

Windows NT Server 4 Professional Reference, Second Edition

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Installing Windows NT Server

In this chapter, you examine installation issues for the Windows NT Server. Before you learn about Windows NT Server installation issues, however, you need to examine some background material to help you better understand the installation process.

Windows NT Server is designed to run on IBM PC ATs that have an Intel 80486 microprocessor or higher (Intel 80486, Pentium, or Pentium Pro) and other RISC processors such as the MIPS, Power PC, and Alpha. On the Intel architecture, Windows NT runs in the protected mode of the Intel chip. In this area, the entire address space of the Intel 80486 architecture is available. The Intel 80486 processor has 32 address lines, creating an address space (RAM size) of 2 to the 32nd power, or 4 GB. This address space enables the Windows NT Server operating system to implement many of its performance-improvement features directly in RAM.

Most server machines do not have 4 GB of physical memory. In this case, Windows NT Server uses virtual memory to temporarily "swap" sections of memory in chunks of 4 KB onto the server hard disk. The Windows NT Server keeps track of the sections of memory that have been swapped out. If the Windows NT Server operating system or an application running on it needs the memory data/program code that has been swapped out, the operating system brings the data back into physical memory. This enables the applications to run on Windows NT servers that have limited physical memory. Ideally, the server's physical memory should be large enough to run the operating system and the server applications so that swapping to disk is eliminated or kept at a minimum. This minimizes the server-swapping overhead.

Planning a Windows NT Server Installation

During the installation of Windows NT Server, you are asked to make a number of selections. Making the proper selection requires knowledge of Windows NT Server concepts. The sections that follow discuss the concepts needed for installing Windows NT Server.

Windows NT Server Requirements

Figure 3.1 shows the hardware and software components that you should understand in order to understand Windows NT Server. Table 3.1 summarizes the hardware system requirements.

FIGURE 3.1 *Windows NT Server hardware components.*

Table 3.1 Hardware Requirements for Windows NT Server

Component	Requirement
Processor	Intel 486, Pentium, Pentium Pro, or supported RISC-based system (example: MIPS R4x00, DEC's Alpha AXP). Windows NT supports up to 4 processors in a Symmetrical Multi-Processing (SMP) mode. Support for additional processors is available from OEMs (Original Equipment Manufacturers).
Display device	VGA or higher resolution.
Hard disk	Minimum 110 MB free disk space during installation for Intel-based systems. Minimum 110 MB free disk space for RISC-based systems.
Floppy disks	For Intel-based systems, a 3 1/2-inch, high density drive or a 5 1/4 -inch, high density drive. These are needed to start the installation by booting from a Setup disk.
CD-ROM	CD-ROM drive or access to a CD-ROM over a computer network.
Network adapters	One or more network adapters. Strictly speaking, network adapters are optional, but without the network adapter, networking features are disabled and cannot be configured.
Memory	16 MB recommended minimum for both Intel- and RISC-based systems. The more the better. Windows NT Server uses virtual memory when more memory is needed to run applications than is physically available. Excessive use of virtual memory can adversely impact server performance.
Pointing device	A mouse or other pointing device, although optional, is highly recommended. Windows NT Server tools are GUI-based, and a mouse is helpful for using these tools.

Windows NT Server supports more than 2,350 Intel-based single processor systems. The Hardware Compatibility List document that ships with Windows NT Server contains a list of systems for which Windows NT Server is tested. You can access the most recent list of Windows NT Server-compatible systems at Microsoft's Web site, or via various newsgroups.

Windows NT Server SCSI Support

Windows NT Server supports the SCSI interface devices such as CD-ROMs, tape drives, and hard drives, as well as numerous non-SCSI devices. For uniformity of hardware access to these peripheral devices, it is recommended that you use a server that has a supported SCSI adapter. This will simplify the installation and hardware maintenance of the system.

SCSI devices from most major manufacturers such as CD-Technology, Chinon, COMPAQ, Digital Equipment Corporation, Hitachi, IBM, NEC, Panasonic, Pioneer, Sony, Texel, Toshiba, and Adaptec are supported. The SCSI (Small Computer Systems Interface) was developed by Adaptec and became an ANSI standard in 1982. It provides a logical bus interface based on the block multiplexor channel of IBM mainframe. Up to eight SCSI devices can be daisy-chained on a common bus (see fig. 3.2). Each SCSI device (including the SCSI controller) has a unique ID (identifier). The SCSI controller's ID is usually set to 7 on Intel-based machines, and the bootable SCSI hard drive is set to a SCSI ID of 0. The SCSI bus can operate at data rates from 7.5 Mbps to 80 Mbps and has increasingly become a popular device interface for large storage disks for workstations and servers.

FIGURE 3.2 *An example of SCSI devices daisy-chained together.*

Another advantage of using the SCSI interface is that you can use it to support SCSI tape drives, which are important for backup operations for the Windows NT Server.

Another type of storage media that can be supported using the SCSI interface is removable media, such as cartridge or floptical drives.

Windows NT Server also supports SCSI scanners for the Intel platforms only. The devices that are supported include the HP ScanJet models IIC, IICx, and Iip.

For higher performance and reliability, Windows NT Server supports RAID SCSI disk drives.

Windows NT Server IDE Support

For Intel-based systems, standard PC disk drives are supported. Standard PC disk drives were developed by Shugart (now Seagate) Technologies and support a maximum of two drives per controller. The typical data rate for these drives is 4 Mbps, and 5 Mbps with extended BIOS (EIDE). Many current high performance EIDE drives support data rates of 20-32 Mbps.

Most standard PC drives now support the IDE (Integrated Device Electronics) interface developed by Conner Corp. in 1988. The IDE interface uses the same device interface as the Shugart drive but integrates device adapter electronics on the motherboard and the hard disk. This results in improved performance compared to the standard PC disk drives (also called ISA/EISA disk drives).

Windows NT Server ESDI Support

Another type of disk drive that is supported by Windows NT Server is ESDI (Enhanced Small Devices Interface). ESDI was introduced by Maxtor Corp. in 1983. The ESDI interface was conceived for the minicomputer environment and supports data rates in the range of 10 Mbps to 24 Mbps.

The ESDI interface has an improved clock mechanism and track buffering compared to the standard PC disk drives. ESDI drives typically are found on older, Intel-based systems. In modern systems, most ESDI drives have been replaced by SCSI drives.

Windows NT Server Non-SCSI, CD-ROM Drives

Although a SCSI interface is recommended for high performance Windows NT Server systems, there are a large number of computers that use proprietary interfaces for CD-ROMs.

Windows NT Server Support for Display Chip Set

Windows NT Server supports most video adapter types that are at least VGA quality or better. Although there are many different video adapter types, they use some popular chip sets. If your video adapter type is not listed in the Windows NT Server installation disks, you can use table 3.2 to select the appropriate driver using the Display option in the Windows NT Server Control Panel.

