

# OPERATING SYSTEMS TECHNOLOGIES EXAM

The fast facts listed in this chapter and the preceding chapter are designed as a refresher of key points and topics required to succeed on the A+ certification exam. By using these summaries of key points, you can spend an hour prior to your exam refreshing your knowledge of key topics to ensure that you have a solid understanding of the objectives and information required to succeed in each major area of the exam.

CompTIA has established two modules for the A+ examination: the Core Hardware Service Technician module and the Operating System Technologies module. The information here is organized to follow the sequence of the Operating System Technologies module test objectives, and each domain that follows includes the key points from each chapter in this book. If you have a thorough understanding of the key points here, chances are good that you will pass the exam.

This book is dedicated to the four domains covered in the A+ Operating System Technologies module. Now that you have read those chapters and answered all the review and exam questions at the ends of the chapters, you are ready to take the exam.

This chapter is designed as a quick study aid that you can use in less than an hour just before taking the exam. Its key points should jog your memory in critical areas. In addition to the information located in this chapter, remember to review the Glossary terms, which are intentionally not covered here.

CompTIA uses the following domains to arrange the



## Fast Facts

objectives for the Operating System Technologies module:

- 1.0 Operating System Fundamentals
- 2.0 Installation, Configuration, and Upgrading
- 3.0 Diagnosing and Troubleshooting
- 4.0 Networks

## 1.0 OPERATING SYSTEM FUNDAMENTALS

The 1.0 domain requires knowledge of major desktop components and interfaces and their functions. The technician should be able to differentiate the characteristics of Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP. This domain also requires knowledge of navigating through the operating system from the command-line prompts and Windows procedures for accessing and retrieving information. Finally, the domain specifies that the technician must be able to identify the major operating system utilities, their purpose, location, and available switches. The main points are as follows:

- There is a little-known MS-DOS system requirement that the `MSDOS.SYS` file must maintain a size in excess of 1KB.
- The `HIMEM.SYS` command loads the DOS extended memory driver (XMS), which manages the use of extended memory installed in the system so that no two applications use the same memory locations at the same time.
- `DRIVER.SYS` creates the logical drive assignments for the system's floppy drives (that is, A: and B:).
- Software creates virtual memory by swapping files between RAM and the disk drive. This memory-management technique effectively creates more total memory for the system's applications

to use. When the system runs out of available RAM, it shifts data to the virtual memory swap file on the disk drive.

- The size of the Windows 9x swap file, called `WIN386.SWP`, is variable and is dynamically assigned.
- The 4KB Windows NT/2000/XP pagefile (named `PAGEFILE.SYS`) is created when the operating system is installed.
- Windows 9x/Me is loaded when the startup routine locates and executes the file named `WIN.COM`.
- Windows 9x provides a mechanism for automatically starting programs whenever the operating system starts: You can add them to the system's `startup` folder. You can then bypass these programs for troubleshooting purposes by pressing the Left-Shift key during startup.
- Establishing a supplemental cache for the CD-ROM drive can enhance the efficiency of a Windows 9x system.
- If a Windows 9x/Me system has a `CONFIG.SYS`, `AUTOEXEC.BAT`, or `.INI` file that has been held over from a previous operating system, any unneeded commands in these files have the potential to reduce system performance. In particular, the `SMARTDRV` function from older operating systems inhibits dynamic `VCACHE` operation and slows the system.
- If a Windows 9x/Me system runs slowly, check the `CONFIG.SYS` and `AUTOEXEC.BAT` files for `SMARTDRV` and any other disk cache software settings.
- The `SYSTEM.INI`, `WIN.INI`, `PROTOCOL.INI`, `CONFIG.SYS`, and `AUTOEXEC.BAT` files can be modified through the System Editor (SysEdit) in Windows 9x/Me.
- In Windows 9x/Me, the system's configuration

information is held in a large hierarchical database called the *Registry*.

