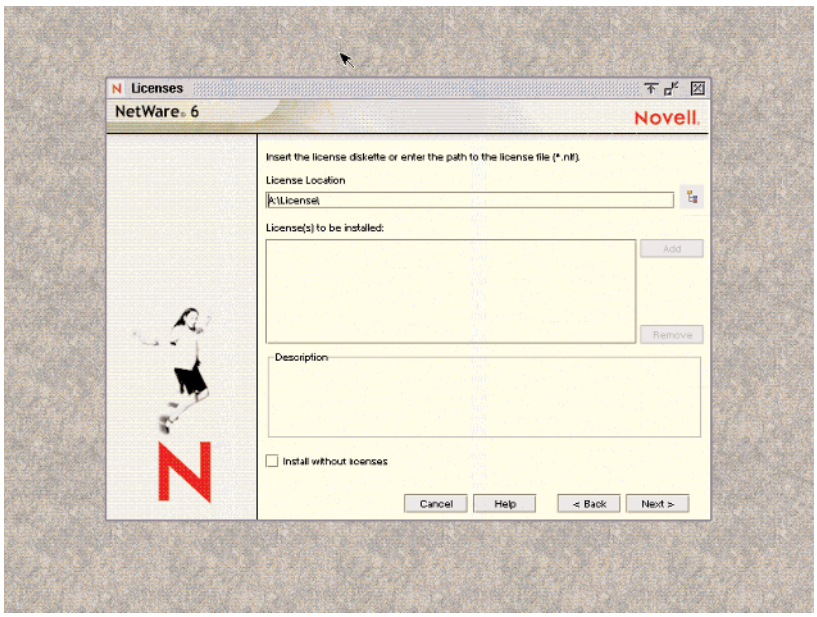
NOTE *Each NDS tree has its own database of objects that is not visible from another tree. If you're using the Client32 software, multiple trees are not a problem. As you'll learn in Chapter 10, Network Neighborhood in Windows 95/98 and My Network Places in Windows Me/NT/2000/XP, after being enhanced by Client32, can see multiple trees. But this doesn't mean that your users won't get confused, so don't go tree crazy. One tree remains best.*

When the NDS Summary screen appears, it will remind you to write down the Admin user's password, the NDS tree name, and the server context. Remember that notepad you're supposed to have?

The NetWare License Software

One of the disks included with your software is labeled as the license disk. It will also have a user count, such as 5 User, 100 User, and so on. The installation program will ask you to insert that disk. Notice in Figure 1.17 that you can choose another location, for example from a hard drive or a server. This is not usually done, but it can be good backup policy to protect the license disk's contents in case the disk itself gets damaged. You can also check the box Install Without Licenses if you want to do this later or are installing the two-user version to practice with at home.

FIGURE 1.17
Entering the location of the license



Novell has rejected some of the onerous copy-protection schemes other vendors use. If the license file from another operating system is used, error messages will appear on the servers and workstations.

None of the license schemes around work perfectly all the time. I've had trouble with NetWare releases on occasion, but less trouble with them than almost any other software. The distributed NDS eDirectory database really helps keep the licensing on track.

License management doesn't take very much time but does require care. Leaving licensing until later works for an existing network, since you'll want to put the license files in your regular spot. For new networks, however, go ahead and feed in the disk when requested.

WARNING *Software piracy is a multibillion-dollar criminal market. Every piece of stolen software used takes money from the developer of the software that could be used to improve the product. Besides that, using software that you didn't purchase is no different from using an automobile that you didn't buy—it's theft.*