Table 3.2 Display Chip Set and Display Driver

Chip Set	Compatible NT Driver
ATI 8514 Ultra	8514A
ATI MACH 8, 32, 64	ATI
Cirrus Logic 5422, 5424, 5426, 5428, 5434	CIRRUS
Compaq AVGA	AVGA
Compaq Qvision 1024, 1280	QV
Compaq Qvision 2000	MGA
Headlands Video 7	V7VRAM
IBM 8514/a	8514A
IBM XGA	XGA
Matrox MGA (ATLAS)	MGA
NCR77C22, NCR77C22E, NCR BLT 32	NCR77C22
S3 911, 911a, 924, 801, 805, 928, 864, 964	S3
Trident 9000, 8900c	TRIDENT
Tseng Labs ET4000, ET4000-W32i, pET4000-W32	ET4000
Western Digital WD90C30, WD90C31, WD90C33	WDVGA
Witek P9000	WITEKP9

Windows NT Server Support for Network Adapters

Windows NT Server supports most network adapters from vendors such as 3COM, AMD, Andrew, Cabletron, Cisco, Cogent, COMPAQ, COPS, Crescendo, DayStar, DCA, DEC, Hewlett-Packard, IBM, ICL, Intel, National Semiconductor, Intel, Madge, NCR, Network Peripherals, Novell/Eagle Technologies, Olicom, Proteon, Standard Microsystems, Thomas Conrad, Ungermann-Bass, and Xircom.

Most of the card types are Ethernet and Token Ring (most of these cards are Ethernet). There also is support for some FDDI and ARCnet network adapters.

For Computer laptop and notebook owners, the Xircom CreditCard Adapter (PCMCIA) and the Xircom Pocket Ethernet Adapters II and III are supported.

Windows NT Server Support for Multimedia Audio Adapters

Windows NT Server supports multimedia audio adapters for Intel, MIPS, and Alpha platforms.

Windows NT Server Software Distribution

The Windows NT Server distribution is available on floppy disks (3 1/2-inch, high density) for Intel platforms and only on CD-ROM for RISC platforms. The CD-ROM distribution also is available for Intel platforms. The preferred installation method is through CD-ROM or by using preconfigured

distribution files stored on a network server. If the CD-ROM method is used on the Intel platform, you also must use the three Setup disks that come with the Windows NT Server distribution unless you use the /B switch with WINNT (or WINNT32) to avoid using the Setup disks. The first Setup disk is bootable and is used to start the Windows NT Server installation.

Understanding Windows NT Server Installation

The following sections explain the necessary concepts for understanding the Windows NT Server installation.

These steps also are summarized for your reference:

- 1.** Boot with Windows NT Server Setup disk, or use the WINNT /B command from the I386 (for Intel-based computers) directory on the CD-ROM distribution. If you are upgrading a previous version of NT 3.5x, run the WINNT32 command, and select your installation options.
- 2.** Select the source media type. For Intel platforms, you can select the floppy distribution installation or the CD-ROM installation. If Setup recognizes a CD-ROM drive, it suggests that you use the CD-ROM method.
- 3.** Verify and, if necessary, change the software and hardware components recognized by Setup.
- 4.** Select the partition on which Windows NT Server is to be installed. You must decide between the file system types such as FAT and NTFS.
- 5.** (Optional) Format the selected partition.
- 6.** Select the default directory in which the Windows NT Server files will be installed.
- 7.** Enter your name and organization.
- 8.** Select the Licensing Mode. Choices are Per Server, and Per Seat.
- 9.** Enter a unique computer name.
- 10.** Decide on the security role of the server computer. Choices are Primary Domain Controller (PDC), Backup Domain Controller (BDC), and Stand-Alone Server.
- 11.** Enter the password for the Administrator Account.
- 12.** Select the option to create an emergency repair disk.
- 13.** Select Components to install. Choices are Accessibility Options, Accessories, Communications, Games, Microsoft Exchange, and Multimedia.
- 14.** Decide how the computer should participate on the network. Choices are Wired to the Network, and Remote Access to the Network.

15. (Optional) Select Install Microsoft Internet Information Server.
16. Decide on the method of detection of network adapters: autodetect or manual. Some network adapters--such as the Xircom CreditCard and the Xircom Pocket Ethernet adapter--only can be selected manually.
17. Select the network protocols to be used with the NIC. The choices are TCP/IP Protocol, NWLink IPX/SPX Compatible Transport, and NetBEUI Protocol.
18. Select Network Services. Choices are Microsoft Internet Information Server, RPC Configuration, NetBIOS Interface, Workstation, Server. By default, all of these options are selected.
19. Enter NIC parameters such as IRQ (interrupt request) number, IO port address, memory base address, DMA line, and so on.
20. If the NWLink IPX/SPX or TCP/IP Transport protocol was selected, you must configure them.
21. If you selected the server computer as a primary domain controller, you must enter the Computer Name, and the name of the domain that the PDC will manage.
22. If you chose to install the Internet Information Server, you will need to select and configure its component options.
23. Select Date/Time Properties. Set date, time, and time-zone information.
24. Select the Display Properties settings.
25. Create the Emergency Repair Disk.

Windows NT Server Installation Concepts

During the Windows NT Server installation, you are asked to make decisions involving the following:

- Determining type of file system: FAT or NTFS
- Determining security role of computer: primary, secondary domain controller, or stand-alone server
- Selecting a computer name
- Selecting the language (locale) settings
- NIC parameters: IRQ, DMA, IO Port, and Base Address

- Choice of protocol stacks: SPX/IPX, NetBEUI, or TCP/IP
- Time-zone information

These topics are discussed next.

Selecting the Type of File System for Windows NT Server

Windows NT Server can be installed on a partition formatted with FAT (File Allocation Table), or NTFS (NT File System). While installing the NT Server, you can install on an existing file system or a new file system. You can format a partition with FAT or NTFS.

The FAT File System

The FAT file system is the standard file system used for DOS/Windows computers. The *File Allocation Table* is a table of links that contain information on the data blocks that make up a file. All the files on a FAT partition share the same table of links, as illustrated in figure 3.3. The data blocks usually are allocated in clusters of four 512-byte units; therefore, each allocation unit is typically 2 KB.

The directory contains entries for file names and their attributes, such as file size, attribute byte (8 bits of information--archive file, system file, hidden file, read only), modification time (16 bits), modification date (16 bits), and starting allocation unit. The *starting allocation unit* is a pointer to an entry in the File Allocation Table.

In figure 3.3, for file example1.txt, the directory entry points to the first allocation unit in block 0002. Block 0002 in the FAT contains the entry 0009, which is a link to block 0009. Block 0009 contains the hexadecimal pattern FFFF. This bit pattern indicates that this is the end of the block chain. This means that allocation units 0002 and 0009 belong to the file example1.txt. Similarly, the file example2.txt's allocation chain is 0001, 0003, 0004, and 0007; and file example3.txt's allocation chain is 0008, 0005, and 0006.

As files are deleted and created, the FAT file system gets fragmented and the FAT chain must point to the correct allocation units for the file. The FAT file system is a simple file system originally designed for small disk and simple file system structures. In fact, the FAT file system was designed with the first version of DOS 1.0 that did not support subdirectories. Over the years, the FAT file system has been improved to accommodate larger disks. Beginning with DOS 4.0, the 12-bit FAT entries were increased to 16-bit entries to allow for partitions that were larger than 32 MB.

FIGURE 3.3 A File Allocation Table.