- The contents of the Windows 9x/Me Registry are located in two files in the `\Windows` directory: `USER.DAT` and `SYSTEM.DAT`. The `USER.DAT` file contains user-specific information, and the `SYSTEM.DAT` file holds hardware- and computer-specific profiles and setting information.
- Each time Windows 95 boots up successfully, the `USER.DAT` and `SYSTEM.DAT` files are backed up and given the `.DAO` extension.
- The backed-up contents of the Windows 98 Registry are stored in the `\Windows\Sysbckup` directory in the form of cabinet (`.CAB`) files, not as `.DAO` files.
- The `Sysbckup` folder is a hidden folder. To examine its contents, you must remove the hidden attribute from it. Inside the folder, the backup files are stored in the format `RB0XX.CAB`, where `XX` is a sequential backup number that is given to the file when it is created.
- The `Current_User` key (`HKEY_CURRENT_USER`) holds data about the user-specific configuration settings of the system, including color, keyboard, desktop, and startup settings.
- Enterprise networks are designed to facilitate business-to-business (B2B) or business-to-customer (or consumer; B2C) operations. Because monetary transactions and customers' personal information travel across these networks, they feature additional, highly protective security functions.
- Enterprise networks consist of multiple domains (called trusted domains) that are linked together but managed independently.
- An intranet requires that each segment have a protective gateway to act as an entry and exit point for the segment. In most cases, the gateway is a device called a router.
- Most enterprise networks are actually intranets. An intranet is a network built on the TCP/IP protocol that belongs to a single organization (that is, a private Internet). Like the Internet, intranets are designed to share information and services, but they are accessible only to the organization's members, with authorization.
- A relatively new term, *extranet*, is being used to describe intranets that grant limited access to authorized, outside users such as corporate business partners. This makes the extranet a partially private, partially public network arrangement.
- The primary domain controller (PDC) contains the directory database for the network. This database contains information about user accounts, group accounts, and computer accounts. You might also find this database referred to as the Security Accounts Manager (SAM).
- When Windows 2000 or Windows XP is first installed, the only usable account is the Administrator account. The Guest account is disabled by default. Someone who has administrator privileges must create any additional user accounts.
- Each user account is given a password and username.
- Authentication is the process of identifying an individual as who he or she claims to be. This process is normally based on usernames and passwords.
- The Windows XP Professional operating system is designed and positioned to compete with Windows NT Workstation and Windows 2000 Professional operating systems. It contains features that make it more suitable as a client in enterprise networks.
- Windows NT establishes virtual memory by creat-

ing the `PAGEFILE.SYS` file on disk. The VMM shifts data between RAM and the disk in 4KB pages.

- The Registry structure is primarily used to hold information about system hardware that has been identified by the enumeration or detection processes of the Plug-and-Play system.
- When a device is installed in the system, Windows should detect it, either directly or through the system's bus managers, and then search the Registry and the installed media sources for an appropriate driver. When the driver is found, it is recorded in the Registry along with its selected settings.
- The user settings portion of the Windows NT/2000/XP Registry is stored in the `NTUSER.DAT` file located in the `\Documents_and_Settings\username` folder. The System portions of the Registry are stored in special groupings called hives.
- The Windows NT and Windows 2000/XP Registries are not compatible with the Windows 9x Registries. This makes the Windows 9x/Me and Windows NT/2000/XP operating systems basically incompatible with each other. The contents of the Windows NT Registry are physically stored in five files, referred to as *hives*. Hives represent the major divisions of all the Registry's keys, subkeys, subtrees, and values.
- The `rdisk.exe` utility, which is located in the `\Winnt\System32` folder, can be used to create a backup copy of the Windows NT Registry in the `\Winnt\Repair` folder.
- The contents of the Registry can be edited directly by using the Windows NT/2000/XP Registry Editor (RegEdt32) utility. Although a copy of the RegEdit tool is available in Windows 2000 and XP, it was designed to work with Windows 9x clients. The editor used to manage the Windows NT/2000/XP Registry is `Regedt32.exe`, and it is located in the `\Winnt\System32` folder.
- In the case of a Windows NT partition, the bootstrap loader is the NT loader file named `NTLDR`. This file is the Windows NT equivalent of the DOS `IO.SYS` file and is responsible for loading the NT operating system into memory. Afterward, `NTLDR` passes control of the system over to the Windows NT operating system.
- With the mini file system in place, the `NTLDR` can locate and read a special hidden boot loader menu file named `BOOT.INI`. `NTLDR` uses this text file to generate the Boot Loader Menu that is displayed on the screen. If no selection is made after a given period of time, the default value is selected.
- The Storage Console provides a standard set of tools for maintaining the system's disk drives. These tools include the Disk Management tool, the Disk Defrag utility, and the Logical Drives utility.
- All the installed MMCs can be accessed either through the Control Panel or by selecting Start, Programs, Administrative Tools. You can also type `MMC` in the Run dialog box accessed from the Start menu.
- In Windows 2000/XP, the Device Manager is usually accessed through the Computer Management Console.
- Even though entries in the Registry can be altered through the RegEdt32 and RegEdit utilities, the safest method of changing hardware settings is to change their values through the Device Manager and other Control Panel icons.
- To access the MS-DOS emulator in Windows 9x or Windows NT 4.0, you select the Run option from the Start menu and type `COMMAND` in the Run