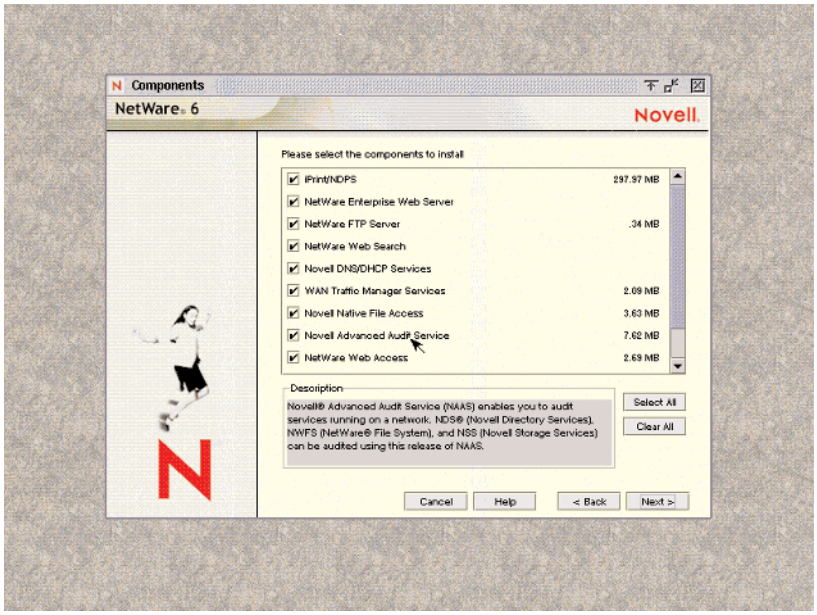
Optional Product Installation

There is one last major set of choices to make. These are optional products that can be installed at this point (go ahead and install them). Check out more detailed descriptions later in the book. You have the following choices:

- iPrint/NDPS
- NetWare Enterprise Web Server
- NetWare FTP Server
- NetWare Web Search
- Novell DNS/DHCP Services
- WAN Traffic Manager Services
- Novell Native File Access
- Novell Advanced Audit Service
- NetWare Web Access
- eDirectory iManage Service
- Novell Internet Access Server
- Novell iFolder Storage Services

A dialog box similar to that shown in Figure 1.18 allows you to make your optional product choices. To choose a product or a service, simply check the box in front of the selection (or uncheck a box if you don't want to install that component). When you have made all your selections, choose Next. Many of the components will bring up additional dialog boxes where they can be individually configured.

FIGURE 1.18
Choosing your optional components



A short description in the aptly named Description box explains about each product. Some of the products in NetWare 5.1 that were optional are now included in the standard NetWare 6 installation package or grouped with other products. You can always add some or all of these at a later time, or delete them if you wish.

Certificate Security—Your Papers, Please

Not exactly an optional product, the Novell Certificate Server must be installed to enable secure data transmissions, and it is required for the NetWare Enterprise Web Server. Put it in, whether you plan to use certificates or not, because some connections you may not think need certificates will use them, such as the Web servers installed to help manage NetWare 6.

The first server in the tree will create and physically store the Security container object and the Organizational CA (Certificate Authority) object for the entire eDirectory tree. If the tree has another functioning CA, the new server will located and reference the existing server, and create an object for itself.

Figure 1.19 shows a server fitting into an existing eDirectory tree with a functional CA. Otherwise, this server would create the CA in the root of the new tree.

Web Access Setup

The following screen, Figure 1.20, shows how to access the WebAccess object for configuration purposes after the server is up and running. Notice that the screen assumes you have a full internal DNS system up and running, because the reference is to `http://<web-server_name>:2211/webaccess`. If this is your first Internet server, or your DNS servers haven't been updated to hold the new server,

you can use the IP address in place of the web server name. Of course, you can do that always, but the name format is easier to remember than 12 digits of IP address.