Figure 3.4 shows the FAT file system organization. The FAT is duplicated to provide a rudimentary level of fault tolerance. The root directory has a fixed size, and this limits the number of files that can be placed in the root directory. Subdirectories are special files that have 32-byte entries for each file in that directory. On a large disk, with heavy file use, the FAT file system can get fragmented and the performance is slower as the FAT table increases in size. Also, as the length of a FAT chain increases, the operating system has to traverse many entries in the FAT chain to access a random block of data in a file. Another limitation of the FAT is that it has the 8.3 (eight-character file name

and three-character extension) naming convention, and lacks recoverability and security features.

You use FAT with Windows NT in order to have a compatible file system with DOS. However, you should be aware that disk-compression software such as DoubleSpace or Stacker is not compatible with Windows NT. If a disk has been compressed using these tools, the files cannot be accessed from Windows NT.

The NTFS File System

NTFS is the preferred file system for Windows NT. It includes a number of performance-enhancing, file-security, and recoverability features that make Windows NT Server a good server platform. NTFS can be used to assign permissions to files and directories on a user or group basis. This feature enables files and directories to be shared or kept private, and it provides the flexibility of implementing virtually any security policy.

In NTFS, files are treated as objects that have user- and system-defined attributes. These attributes are stored in the file itself. The file system information (metadata)--such as file name, file size, data, security descriptor, and so on--is part of the file, for example. Each attribute is defined by an attribute code and an optional attribute name.

FIGURE 3.4 FAT disk partition organization.

Each NTFS volume has a Master File Table (MFT). An *MFT* is a special file that has information on files on the volume (see fig. 3.5). The first record is the MFT descriptor record, which describes the Master File Table itself. The second record is a duplicate of the first record, and is the MFT mirror record. The MFT mirror record provides redundancy of the MFT description in case the primary MFT record is corrupted. The locations of the data segments of the MFT record and its mirror are recorded in the boot sector. The boot sector is duplicated, and the duplicate is kept in the logical center of the volume.

The third record in the MFT is the Log File record, which is used for file recovery. After the first 16 records, follow the records that describe files and directories. If a file or directory is sufficiently small (approximately 1,500 bytes or less), it can be placed entirely in the MFT table. This is illustrated in figure 3.5 by the small file record and the small directory record, which do not have any extents. If a file or directory is large and cannot be placed entirely in the MFT table, extents are used for the additional data. Extents are external clusters in the volume, with pointers to it kept in the MFT table.

For small files, data access is rapid because a single lookup in the MFT retrieves all information on the file. Compare this to a FAT system where the FAT table would have to be accessed, and then the allocation chain for the file would have to be retrieved as separate disk-access operations. Directories are represented in a manner similar to ordinary files, except that the directory contains indices to file information. Although small directories are contained entirely in the MFT table, larger directories are organized as B-trees that are contained in extents. All information on a file, including its data, is called the *attributes* of a file. When a file or directory's attributes are contained entirely in the MFT, they are called *resident* attributes. The attributes of a file (such as data) that are kept in extents are called *nonresident* attributes. Table 3.3 shows the attributes that have been defined for NTFS.

FIGURE 3.5 The master file table (MFT).

Table 3.3 NTFS Attributes

Attribute	Description
Attribute list	Lists other attributes for large files.
Bitmap	Provides a map of the records used in the MFT.
Data	Contains the file's data. A file has one unnamed data attribute. Optionally, you can give a file additional name data attributes by using a special syntax.
Extended attribute information	Used by file servers that are linked to OS/2 systems. Not used in Windows NT.
Extended attributes	Used by file servers that are linked to OS/2 systems. Not used in Windows NT.
File name	A file can have multiple file-name attributes such as short file names and long file names. Short file names are DOS-compatible, case-insensitive names for files that follow the 8.3 rule. Long file names can contain up to 255 unicode characters. The use of short file names also permits the NTFS file system to be accessed from DOS stations across a network. Additional names for POSIX compliance, such as hard and symbolic links, are considered as file-name attributes.
Index allocation	Used to implement index (?) directories.
Index root	Used to implement index (?) for the root.
Security descriptor	Shows security-related information such as permissions and ownership.
Standard attributes	Refers to time stamps, link counts (for POSIX file system support), file size, and so on.
Volume information	Attribute used for the volume system file. It contains a version number, volume name, and other volume-related information.

NTFS uses special system files that are hidden from view on the NTFS volume. These system files are used to store the volume's metadata and are created when the volume is formatted. Table 3.4 shows some of the system files.

Table 3.4 NTFS System Files

System File Name	Description
\$.	Root file name index. This is the root directory.
\$AttrDef	Attribute definition. Contains attribute names, numbers, and descriptions.
\$BadClus	Bad cluster file. A table containing location of all the bad clusters in the volume.
\$Bitmap	Cluster bitmap. This is a map of the allocation units that are in use for the volume.
\$Boot	Boot file. This contains the bootstrap program for a bootable volume.
\$LogFile	Log file. Used to record transaction steps that are used for recoverability

	purposes.
\$Mft	Master file table (MFT). Lists the contents of an NTFS volume in which the file resides.
\$MftMirr	A mirror of the critical parts of the MFT for redundancy purposes.
\$Volume	Contains volume-related information such as volume name and version.

You can format any hard disk partition as a FAT or NTFS volume. You cannot format a floppy disk as an NTFS volume, however. The file system type can be established during installation. You also can use the FORMAT utility to specify the file system type option, or you can use the CONVERT utility to convert from FAT to NTFS. The use of these utilities is discussed next.

You must be a member of the Administrators group (the Windows NT group that lists all Administrator users) to format a hard drive. The syntax of the FORMAT command follows:

```
format drive: [/fs:fst] [/v[:label]] [/a:usize] [/q] [/f:size] [/t:tracks -/n:sect
```

Explanations of this syntax follow:

- **drive:** specifies the drive to be formatted. If the switches are not specified, FORMAT uses the drive type to determine the default format for the disk.
- **/fs:*fst*** specifies a value of FAT or NTFS for the corresponding file system type. Floppy disks can be formatted with a FAT file system only.
- **/v:*label*** specifies the volume label.
- **/a:*usize*** specifies the allocation unit size to use on NTFS disks. If the unit size is not specified, it is chosen based on disk size. The default is 512 bytes if the disk is less than 512 MB; 1,024 bytes if the disk is between 512 MB and 1 GB; 2,048 bytes if the disk is between 1 GB and 2 GB; and 4,096 bytes if the disk is more than 2 GB. A unit size of 512 bytes creates 512 bytes per cluster and 1,024 bytes per file record; a unit size of 1,024 bytes creates 1,024 bytes per cluster and 1,024 bytes per file record; a unit size of 2,048 bytes creates 2,048 bytes per cluster and 2,048 bytes per file record; and a unit size of 4,096 bytes creates 4,096 bytes per cluster and 4,096 bytes per file record.
- **/q** deletes the file table and the root directory of a formatted disk, but does not scan the disk for bad areas. This is a quick format that should be used to format only previously formatted disks that you know are in good condition.
- **/f:*size*** specifies the size of the floppy disk to format. The floppy disk sizes are listed in table 3.5.