dialog box.

- To access the MS-DOS emulator in Windows 2000/XP, you select the Run option from the Start menu and type `CMD` in the Run dialog box.
- Files with `.COM`, `.EXE`, or `.BAT` extensions can be started directly from the command prompt.
- In hard-drive-based systems, it is common to organize related programs and data into areas called *directories*. This makes them easy to find and work with because modern hard drives can hold large amounts of information. The directories in the various versions of Microsoft operating systems can hold up to 512 directory or filename entries in the root directory.
- Special key combinations enable you to move between tasks easily. By pressing `Alt+Tab`, you can quickly select one of the open applications. Similarly, the `Alt+Esc` key combination enables you to cycle through open application windows. Pressing `Ctrl+Esc` opens the Start menu.
- Right-clicking an icon produces a pop-up menu that enables you to open, cut, or copy a folder (an icon that represents a directory); create a shortcut; delete or rename a folder; or examine properties of the folder.
- You use the View window to define how the folders and files in the selected window should be displayed onscreen.
- To see hidden and system files in Windows 98, you can select the View tab and click the Show Hidden Files button. The option in Windows 98 is called Show All Files. In Windows 2000/XP, the option is Show Hidden Files.
- Options that apply to the current window are displayed as dark text. Options that are not applicable to the window are grayed out.
- When a disk drive icon is selected, clicking the File option produces a menu that includes provisions for creating a new folder, formatting a disk, sharing a drive with the network community, backing up the contents of the drive, and displaying a drive's properties.
- A check mark located next to a menu option indicates that the item is currently in use.
- When you delete a folder or file from the Windows system, Windows removes the first three letters of its name from the drive's FAT so that it is invisible to the system. However, the system records the presence of the deleted file or folder in the Recycle Bin. The system is free to reuse the space on the drive because it does not know that anything is there. As long as it hasn't been overwritten with new data or been removed from the Recycle Bin, the file or folder can be restored from the Recycle Bin.
- If the Recycle Bin icon is missing, there are two ways to restore it: Establish a shortcut to the Recycle Bin by using a new icon or reinstall Windows 9x, which always places the Recycle Bin on the desktop.
- The Recycle Bin does not retain the files deleted from removable media, such as floppy disks and removable hard drives. When a file or folder is removed from one of these devices, the information is deleted directly from the system.
- If the taskbar is hidden, pressing the `Ctrl+Esc` key combination retrieves it and brings it to the screen. This pops up the Start menu, along with the taskbar. You can enter the Start, Settings, Taskbar, and Start menu options to change the taskbar settings so that the taskbar is not hidden.
- The Control Panel is the primary user interface for assigning ports for printers and mouse devices,

as well as for specifying how various peripheral devices respond.