FIGURE 1.19
Getting your papers (certificates) in order

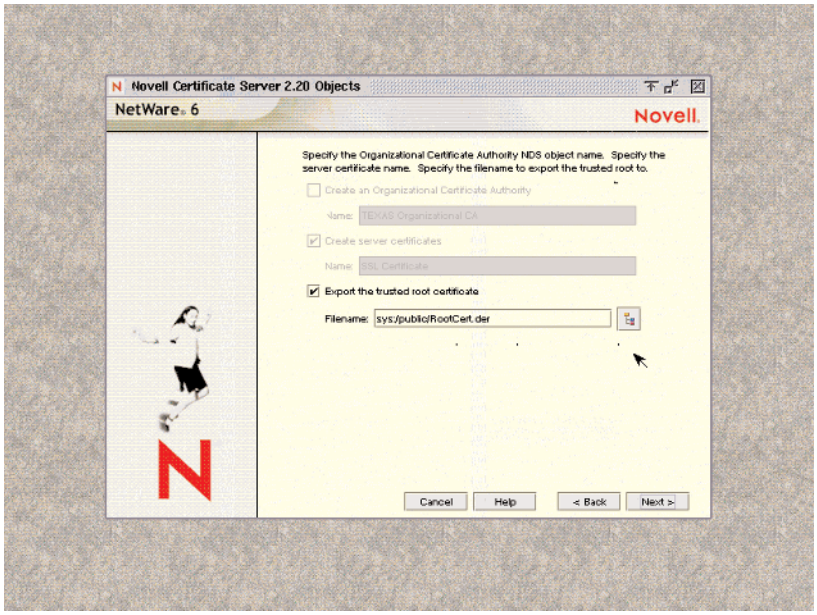
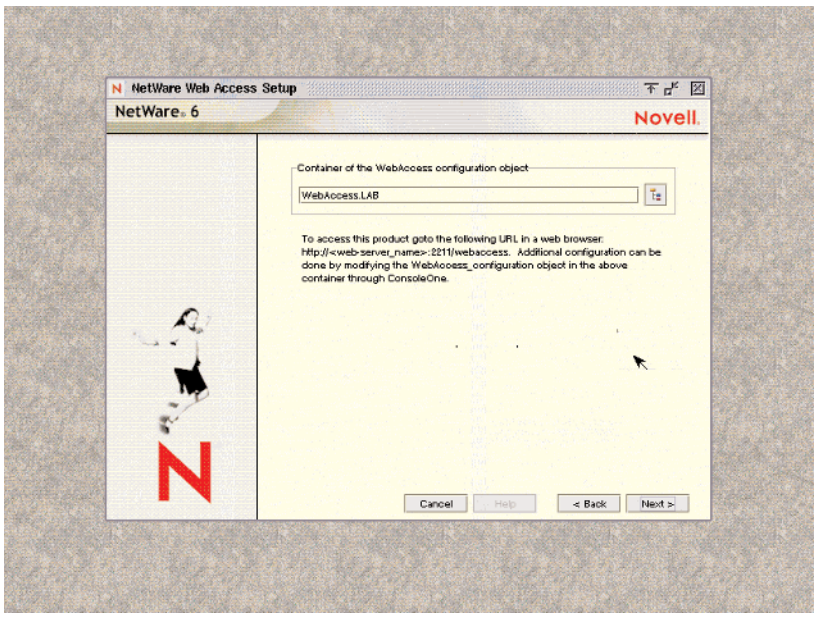


FIGURE 1.20
NetWare Web Access Setup screen



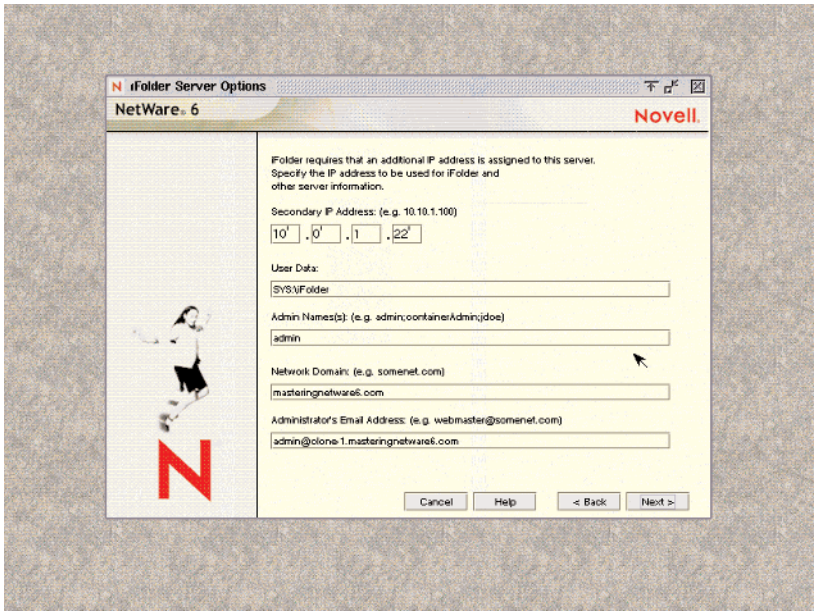
Next appears a follow-up screen asking about the Mail Gadget, iPrint Gadget, and MyFiles Gadget locations. The default checked box for "Setup … later" should be kept. You don't know where any of these things will live yet, so don't worry about it.

iFolder Server Options

Here you are, not at all sure what iFolder is, and you need to set an IP address for it. Didn't you just set an IP address for the server itself? Yes, but we have another software server that needs another IP address. Bump the server IP address up one, as shown in Figure 1.21, to keep things simple.

iFolder, a new utility that synchronizes every client system you have (desktop, home, and traveling laptop for instance) with the files stored in a private server area, runs on the Apache Web Server software. The new IP address makes it easier to control Apache and requires fewer holes in your firewall to support port numbers for connections.