Table 3.5 Floppy Disk /F Value

Parameter Value for /F	Floppy Disk Type
160 KB	160 KB, single-sided, double-density, 5 1/4-inch disk
180 KB	180 KB, single-sided, double-density, 5 1/4-inch disk
320 KB	320 KB, double-sided, double-density, 5 1/4-inch disk
360 KB	360 KB, double-sided, double-density, 5 1/4-inch disk
720 KB	720 KB, double-sided, double-density, 3 1/4-inch disk
1200 KB or 1.2 MB	1.2 MB, double-sided, quadruple-density, 5 1/4-inch disk
1440 KB or 1.44 MB	1.44 MB, double-sided, quadruple-density, 3 1/2-inch disk
2880 KB or 2.88 MB	2.88 MB, double-sided, 3 1/2-inch disk
20.8 MB	20.8 MB, 3 1/2-inch floptical disk

- **/t:tracks** specifies the number of tracks on the disk. If you use the /t switch, you also must use the /n switch for sector size. The /t and /n switches provide an alternative method of specifying the size of the disk to be formatted. You cannot use the /f switch with the /t switch.
- **/n:sectors** specifies the number of sectors per track. If you use the /n switch, you also must use the /t switch for number of tracks. The /n and /t switches provide an alternative method of specifying the size of the disk to be formatted. You cannot use the /f switch with the /n switch.
- **/1** formats a single side of a floppy disk.
- **/4** formats a 5 1/4-inch, 360 KB, double-sided, double-density floppy disk on a 1.2 MB disk drive. When combined with the /1 switch, this switch formats a 5 1/4-inch, 180 KB, single-sided floppy disk.
- **/8** formats a 5 1/4-inch disk with eight sectors per track. This switch formats a floppy disk to be compatible with MS-DOS versions prior to 2.0.

The CONVERT utility can be used to convert FAT volume to NTFS. You cannot convert the current drive, because the current drive is in use and cannot be locked. If CONVERT cannot lock the drive, it offers to convert it the next time the computer reboots. The syntax of the CONVERT command follows:

```
convert [drive:] /fs:ntfs [/v] [/nametable:filename]
```

Explanations of this syntax follow:

- **drive:** specifies the drive that is to be converted to NTFS.

- **/fs:ntfs** specifies to convert the volume to NTFS.
- **/v** specifies verbose mode, in which details of the conversion process are displayed during conversion.
- **/nametable:filename** creates a name-translation table in the root directory of the converted volume using the specified file name. You can use this switch if you encounter difficulty converting files with unusual file names.

You cannot convert from NTFS to FAT without backing up files, reformatting the partition, and restoring the backed up files. You will lose any security-related permissions associated with the directories and files.

Comparing the FAT and NTFS

Table 3.6 compares the features of FAT and NTFS.

Table 3.6 Comparison of FAT, HPFS, NTFS

Feature	FAT	NTFS
File name	8 plus 3 (8.3) character limit. Only single period allowed	255, 16-bit unicode characters with multiple periods allowed
Maximum path length	64	No limit
File size	2^{32} bytes	2^{64} bytes
Partition	2^{32} bytes	2^{64} bytes
Directories	Unsorted	B-tree
Attribute	Few bit flags	All information, including data, is treated as attributes
Built-in security NTFS directory/file permissions	No	Yes
Design approach	Simple	Fast access with recoverability and security

You should select the NTFS partition instead of FAT except in the following situations:

- Choose the FAT partition if you want the partition to be accessible from DOS, OS/2, and NTFS. In this situation, you have multiple operating systems installed on your computer.
- If you are installing on an existing partition, choose the default option to keep the current files intact. After the installation is successful, you can convert to other partition types.

Tables 3.7 and 3.8 point out the relative advantages of each partition type.

Table 3.7 Advantages and Disadvantage of NTFS

Advantages	Disadvantages
Supports files and directories with up to 255 extended attributes.	NTFS is recognizable only by Windows NT. If you have multiple character names and operating systems installed on your computer, the other systems cannot recognize the operating NTFS.
Automatically generates short DOS- compatible file names. Built-in reliability, because of log of activities kept in the log file. The log file can be used to restore files in the event of disk problems. Built-in security that enables you to specify permission on directories and files. DOS and OS/2 programs that run under the Windows NT DOS and OS/2 subsystems can access the NTFS volume.	

Table 3.8 Advantages and Disadvantage of FAT

Advantages	Disadvantages
Enables files to be accessed by DOS/Windows 3.1, OS/2, and Windows NT.	Less robust than Windows NT.
Most widely used file system for PCs.	Cannot support long file names.
	No built-in security for directories and files.

Selecting the Security Role of the NT Server Computer

A Windows NT Server computer can be set up as a primary or backup domain controller for a Windows NT domain, or as an ordinary server computer. During installation, you must select the security role served by the Windows NT computer.

A Windows NT *domain* is a group of servers that share a user accounts database and have a common security policy (see fig. 3.6). Because the user accounts database is shared in the domain, it is only necessary to define a user account for the entire domain rather than to define user accounts for each Windows NT Server. This greatly simplifies user account administration.

A server can belong to only one domain. One of the servers in the domain acts as the main or primary domain controller (PDC); the other servers act as backup domain controllers (BDCs). If the server belongs to a domain, it can either be a primary domain controller or a backup domain controller. There can be only one PDC per domain. Any one of the other servers that act as BDCs can be promoted to PDC in case of failure of the primary domain controller. This promotion is not done automatically; it is performed as a result of explicit actions taken by the network administrator. Both primary and backup domain controllers can authenticate network logons.

The PDC maintains the centralized security database of the domain. This security database is replicated to other BDCs on a periodic basis.

FIGURE 3.6 *The Windows NT domain.*

If your Windows NT Server is the first computer on the network, and you intend to use domains on your network, you must designate this server as a PDC. If your Windows NT server is not the first server in the domain, you must have at least a PDC connected to the network. You can designate the Windows NT Server as a BDC, in which case you must know the administrator password for the domain in order to join the domain. Knowledge of the password for the Administrator domain account is necessary; otherwise, anyone can install a Windows NT Server and have it join the domain. This can lead to chaos on real-life networks.

Selecting a Computer Name

As part of the Windows NT Server installation, you must specify a name that identifies your computer to the network. This must be a name that cannot exceed 15 characters and must be unique on the network. This name is used by NetBIOS, and the 15-character limitation is a NetBIOS limitation.

If you select a duplicate computer name, you can change it from the Network applet in the Windows NT Server Control Panel (see figs. 3.7 and 3.8).

FIGURE 3.7 *The Network applet in the Control Panel.*

Table 3.9 shows the list of characters that should not be used for computer names. Using these characters can cause unexpected results when trying to access your computer over the network. In addition, you should not use spaces in computer names for servers to be used as domain controllers if you plan on using log-in scripts.

Table 3.9 Characters to Avoid for Computer Names

Character	Key Combination Used to Produce the Character
Bullet	Alt+0149
Currency sign	Alt+0164
Broken vertical bar	Alt+0166
Section sign	Alt+0167
Paragraph sign (MS Word)	Alt+0182

FIGURE 3.8 *The Identification Changes dialog box.***Selecting the Language Settings**

During installation, you must select the Time and Date, Time Zone or locale to be used on the Windows NT Server computer. This choice determines how the Windows NT Server formats date, timestamp, and currency information. You can change the language after setup is complete by running the Regional Settings applet from the Control Panel (see figs. 3.9 and 3.10).

You also can selectively change the date, time, currency, and number format regardless of the locale

settings used.

Selecting NIC Parameters

Windows NT Server supports built-in networking. During installation, it tries to recognize any network boards on the server computer. Alternatively, you can manually select the network board type installed in the computer.