- The Windows Control Panel is the user's primary interface for configuring system components.
- The Add New Hardware Wizard guides the manual installation process from the hardware component list and prompts for any necessary configuration information. If Windows 9x does not support a device, you must click the Have Disk button and load the drivers supplied by the device's manufacturer.
- You use the Windows Setup tab of the Add/Remove Programs applet to add or remove selected Windows 9x components, such as communications packages or additional system tools. You use the Windows Startup Disk tab to create a clean startup disk for emergency startup after a crash.
- The System Properties page features the General Information, Device Manager, Hardware Profiles, and Performance tabs. The General tab supplies information about the system's operating system version, registered owner, microprocessor type and RAM capacity, and ownership and registration.
- The Device Manager utility provides a graphical representation of the devices configured in the system. This interface can be used to identify installed ports, update device drivers, and change I/O settings. It can also be used to manually isolate hardware and configuration conflicts.
- In Windows 9x, you can access the Device Manager by selecting Start, Settings, Control Panel and then clicking the System icon.
- The Device Manager contains a set of buttons that permit its various functions to be accessed. These buttons include Properties, Refresh, Remove, and Print.
- MS-DOS does not allow some special characters in filenames: [ , ] , : , ; , + , = , \ , / , < , > , ? , and , .
- From the command prompt, you can use the `ATTRIB` command to change file attributes such as Read-only (+R or -R), Archive (+A or -A), System (+S or -S), and Hidden (+H or -H). The plus (+) and minus (-) signs add or subtract the attribute from the file.
- The \* notation is called a *wildcard*, and it allows operations to be performed with only partial source or destination information. Using the notation \*.\* tells the software to perform the designated command on any file found on the disk, using any filename and extension.
- A question mark (?) can be used as a wildcard to represent a single character in a filename or extension.
- When long filenames are displayed in non-Windows 9x systems, they are truncated (shortened) to fit the 8.3 DOS character format and identified with a tilde character (~), followed by a single-digit number.
- The tilde character (~) is inserted into the seventh character space for up to nine iterations of similar filenames. After that, Windows replaces the sixth character, for iterations up to 99. Windows 95 applies this same convention to the naming of directories.
- From Windows NT 4.0 forward, the NT operating system has been able to handle long filenames. Filenames in Windows NT can be up to 256 characters long.
- Filenames in Windows 2000 can be up to 215 characters long, including spaces.
- Windows 2000 filenames cannot contain the following characters: /, \, :, \*, ?, ", and |.

- Files and folders can be encrypted from the command line using the `CIPHER` command. You can obtain information about the `CIPHER` command and its many switches by typing `CIPHER /?` at the command prompt.
- To encrypt a file, you can access its properties page by right-clicking it and selecting the Properties option from the pop-up menu. Then, you move to the Advanced Attributes screen under the General tab and click the Encrypt Contents to Secure Data check box.
- To compress a particular file or folder, right-click it in Windows Explorer and then select the Properties option followed by the Advanced button to access its Advanced Properties screen. Click the Compress Contents to Save Disk Space check box to compress the file or folder.
- You can mark compressed files so that they are displayed in a second color for easy identification. You do this through the Folder Options setting in the Control Panel. From this page, you select the View tab and click in the Display Compressed Files and Folder with Alternate Color check box. The only other indication you receive concerning a compressed or encrypted file or folder is an attribute listing when the view setting is configured to display in Web style.
- You can expand the contents of a folder by clicking the plus (+) sign node beside the folder. Conversely, you can contract the contents of a folder by clicking the minus (-) sign node.
- Right-clicking a document file in Windows Explorer or My Computer produces a pop-up menu with options that enable you to copy, cut, rename, open, or print the document.
- By default, the Windows Explorer does not show `.SYS`, `.INI`, or `.DAT` files.
- Changing file attributes from Windows Explorer involves right-clicking the desired file, selecting the Properties option from the pop-up list, moving to the General page, and clicking the desired attribute boxes.
- To create a new folder in Windows Explorer, you select a parent directory by highlighting it in the left window. Then you click the File menu button, move the cursor to the New entry, and slide across to the Folder option and click it.
- Right-clicking a new icon produces a menu that has options to rename the icon, create a shortcut for the icon, and establish the icon's properties (including its attributes).
- A small arrow in the lower-left corner of an icon identifies the icon as a shortcut icon.
- The Windows XP All Programs menu contains the usual entries from previous Programs menus. Technicians should be most familiar with the contents of the Accessories and Administrative Tools options. These two locations provide the most direct access to most of the diagnostic and maintenance tools provided by the Windows XP operating system.
- One additional technician-related entry to note in the Windows XP All Programs menu is the Remote Assistance icon. This utility can be used to enable remote computer users, such as remote technicians or administrators, to take over the local computer and operate it from their desktop.
- The Windows XP Remote Assistance feature must be activated locally; this process normally involves turning control over to a trusted individual for assistance purposes.
- The Windows 2000/XP Administrative Tools menu is another key location for technicians. This applet provides access to the system's major administration and management tools.