FIGURE 1.21
iFolder configuration details

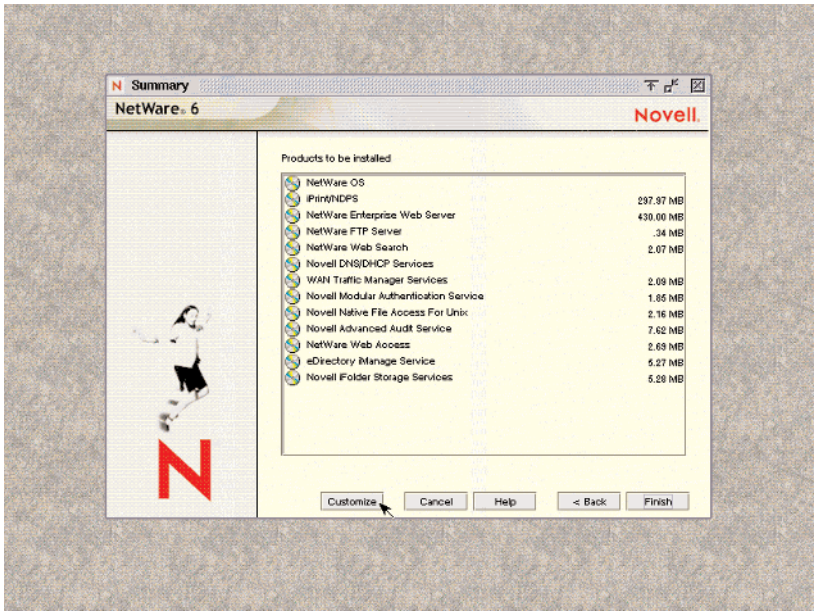


Notice the assumptions made by NetWare: it creates a folder for the iFolder information (SYS:\iFolder), it tags the administrator, it sets the domain name, and it sets the administrator's e-mail address. The e-mail address will be wrong, of course, but the figure shows the default. Feel free to change the e-mail address to one that works on your network.

Installation Summary and Customize Option

Time for the big file-copy blowout, and you get one more chance to go through and change any of the settings you've made so far. Believe it or not, everything you've checked and configured can be reached by clicking the Customize button, which is where the arrow cursor is resting in Figure 1.22.

FIGURE 1.22
Summary and last configuration chance (pre-installation)



Why doesn't Novell just put this screen up and forget all the rest? Because it's easier to march through consecutive steps than confront a ton of configuration steps on one screen.

Click the Finish button. Many files get copied—nearly 2GB worth. These include not only the files you can see in Figure 1.22, but also the operating system files, which take about 1GB. So go to lunch. The installation will finish before you get back, but you have a good excuse for a break.

Finishing the Installation

Congratulations, you have just installed a NetWare 6 server! Okay, you need to reboot first to get everything working, but you're really close to finished. That wasn't so hard, was it? While you are watching the file-copy progress, notice all the information that Novell provides. It looks a lot more like a Windows product installation than a server installation.

As is typical of almost all Windows programs you install today, there is a progress indicator toward the bottom of the screen. It will (slowly) move to 100 percent. Along the way, you will see ads for various new features and capabilities in the background, another feature common to most modern Windows programs.

The copying process will take quite a long time, depending on the options you have chosen, the speed of your CD-ROM drive, and so on. Sooner or later, you will see the final dialog box, which contains a quick summary and informs you of any errors. You should review this file when you are finished. You are also told that you should restart the computer now, so that all of the selected options and configuration options may take effect. If you like, you may also read the readme file now. No, really, that's not a joke. You should read it. I'm serious.

Removing Novell eDirectory

IN A HURRY 1.2: REMOVING EDIRECTORY FROM A SERVER

1. At the server console prompt, type **NWCONFIG**.
2. Highlight Directory Options and press Enter.
3. Highlight Remove Directory Services from This Server and press Enter.
4. Read the warnings.
5. Verify your intent to delete Directory Services.
6. Log in as Admin or equivalent.
7. Read the warnings concerning the single NDS eDirectory tree.
8. Verify your intention to delete the eDirectory.
9. Read the messages about further actions.

Paranoia about planning your NDS tree was rampant when NetWare 4 first hit the streets, because it was new. The tools to recover from mistakes were incomplete, and some customers deleted NDS rather than try to fix it.

That's no longer true, even for the most paranoid of administrators. But if you do want to remove NDS, right at installation is a good time to do so. Play with it a couple of days, if you have this in a test environment, and screw it up good. Installation is so quick with NetWare 6 that it actually may be faster to reload NDS than to rework a mangled tree, especially in a single-server network.