FIGURE 3.9 *The Regional Settings icon in the Control Panel.*

FIGURE 3.10 *The Regional Settings dialog box for changing locale settings.*

The network interface cards (NICs), are characterized by parameter settings such as IRQ number, I/O port address, DMA channel, and memory base address. On computers with an ISA bus, you must select these settings to avoid conflicts with other peripheral cards and devices that you are using in the computer.

The NIC parameters can be set manually by jumper settings or through software. The software usually is shipped by the vendor with the NIC. Most configuration software for NICs is DOS-or Windows-based.

A model for a network adapter is shown in figure 3.11. Data encapsulated in packets is transferred between the network and the CPU through the computer bus and the NIC. To encode signals suitably for transmission, the NIC provides a transmitter/receiver function. After the packet signal is received from the network, it is encoded as a bit pattern and stored in the NIC's data buffers. The adapter logic implements the media-access method used by the network (CSMA/CD for Ethernet, and token passing for Token Ring). The adapter logic also controls the transfer of network data by way of the computer's bus.

FIGURE 3.11 *A model for a NIC.*

When a packet arrives from the network, the computer is informed about this event through one of the interrupt lines (see fig. 3.12). On Intel processors, the IRQ line on which the interrupt is seen is used to index the interrupt vector table stored in lower memory. The interrupt vector table contains a pointer (address) of the interrupt service routines used to handle the packet.

For the Intel-based computers, there are 16 interrupt lines. Some of these interrupt lines are dedicated for standard peripheral devices. Table 3.10 shows standard IRQ assignments for some common devices. You must select an IRQ for the NIC that does not conflict with any existing device IRQs.

FIGURE 3.12 *Interrupt request lines.*

In the early PC/XT computers, there was only one interrupt controller chip: the Intel 8259 chip (see fig. 3.13). The 8259 chip supports only interrupt channels (usually numbered 0 through 7). The interrupt channel 0 was hard-wired to the system timer (triggers 18.2 times a second) on the motherboard, and the interrupt channel 1 was hard-wired to the Intel 8042 keyboard controller. Lower channel interrupt numbers have a higher priority than higher channel numbers. This ensures that the system timer has the highest priority and the keyboard the next highest. The PC/XT was designed for interactive use, so it made sense to give the keyboard a higher interrupt priority than most other

devices.

When IBM designed the PC/AT, it realized that the eight interrupt channels were not enough, and decided to add another Intel 8259 chip controller to increase the number of interrupt levels to 16. In order to achieve this goal and to maintain compatibility with the PC/XT, IBM design engineers used the unused interrupt channel 2 of the first Intel 8259 controller chip, and connected it to the second Intel 8259 controller chip. The second Intel 8259 controller chip's interrupt channels were numbered 8 through 15, and IRQ 2 on the first Intel 8259 controller chip was connected to IRQ 9 on the second Intel 8259 controller chip. This means that whenever IRQs 8 through 15 on the second Intel 8259 controller chip are triggered, IRQ 9 is triggered. Because IRQ 9 on the second Intel 8259 controller chip is connected to IRQ 2 on the first second Intel 8259 controller chip, IRQ 2 is triggered. The implication of this is that IRQ 8 through 15 has higher priority than IRQ 3 through 7. IRQ 2 therefore acts as a "gateway" to IRQ 8 through 15. For some NICs that are installed with a setting of IRQ 2, you might have to tell the Windows NT Setup program that it is installed at IRQ 9 in order for the Setup program to recognize the NIC.

FIGURE 3.13 *A single Intel 8259 interrupt controller for the PC/XT.*

In table 3.10, you can see that COM2 is assigned an IRQ of 3, and COM 1 is assigned an IRQ of 4. In the initial PC systems, it was expected that the modem would be connected to COM2, and a parallel printer to COM1. The system was designed to give the modem a higher priority than the printer.

Table 3.10 **IRQ Settings**

IRQ	Device Used	Comments
0	Time	Hard-wired in the motherboard
1	Keyboard	Hard-wired in the motherboard
2	Cascaded to 8 through 16 IRQs	
3	COM2/COM4	
4	COM1/COM3	
5	LPT2	Not typically used; available for NICs
6	Floppy controller	
7	LPT1	
8	Real-time clock	Hard-wired in motherboard
9	--	IRQ 2 on first 8259 controller tied to second 8259 controller at IRQ 9
10	--	Can be used for NICs
11	--	Can be used for NICs unless used by some SCSI adapters
12	--	PS/2, in-port mouse
13	Math coprocessor	Used to signal detected errors in math co-processor
14	Hard drive	
15	Secondary disk controller	

When a packet arrives from the network, it must be transferred to the system memory used by the

CPU. One way of accomplishing this is to map the data buffers on the NIC into the system memory map (see fig. 3.14). This method enables the CPU to access the packet in the data buffers directly. The start of the system memory to which the data buffers are mapped is called the *memory base address*. This is a parameter on the NIC that must be set to values between A0000 (hexadecimal) to FFFFF (hexadecimal), which also are called the *upper memory area*. Table 3.11 shows the memory base addresses used by common devices for the PC. You must ensure that the NIC's memory base address and range does not conflict with that of any device in the server computer.

Table 3.11 Memory Base Addresses of Common PC Devices

Memory Range	Device
B0000-B1000	Monochrome Adapter
B8000-C0000	Color Graphics Adapter
A0000-C0000	Enhanced Graphics Adapter
D0000-E0000	Expanded Memory
F4000-FFFFFF	XT BIOS
E0000-FFFFFF	IBM AT BIOS
F0000-FFFFFF	Clone AT BIOS

FIGURE 3.14 *The memory base address.*

The interrupt service routines (part of the network driver software) often need to find out the status of the NIC after issuing a command to the NIC (see fig. 3.15). This is done using I/O port addresses. The I/O port address for the Intel-based machines is independent of system memory and is 1,024 bytes. Some common I/O port addresses for devices are shown in table 3.12. You must ensure that the I/O address range of devices does not overlap.

Table 3.12 I/O Port Addresses of Common PC Devices

I/O Address	Device
278	LPT2
2F8	COM2
300	--
378	LPT1
3BC	--
3F8	COM1

FIGURE 3.15 *I/O port address.*

Selecting the Protocol Stack

Windows NT Server supports the following transport protocol choices:

- NWLink IPX/SPX Compatible Transport

- TCP/IP Protocol
- NetBEUI Protocol
- NWLink NetBIOS
- DLC Protocol
- Point-to-Point Tunneling Protocol (PPTP)
- Streams Environment

These transport protocol choices and their relationships with the OSI model are illustrated in figure 3.16.

The NWLink IPX/SPX Compatible Transport is Microsoft's implementation of Novell's IPX/SPX transport protocol stack. This choice is selected by default, because IPX/SPX is implemented at many sites. IPX supports routing and NetWare client/server applications. If you are running applications that make use of IPX/SPX sockets, you must select the NWLink IPX/SPX protocol.

The TCP/IP Protocol is Microsoft's implementation of the industry standard TCP/IP protocols. If your Windows NT Server needs to connect to the Internet or communicate with other Unix hosts or a host that uses TCP/IP protocols, you should select this option. Like IPX, the IP (Internet Protocol) protocol is routable. Select this option during installation if you are already familiar with TCP/IP network administration basics and have information such as the IP address, subnet mask, and DNS server address available at the time of installation. You always can install and configure the TCP/IP protocol as a separate step after the Windows NT Server installation. This option is selected by default.