- Important entries in the Administrative Tools submenu include the Computer Management applet, which has tools for managing the system's disk systems as well as both local and remote computers; the Local Security option, which is used to configure local security policies; and the Event Viewer and Performance tools, which are used to monitor system events and performance so that problems can be spotted and corrected before major failures occur.
- In Windows XP, the Control Panel option is included directly on the Start menu instead of a submenu.
- The Windows XP Control Panel includes advanced applets for wireless networking and speech functions not found in other versions, as well as a taskbar and Start menu option that can be used to customize these structures and control what items are displayed through them. A new feature provided in this applet is the ability to lock the taskbar so that it cannot be moved or changed.
- Installing a new operating system on a hard drive takes five basic steps: Partition the drive for use with the operating system, format the drive with the basic operating system files, run the appropriate Setup utility to install the complete operating system, load all the drivers necessary for the operating system to function with the system's installed hardware devices, and reboot the system to activate all the system components.
- The first, or primary, partition exists as drive C:. After the primary partition is established and properly configured, an additional partition, referred to as an *extended partition*, is also permitted. The extended partition may be subdivided into 23 logical drives.
- The high-level format procedure is used to load an operating system into a partition.
- In a FAT-based system, a *cluster* is the smallest piece of manageable information.
- The sectors on a FAT-based disk hold 512 bytes each.
- Each directory and subdirectory (including the root directory) can hold up to 512 32-byte entries that describe each of the files in them.
- On a hard-disk drive, 32 sectors are normally set aside for the root directory. Therefore, the root directory for such a disk can accommodate up to 512 entries.
- In Windows 9x, you can convert partitions created on a FAT16 drive into a FAT32 file system by using the `CVT.EXE` command-line utility. You can also perform this operation by accessing the Drive Converter (FAT32) utility by selecting Start, Programs, Accessories, System Tools, Drive Converter. Selecting this option runs the `CVT1.EXE` file, which starts the Drive Converter Wizard. The main drawback to doing this is that there is some possibility of data corruption and loss. Not surprisingly, there is no utility for converting FAT32 partitions to FAT16.
- To use the FAT32 system, the hard drive must be formatted using the `FDISK/FORMAT` functions in OSR2. This makes FAT32 incompatible with older versions of Windows (even Windows 95a and Windows NT) and disk utilities and troubleshooting packages designed for FAT12/16 systems.
- To use the FAT32 `FDISK` function in OSR2, you need to enable the Large Disk Support option. After completing the `FDISK` operation, manually reboot the system and perform a `FORMAT` operation using the OSR2 CD, or start disk.
- The VFAT system replaces the SMARTDRV disk-caching utility with a protected-mode driver named VCACHE.