From the server console screen (the one with the prompt), type **NWCONFIG**. Highlight Directory Options and press Enter to see the Directory Services Options menu. Highlight Remove Directory Services from This Server and press Enter. Depending on the situation in your network, you will see various warning messages.

Warning, Warning

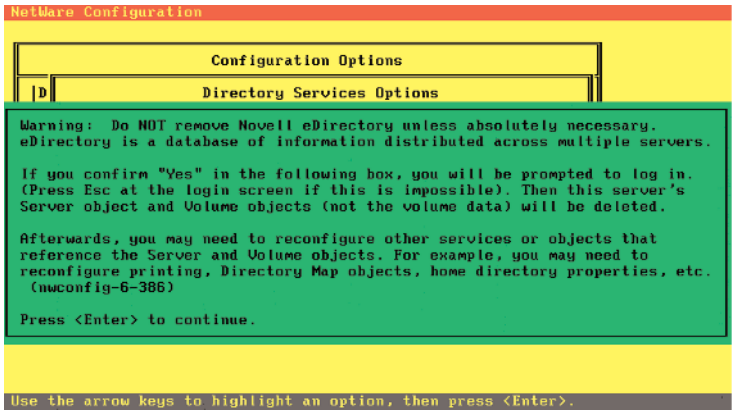
NDS removal is a big deal and should be done only under the *rarest* of circumstances after the server has been put in use. However, during initial installation, you may want to play with different NDS arrangements. If one plan doesn't work well, it's little trouble to delete a basically empty NDS tree and reinstall. These instructions are only for situations in which NetWare 6 is in a pilot network test mode, no valuable information is contained on the server, and no users are going to be stranded.

However, and this is serious, *deleting a working NDS eDirectory tree erases all users, objects, printers, print queues, and groups*. This is an important point. When you remove the eDirectory, you perform a lobotomy on your server. This is the same as erasing the bindery files on a NetWare 3.*x* server. No, it's actually worse than erasing bindery files. Bindery files concern only one server at a time. If you erase a bindery, only one server's users are inconvenienced. With NetWare 6, hundreds of users may suffer some aggravation.

Directories that are part of a large network may be referenced in scores or hundreds of object descriptions. Some users may not discover the loss of the eDirectory information for that one server for weeks or months, but that just amplifies the hassle when they do realize it's gone.

Be careful about removing NDS from an existing network. Try *everything* else before you dump the eDirectory (assuming you're not just playing and are redoing NDS for learning purposes). Production systems shouldn't need an NDS replacement. Figure 1.23 shows NetWare's warning.

FIGURE 1.23
Warning! Warning!



You cannot delete the eDirectory without proving you have the authority to do so. This would be a big security hole if just anyone could trash your server. NDS will demand the administrator's full NetWare name and password before proceeding. Then you'll need to wade through several more screens threatening dire things before you can actually do any deleting.

Installation Is Good, But It Will Get Better

When Novell first included a Simple Installation option in NetWare 4, some network resellers were unhappy. How can you charge a customer for installation when the customer knows the installation process is a snap? With the addition of the GUI for the installation program (beginning in NetWare 5), the procedure can even be considered "user-friendly." NetWare 6 installation is practically a breeze.

Customers, of course, are happy with these new installation features. Installing NDS (eDirectory) is simple, and any eDirectory tree mistakes can be easily corrected. What could be wrong?

What if this is too easy? What if customers figure, "no pain, no gain?" After all, NetWare is now almost as easy to install as DOS. It's much easier to configure than Windows of any version. How can this product be any good?

But only those with experience might take the "too-easy" view. Most people today *expect* things to be easier. You and I are in the computer business, and we know how much easier things are today than five years ago. People in the "real" world just see how computers are still more difficult to use than they should be.

Amazingly, the most difficult areas are those that home computer users most want. Have you installed a sound board and CD-ROM drive lately? Not simple. Modems are still killers, especially if they're cheap (and even worse if the cheap bundled software isn't configured for that particular modem). The result of these problems is that people think computers are getting harder to understand, not easier. They may be right.

I'm waiting for the installation procedure that listens to the network and configures itself. The first disk that loads the SERVER.EXE program would start a network monitor, listen for the NDS information, and fill out several proposed configurations. You then choose your favorite and get another cup of coffee. That's the kind of installation routine I want. It would also make books like this shorter.