The NetBEUI (Network BIOS Extended User Interface) transport is a native protocol used in Windows NT, LAN Manager, and IBM's LAN Server networks. NetBEUI is meant for small departmental-sized networks. According to Microsoft, NetBEUI is suitable for up to 200 clients. NetBEUI has some undesirable characteristics such as the fact that it is not routable because it does not have an explicit network layer (layer 3 of the OSI model). Its other shortcoming is that it tends to use frequent broadcasts, which can add to the network traffic for large networks. Its advantage is its simplicity, because it does not require any explicit network configuration. NetBEUI also is installed automatically if you install the Remote Access Server (RAS). If your Windows NT Server communicates with other computers such as Windows for Workgroups, or LAN Manager networks that use NetBEUI protocols, you must select NetBEUI as one of the protocols.

FIGURE 3.16 *Windows NT Server transport protocol choices.*

Installing Windows NT Server

This section describes the Windows NT Server installation procedure in detail and discusses the different ways of safely shutting down the Windows NT Server. You also will learn how to use the debug version of the hardware detection program, NTDETECT.COM.

Performing a Windows NT Server Installation

This section gives you a tour of a Windows NT Server installation. You can use the following checklist of information to perform your own Windows NT Server installation.

Windows NT Server Installation Checklist

1. Your computer

name: _____

2. Your printer name: _____

3. Your printer

model: _____

4. Network Adapter Card: SMC [WD] EtherCard 8013WB

IRQ

Level: _____

Memory Base

Address: _____

IO Port

Address: _____

5. Domain

name: _____

6. Administrator Account

Setup: _____

Username: _____

Password: _____

7. Time

zone: _____

Automatically switch to daylight savings time

Standard time only

Daylight savings time only

Additionally, you need the following disks:

Windows NT Setup disks

Windows NT CD-ROM distribution disk

A writable floppy disk, labeled "Emergency Repair Disk," which will be created as part of the installation.

To install Windows NT Server, follow these steps:

1. Insert the NT Setup disk into drive A.
2. Insert the Windows NT CD-ROM into the CD-ROM drive.
3. Turn on the power (reboot) for your computer.

The Setup program reads the Hardware Abstraction layer module (hardware-specific module for the hardware platform) and the Windows NT configuration data.

The Windows NT Setup screen appears. You are prompted to insert Setup Disk #2.

4. Insert Setup Disk #2 and press Enter.

The Setup program reads the locale-specific data, the keyboard drivers, and the FAT system files. You also see information on the number of processors recognized by Windows NT Server.

5. You can press F1 to learn more about the setup program. To continue with the installation, press Enter. To repair a damaged Windows NT Server installation, press the "R" key; you must have previously created an Emergency Repair Disk during the installation to use this option.

If you need to stop the installation at this point, press the F3 key.

6. You see a message about the Windows NT Server setup. Setup automatically detects floppy-disk controllers and ESDI/IDE hard disks without user intervention. On occasion, detection of other hardware devices such as SCSI adapters and CD-ROM devices can cause the computer to become unstable. This happens because the Setup program probes the hardware by polling and writing to port addresses where it expects devices to be. Setup can become confused or make wrong decisions on devices if the different devices have similar characteristics. If this occurs, you can bypass Setup's mass storage device detection by pressing S and manually selecting the SCSI adapters, CD-ROM devices, and special disk controllers.

If you want Setup to automatically detect mass storage devices, press Enter.

Setup loads the different SCSI device drivers, and displays the SCSI hardware interfaces that it discovers.

7. Enter the third Setup disk when you are prompted to do so.

You will see a list of mass storage devices that Setup has recognized.

If Setup doesn't find the mass storage interface, you can press S to enter additional drivers.

8. Press Enter to continue.

Setup loads the NT File System (NTFS).

If one or more of your hard disks have more than 1,024 cylinders, NT displays a message informing you of this fact. MS-DOS normally is limited to 1,024 cylinders per hard disk. Some disk controllers use sector-translation modes to accommodate larger disks. In the sector translation mode, the number of cylinders does not exceed 1,024, but the number of heads and sectors are assigned "fictitious" or logical values to access all the disk space for DOS. If the disk size appears too small when Setup later displays this information, you should exit Setup and check your CMOS drive type settings. If you receive this message, press Enter to continue.

9. If NT detects that you have a CD-ROM drive, you see a message that it has detected a CD-ROM. To use the CD-ROM for installation, press Enter. To install Windows NT Server from 3 1/2-inch disks, press A.

If you are installing from CD-ROM, the CD-ROM file system is now loaded.

10. Setup displays the Windows NT Licensing Agreement. After you have read, and agree to the license agreement, press F8 to continue.

11. Setup will search for previous versions of Windows NT. If a previous version of NT is found, you will be able to press Enter to upgrade the existing NT installation. Press N to install a fresh copy of NT.

12. The Windows NT Server setup displays a list of hardware and software components. Ensure that the list matches your expectations of the hardware components. If your mouse is not plugged in, you see the message No Mouse or Other Pointing Device for the pointing device.

13. Change the settings, if necessary, to match your hardware configuration.

13. Highlight "The Above List Matches My Computer" and press Enter.

14. The partitions on your disk are displayed.

To delete an existing partition, highlight it and press D. Then confirm your choice by pressing L.

To create a partition in the unpartitioned space, press C. You see a form displaying the following information:

The minimum size of the new partition: _____

The maximum size of the new partition: _____
Create partition of size (in MB): _____

15. The Setup program displays the minimum and maximum sizes of the partition. You must select the partition size to create.

16. If you have multiple partitions, such as a DOS partition and an NT partition, you see a list of partitions. Highlight the partition in which to install the Windows NT server.

You are given a choice of formatting the selected file system to FAT or NTFS.

Selecting the FAT files system has the advantage of it being used under MS-DOS, Windows NT, and OS/2. The disadvantage, however, is that it does not have the security, performance, and fault-tolerant features of Windows NT. Also, using the FAT file system limits you to the eight-character file names and three-character extensions.

If you want to implement a locally secure file system and use NTFS's high-performance capabilities, you should select the NTFS file system. If you select the FAT file system, the files on the server can be compromised by booting the NT server with a DOS disk and accessing the files on the NT server's FAT file system.

If you select the FAT file system, it is still possible to secure the files against network access, but not against local access.

The Setup program displays a message saying that the partition is being formatted. You see a completion status bar on the percentage of the partition that has been formatted.

17. You see a screen informing you about the location where you want the files to be installed. The default location is \WINNT. If you want to install the Windows NT Server in a directory other than the default directory, you can edit this value.

18. Press Enter to continue.

19. In addition to performing a basic examination, Setup can perform an exhaustive, and potentially time consuming, secondary examination of some drives. To allow Setup to perform this secondary examination, press Enter. To skip the secondary examination, press Esc. It is recommended that you perform the secondary examination of the hard disk, unless you are installing a test server and are short on time.

You see a status indicator showing the percentage of files being copied.