- Windows NT, Windows 2000, and Windows XP disk organization is based on a more dynamic Master File Table (MFT) structure.
- The smaller cluster size of the NTFS format makes it more efficient than FAT formats for storing smaller files. It also supports larger drives (more than 1GB) much more efficiently than FAT16 or FAT32 structures. NTFS is more complex than the FAT systems and therefore is not as efficient for smaller drives.
- Windows 2000 supports several file-management system formats, including FAT, FAT16, FAT32, CDFS (which is used on CD-ROMs), and NTFS4, along with the new and improved NTFS5.
- NTFS offers the following benefits over other file-management systems: More efficient drive management due to its smaller cluster size capabilities; support for very large drives, made possible by its 64-bit clustering arrangement; increased folder and file security capabilities; recoverable file system capabilities; and built-in RAID support.
- The Windows 2000/XP Disk Management utility is a graphical tool that handles two distinctive types of disks: basic and dynamic disks.
- A basic disk is a physical disk that contains partitions, drives, or volumes created with Windows NT 4.0 or earlier operating systems.
- A dynamic disk is a physical disk created from a basic disk using the Windows 2000 Disk Management utility.
- To install Windows 2000 or Windows XP on a dynamic volume, the volume must be either simple or mirrored, and it must be a volume that has been upgraded from a basic volume.
- You can convert basic volumes to dynamic volumes by using the Disk Management tool. You do this by selecting Start, Run; entering `DISKMGMT.MSC` in the Run dialog box; and then clicking the OK button.
- A simple volume contains disk space from a single disk and can be easily extended if necessary if it was originally created as a dynamic volume.
- A spanned volume contains disk space from two or more disks (up to a maximum of 32). The amount of disk space derived from each disk can vary.
- A mirrored volume consists of two volumes on different disks that are the same size and contain exactly the same data. In the event that one of the disks fails, the other will continue functioning, providing disk fault tolerance (RAID-1).
- Striped volumes contain disk space from two or more disks (up to a maximum of 32). The amount of disk space derived from each disk must be the same. These volumes offer the best disk-drive system performance.
- A RAID-5 volume, also known as a striped volume with tolerance, provides disk fault tolerance. The data is divided into 64KB chunks and written to all the drives in a fixed order.
- Only systems running Windows 2000 or Windows XP can access dynamic volumes. Therefore, basic volumes should be established on drives that Windows 9x or Windows NT 4.0 systems need to access.
- In Windows 9x or Windows Me systems, the Disk Management functions are located in several areas of the system. You can find the icons for Backup, ScanDisk, and Disk Defrag by selecting Start, Programs, Accessories, System Tools, and then the appropriate program. The executable file for ScanDisk can be found in `C:\Windows\Command`. The Disk Defrag program is under `C:\Windows`. The Backup utility is located in `C:\Program_Files\Accessories` in Windows

- 9x/Me, in `C:\WINNT\SYSTEM32` in Windows NT/2000, and in `C:\Windows\System32` in Windows XP.
- Over time, lost units can pile up and occupy large amounts of disk space. To remove lost units from the drive, you can add the `/F` modifier to the `CHKDSK` command, to convert the lost units into files that can be investigated and removed if necessary. In some cases, the converted file is a usable data file that can be rebuilt for use with an application. You often use the `CHKDSK /F` command before running a drive defragmentation program.
  - By default, the command-line version of ScanDisk runs automatically during startup whenever the operating system detects that the system was not shut down properly. However, the ScanDisk utility was removed from the Windows XP operating system.
  - The standard ScanDisk operation examines the system's directory and file structure. However, a thorough option can be selected to examine the physical disk surface, as well as its files and directories. If potential defects exist on the surface, ScanDisk can be used to recover data stored in these areas.
  - If a user decides to install the Windows Backup feature, the actual Backup utility file (`Backup.exe`) is placed in the `C:\Program Files\Accessories` directory. Windows also creates a shortcut icon for the Backup utility in the `C:\Windows\Start Menu\Programs\Accessories\System Tools` directory.
  - In a full, or total, backup, the entire contents of the designated disk are backed up, including directory and subdirectory listings and their contents. This backup method requires the most time each day for backing up, but it also requires the least time for restoring the system after a failure because only the most recent backup copy is required to restore the system.
  - Restoring a system from an incremental backup requires the use of the last full backup and each incremental backup taken since that full backup was made. This method requires the least time for backing up the system but the most time for restoring the system.
  - The differential backup option is a valuable time saving feature in a periodic backup strategy. To restore a system, you need a copy of the last full backup and the last differential backup.
  - The Grandfather-Father-Son method uses three different groupings of backup tapes: the Grandfather for monthly backups, the Father for weekly backups, and the Son for daily backups.
  - In addition to backing up data files and applications, also backing up the key system configuration and information is often convenient. This type of data, called *System State data*, is stored so that the system can be rebuilt quickly in case of a failure. Windows 2000 and Windows XP Backup utilities provide an option specifically to perform System State data backup. The System State data can be backed up by itself or as part of the regularly scheduled system backup operation.
  - The Disk Defrag program realigns the positioning of related file clusters to speed up the operation of the drive.
  - In Windows 2000 you can access the Disk Defrag program by selecting Start, Settings, Control Panel, clicking the Administrative Tools icon, and then selecting Computer Management.
  - To minimize the adverse effects of poorly written device drivers on a system, Microsoft works with hardware suppliers and signs (that is, certifies) their drivers for Windows 98 compatibility by adding special digital codes to them. This driver-signing tool is valuable to administrators who do not want users to introduce questionable devices and drivers into the system.

- The System Monitor can be used to track the performance of key system resources for both evaluation and troubleshooting purposes. If system performance is suspect but there is no clear indication of what might be slowing down the system, the System Monitor can be used to determine which resource is operating at capacity, thereby limiting the performance of the system.
- The Device Manager displays an exclamation point (!) inside a yellow circle whenever a device is experiencing a direct hardware conflict with another device. The nature of the problem is described in the device's Properties page.
- When a red X appears over a device's icon, the device has been disabled because of a user-selection conflict. This situation can occur when a user wants to disable a selected device without removing it, and this arrangement can be established through the Device Manager's Disable in This Hardware Profile option. Selecting this setting keeps the driver from loading until it is reactivated and is located in the Properties page for the particular device.
- When you suspect a device conflict, you can click the name of the offending device in the Device Manager listing, right-click the item, select Properties from the pop-up menu, and then click the Resources tab to examine the conflicting device's list. You can also access the Properties page by double-clicking the device driver name.
- Windows 2000 and Windows XP include two Registry editors: RegEdit and RegEdt32. Both of these utilities enable you to add, edit, and remove Registry entries and perform other basic functions. However, you can perform specific functions only in one editor or the other.
- RegEdt32 is the Registry editor that has historically been used with Windows NT versions.
- As a system operates, the Dr. Watson utility monitors the code moving through the system and logs its key events in the `DRWATSON.LOG` file. The Dr. Watson log contains a list of the events that were going on up to the time of a system error occurrence.
- You also can start Dr. Watson through the Tools menu in the System Information screen. You can find this option by selecting Start, Programs, Accessories, System Tools, Dr. Watson.
- To empower the network administrator, Windows 2000 and XP furnish two types of permissions that administrators can apply to files and folders in Windows NT systems: Share and NTFS permissions.
- Share permissions can be assigned only to the folder level. However, Windows 2000 and XP NTFS permissions are much more robust than share permissions. These permissions can be set at the file level in NTFS systems. However, share permissions are the only network access control option available for non-NTFS partitions.
- The NTFS5 system includes security features that enable permission levels to be assigned to files and folders on the disk. These permissions set parameters for activities that users can conduct with the designated file or folder.

## 2.0 INSTALLATION, CONFIGURATION, AND UPGRADING

The 2.0 domain requires knowledge of installing, configuring, and upgrading Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP, and bringing the operating system to a

basic operational level. This domain requires the technician to identify steps to perform an operating system upgrade from Windows 9x/ME, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP. He or she must also be able to describe the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

Furthermore, the domain requires that the technician be able to identify procedures for installing/adding a device—including loading, adding, and configuring device drivers—and required software. Finally, the domain specifies that the technician must be able to identify procedures necessary to optimize the operating system and major operating system subsystems.

The main points are as follows:

- The operating system release is the version of the installation media produced and distributed as a complete unit.
- Rather than provide customers with new versions of the operating system when new features are added or major problems are corrected, software manufacturers provide OEM patches for their products.
- Patches released in the form of updates, or in collections that include additional functionality or new device drivers, are referred to as service packs.
- Windows 95 must be installed over an existing operating system. In particular, the Windows 95 installation program must find a recognizable FAT16 partition on the drive.
- A Windows 95 system must be at least an 80386DX or higher machine, operating with at least 4MB of RAM (8MB is recommended).