Occasionally, problems with CD-ROM drives, SCSI adapters, hard disks, or system board incompatibilities result in a failure to copy critical files properly. The Setup program displays a message that the checksums on the files do not match. You must fix the hardware problem before you can install Windows NT Server successfully. Sometimes using different types of RAM chips and incompatibilities between the RAM devices can cause strange errors during installation when files are being copied from the CD-ROM. If SIMMs are being used, ensure that they are of the same type and from the same manufacturer.

20. After all the files are copied, the Setup program asks you to remove any Setup disks from the floppy drive. After you remove the floppy disk, press Enter to restart the computer.

The Windows NT Server machine reboots.

21. After the computer restarts, you will see the Welcome to the Windows NT Setup Wizard screen. There are three parts to the Setup Wizard. The Setup Wizard parts are as follows:

n Gathering information about your computer

n Installing Windows NT Networking

n Finishing Setup

The Setup Wizard will guide you through the remainder of the setup process. Click on Next to continue and gather information about your computer.

22. You see a form asking you to enter your name and organization. Press Tab to go between fields or use the mouse to go to the next field (click on the next field). Click on Next to continue.

23. Enter your 10 digit "CD Key," located on the back of your CD case. Click on Next to continue.

24. You see the Licensing Modes screen asking you to choose "Per Server" or "Per Seat" licensing. If you choose "Per Server" licensing, you must specify the number of concurrent connections for which you're licensed. Each concurrent connection requires a separate CLIENT ACCESS LICENSE. If you choose "Per Seat" licensing, you can use the License Manager, located in the Administrative Tools folder, to record the number of CLIENT ACCESS LICENSES purchased. Click on Next to continue.

25. Enter a unique computer name (limited to 15 characters) for your server computer in your domain. Verify that you entered your computer name correctly and click on the Next button.

26. You see a form asking you to identify the Windows NT Server Type. You can select the Windows NT Server to act as a primary domain controller, backup domain controller, or as a stand-alone server computer. The domain controller is used to manage the domain's security policy and master database. If you do not want your server to manage the security policy and the master database for the domain, you should select the Windows NT Server as a stand-alone server computer.

You can change this security role only by reinstalling the Windows NT Server.

27. You see the Administrator Account password screen. You must enter a password, which will be used by the Administrator account. The password can be 14 digits or less, and is case-sensitive. Re-enter the password in the Confirm Password field. Click on Next to continue.

28. Setup can create an emergency disk that contains information on repairing your Windows

NT Server in case of file system or other damage. You see a prompt asking you whether you want to create this emergency disk. You generally should answer Yes, unless you already have created such an emergency disk from a previous installation that used the same Setup configuration information. Click on Next to continue.

NOTE: You can create (or update) the emergency disk after the installation by running the program RDISK.EXE, which is installed in the Windows NT Server SYSTEM32 directory.

29. Windows NT Setup displays a list of the following optional components groups that can be installed. These optional components groups follow:

- **Accessibility Options.** Includes options to change keyboard, mouse, sound, and display for people with mobility, hearing, and visual impairments.
- **Accessories.** Includes Windows NT accessories and enhancements.
- **Communications.** Includes accessories to help you connect to other computers and online services.
- **Games.** Includes Solitaire, Pinball, Minesweeper, and Freecell.
- **Multimedia.** Includes programs for video, animation, and for playing sound on CD-ROMs and sound cards.
- **Windows Messaging.** Includes Electronic Mail and messaging utilities.

The tasks that are to be performed have a "check" in the check box beside them. If you want to selectively install individual components or files within a component group, highlight the component group and click on the Details button. Figure 3.17 shows optional NT components.

The components with the amount of disk space follow:

Group Components	Bytes Used
Accessibility Options	0.1 MB
Accessories	7.1 MB
Communications	0.7 MB
Games	2.8 MB
Multimedia	6.6 MB
Windows Messaging	4.6 MB
Total	21.5 MB

FIGURE 3.17 *Optional Windows NT components.*

30. After you make your component selections, click on the Next button.

31. The Setup Wizard is now ready to install Windows NT Networking. Click on Next to proceed.

32. Setup needs to know how your computer will participate on the network. The options are as follows:

n **Wired to the network.** Your computer is connected to the network by an ISDN or Network adapter.

n **Remote access to the network.** Your computer uses a modem to remotely connect to the network.

You can choose to check both options.

33. During the installation process, Setup can detect network adapters installed in the Windows NT Server machine. You can select the Start Search button to have Windows NT automatically detect your network adapter. If you do not want to auto-detect the network adapter, but select the network adapter manually, you should select the "Select from list" button.

If you select the auto-detection feature, Setup probes the server hardware for a network adapter and stops at the first one it identifies. You can accept the identified network adapter or select "Find Next," which causes Setup to look for additional network adapters.

If you click on the "Select from list" button, Setup displays the Network Adapter Setup dialog box.

34. The Setup program lists the network adapters it has detected. Select the Next button.

35. Setup needs to know if you want to install the Internet Information Server (IIS). The IIS includes a Web server, FTP server, and Gopher server. Click on Next to continue.

36. After the NIC drivers are selected, you must select the network protocols. Your choices follow:

n **TCP/IP Transport.** This is Microsoft's implementation of the industry standard TCP/IP protocols. If your Windows NT Server needs to connect to the Internet or communicate with other Unix hosts or a host that uses TCP/IP protocols, you should select this option. Like IPX, the IP (Internet Protocol) protocol is routable. Select this option during installation if you already are familiar with TCP/IP network administration basics and have information such as the IP address, subnet mask, and DNS server address available at the time of installation. You can always install and configure the TCP/IP protocol as a separate step after the Windows NT Server installation. This option is selected by default.

n **NWLink IPX/SPX Compatible Transport.** Select this protocol if you have applications that need this protocol, or if you are installing Windows NT in a NetWare-based network.

n **NetBEUI Transport.** NetBEUI (Network BIOS Extended User Interface) is a native protocol used in Windows NT, LAN Manager, and IBM's LAN Server networks. It is meant for

small departmental-sized networks. According to Microsoft, NetBEUI is suitable for up to 200 clients. NetBEUI has some undesirable characteristics, such as the fact that it is not routable because it does not have an explicit network layer (layer 3 of the OSI model). Its other shortcoming is that it tends to use frequent broadcasts, which can add to the network traffic for large networks. Its advantage is its simplicity, because it does not require any explicit network configuration. NetBEUI also is installed automatically if you install the Remote Access Server (RAS). If your Windows NT Server communicates with other computers such as Windows for Workgroups, or LAN Manager networks that use NetBEUI protocols, you must select NetBEUI as one of the protocols.

37. After you select the network protocols, select the Next button.

38. Setup displays a list of services to be installed. To add additional services, click on the Select from list button, and select the services.

The following is a list of additional services:

- DHCP Relay Agent
- Gateway (and Client) Services for NetWare
- Microsoft DHCP Server
- Microsoft DNS Server
- Microsoft TCP/IP Printing
- Network Monitor Agent
- Network Monitor Tools and Agent
- Remoteboot Service
- RIP for Internet Protocol
- RIP for NwLink IPX/SPX compatible transport
- RPC support for Banyan
- SAP Agent
- Services for Macintosh
- Simple TCP/IP Services
- Windows Internet Name Service

Services can be added or removed later, by using the Network Applet, located in the Control Panel. Click on Next to continue.

39. Setup is now ready to install the previously selected network components. Click on Next to continue.

40. A dialog box appears that has filled in the NIC parameters that the Setup program recognizes. Verify that the NIC parameters shown match the actual hardware settings on the NIC. Click on the Continue button.

41. A dialog box appears that asks you if there is a DHCP server on the network.

Network components will be copied to the server, and you will be asked to configure the selected network components, as the setup process proceeds.

42. If you selected the NWLink IPX/SPX protocol stack, you see the NWLink IPX/SPX Protocol Configuration dialog box.

For Ethernet and Token Ring network adapters, you can select Auto Frame Type Detection to automatically detect the frame type for your network. You should select the auto-frame detection method if you are not sure of the frame type used for your network. If you know the different frame types that are used for your network, you can select the Manual Frame Type selection to add additional frame types.

If you are on a network that uses NetWare 3.11 or earlier servers, you can use Ethernet 802.2 frame types. For networks that use NetWare 3.12 (or higher) and NetWare 4.x, you can use Ethernet 802.2 frame types. For networks that use a mix of NetWare 3.11 (or earlier), NetWare 3.12 (or higher) and NetWare 4.x, you should specify both Ethernet 802.2 and Ethernet 802.3 frame types. If you have Macintosh stations on the network, you should add the Ethernet SNAP frame type. If you need to communicate with other TCP/IP-based workstations and servers that use the Ethernet II frame type (such as Unix workstations and NetWare TCP/IP platforms), you should add the Ethernet II frame types.

If asked, you also can select the IPX network number. This is an eight-digit hexadecimal number assigned to the cable segment.

43. For a Token Ring adapter, select the 802.5 frame type.

44. If you selected TCP/IP Protocol, you will see the TCP/IP Properties sheets. You must specify an IP Address, Subnet Mask, and Default Gateway. You also can configure DNS, WINS Address, DHCP Relay, and Routing.

Click on the OK button to continue.

45. Setup presents you the option to disable or enable network bindings, or to arrange the order in which your computer will find information on the network. Click on Next to continue.

46. Setup is now ready to start the network, and complete the networking installation. Click on Next.

47. If you had requested that Setup create a Primary Domain Controller, you are asked to

supply a Computer Name and a Domain Name. Click on Next to continue.

48. The Setup Wizard is ready to finish the installation process, and configure any remaining network related components. Click on Finish to complete the setup procedure.

49. If you has previously chosen to install the Internet Information Server, you are presented with the IIS installation options. Select the desired components and then select the installation directory. Click on OK to continue.

Select the IIS component publishing directory locations. Click on OK to continue.

Setup will copy and install the selected IIS components.

Optionally, you can install ODBC drivers. Select an ODBC driver from the list and click on the Advanced button to configure advanced ODBC installation options. Click on OK after you finish.

50. Setup displays the Date/Time Properties screen. Windows NT Server-based networks can be enterprise-wide, with servers located in in different time zones. To support such enterprise networks, you must specify the time zone for the Windows NT Server. You specify the time zone as the number of hours offset from GMT. Windows NT Server has built-in knowledge of whether daylight savings apply to a particular time zone. The time zone for the state of Indiana in the United States, for example, is listed separately from Eastern Time (U.S. and Canada) because there is no daylight savings time in that state. If the time zone were set to Eastern Time (U.S. and Canada), daylight savings time would be observed.

The time zones that are supported in Windows NT Server are listed in Appendix E.

You always can change the time zone setting after installation by activating the Date/Time Applet from the Windows NT Server Control Panel (see figs. 3.18 and 3.19). You can use the dialog box in figure 3.19 to set the date and time for the Windows NT Server computer.

You must select the date, time, and time-zone information. You also can check the box for automatically adjusting the daylight savings time. Make appropriate changes for your locale, then click on the Close button to continue.

FIGURE 3.18 *The Date/Time applet.*

FIGURE 3.19 *The Date/Time Properties dialog box.*

51. The Setup program displays the video adapter type that it found on your server computer. Select OK and use the controls to select the size and number of colors for your display (see fig. 3.20). You then can use the Test button to examine these settings.

FIGURE 3.20 *Using the Display settings.*

The Display settings include information on the following:

- n Color palette

- n Font size

- n Desktop area (in pixels)

- n Refresh frequency

You can list the other resolution modes or change the display type.

52. After you select OK, your graphics adapter is reset and a test bitmap is displayed for five seconds. You then must answer whether the test bitmap displayed successfully.

Click on the Ok button to save your configuration and continue.

53. Setup will copy any remaining files, set security on the system files, and save the configuration.

54. Setup is ready to create an "Emergency Repair Disk." Insert your ERD into the floppy drive and click on the OK button to continue. Setup usually formats the floppy disk and then copies the necessary files.

55. After the ERD has been created, remove all disks from floppy drives and remove compact discs from all CD-ROM drives. Click on the Restart Computer button to finish the setup installation process, then restart the computer.

56. The NTDETECT program probes the hardware, and the OS Loader loads Windows NT Server. During the installation, the type of system on the hard disk is FAT. After Windows NT boots from the hard disk, it converts the FAT file system to an NT file system because you have selected NTFS as your choice. After converting to NTFS, Windows NT reboots itself. The conversion is done only once at the time of installation.

57. After a few automatic reboots, you should see the Windows NT Server logo and log-on screen. Press Ctrl+Alt+Del to initiate the server login. Log in using the Administrator user name and the password that you set during installation for this account on the NT domain that you selected or created.

Shutting Down and Logging Out of a Windows NT Server

You can shut down or log out of a Windows NT Server by using any of the following methods:

Method 1

- 1.** Click on the Start button on the Taskbar.

- 2.** Click on Shut Down. You are then presented with three options, as follows:

- n Shut Down the computer?

n Restart the computer?

n Close all programs and log on as a different user?

If you select the Shut down the computer? option, applications are terminated and unsaved data in memory is flushed to disk. If you select the Restart the computer? option, Windows NT shuts down and restarts the computer as if you had just turned on the power to the computer (cold boot for Intel platforms). If you select the Close all programs and log on as a different user? option, applications are terminated, unsaved data in memory is flushed to disk, and you see the Begin Logon dialog box.

Method 2

1. Press the Ctrl+Alt+Del.

You see a screen that has a Logoff and Shut Down buttons, as well as Lock Workstation, Change Password, Task Manager, and Cancel (see fig. 3.21).

2. Click on the Logoff button or the Shut Down button. If you choose to log off or shut down, your applications are terminated and unsaved data in memory is flushed to disk. If you select the Shut Down option, you see another dialog box that contains a Shutdown and **R**estart option. When you choose the Shutdown and **R**estart option, Windows NT Server restarts the computer as if you had just turned on the power to the computer (cold boot for Intel platforms).

If you choose the **L**ogoff option, you are asked to confirm your choice of ending the Windows NT session.

FIGURE 3.21 *Using the Windows NT Security dialog box.*

Conclusion

In this chapter, you learned about the installation issues for the Windows NT Server. A guided tour of the Windows NT Server was provided. Many of the installation concepts needed to understand the Windows NT Server installation were discussed prior to showing you the installation procedure.

The installation procedures discussed in this chapter should suffice for the majority of installation situations. The next chapter discusses variations to the standard installation procedure.