- Although 80386DX is the listed minimum microprocessor for running Windows 95, the recommended processor is an 80486DX; Pentium processors are actually the preferred microprocessors for running Windows 95. Likewise, 4MB may be the minimum RAM option, with 8MB being the recommended option, but 16MB, 32MB, and 64MB are preferred for running Windows 95.
- To install Windows 98, the system hardware must be at least an 80486DX/66 or higher machine, operating with at least 16MB of RAM. The system should also possess a modem, a mouse, and a 16-color VGA or better monitor. The system's hard drive should have between 120MB and 355MB of free space available to successfully install Windows 98.
- The minimum hardware requirements for installing Windows 2000 Professional on a PC-compatible system are a 133MHz Pentium P5 equivalent or better microprocessor, 64MB to 4GB maximum of RAM, 650MB or more free hard-drive space on a 2GB drive, and VGA monitor.
- If your system has hardware devices that are not on the Windows 2000 Hardware Compatibility List, you should contact the manufacturer of the device to determine whether it has new, updated Windows 2000 drivers for the device.
- In the case of 16-bit operating systems, such as MS-DOS or Windows 3.x, the `winnt.exe` option should be used. `winnt32.exe` is used with 32-bit operating systems.
- Any antivirus programs should be disabled prior to running Windows 98 Setup. Antivirus programs can be re-enabled after the setup process has been completed.

- The easiest upgrade path to Windows 2000 is from the Windows NT 4.0 operating system. Upgrading from Windows 9x is potentially more difficult.
- You should be able to install Windows 2000 by simply starting the system with the Windows 2000 distribution CD-ROM in the drive so that it can be auto-detected.
- The minimum microprocessor requirements for installing Windows XP Professional on a PC-compatible system are Pentium II 233MHz or higher or compatible processor required; Pentium II 300MHz or compatible processor recommended. Dual-processor configurations are also supported with Windows XP.
- The minimum RAM requirements for installing Windows XP Professional on a PC-compatible system are 64MB required; 128MB recommended. The more memory installed, the better. Maximum supported RAM is 4GB.
- The minimum HDD space requirements for installing Windows XP Professional on a PC-compatible system are 2GB with 650MB of free space required; 2GB of free hard-disk space is recommended. A 1.5GB partition size is required, with 2GB recommended. Additional disk space is required for installing over a network. The maximum hard-disk space supported for a partition is 2TB.
- Systems can be upgraded to Windows XP Professional from Windows 98 and Windows Me as well as Windows NT 4.0 (with Service Pack 5) workstations and Windows 2000. This includes older FAT16, FAT32, and NTFS systems. As was the case with Windows 2000, the Windows XP operating system can recognize all three file-system types when it is installed.
- If a disk is formatted with NTFS, MS-DOS and Windows 9x/Me operating systems are not able to read the files in the NTFS partition. These operating systems are not NTFS aware. However, Windows NT and Windows 2000 can both operate with the FAT file systems used by MS-DOS and Windows 9x/Me.
- If the BIOS does not locate the boot record in one of the indicated drives, it is likely to display a `Non-System Disk or Disk Error Or ROM BASIC Interpreter Not Found` message onscreen.
- The following files, in the following order, are required to boot an MS-DOS system: `IO.SYS`, `MSDOS.SYS`, `CONFIG.SYS`, `COMMAND.COM`, and `AUTOEXEC.BAT`.
- Pressing the F5 key, or the Left-Shift key, during MS-DOS startup skips over the `CONFIG.SYS` and `AUTOEXEC.BAT` files. Pressing the F8 key proceeds through the `CONFIG.SYS` and `AUTOEXEC.BAT` files one step at a time, waiting for confirmation from the user.
- `IO.SYS` loads the `WIN.COM` file to control the loading and testing of the Windows 9x core components.
- In a dual-boot system, a startup menu is established; it can be used to boot the system into different operating systems on the disk. Depending on which operating system option the user selects from the menu, the system retrieves the correct set of files and then uses them to boot the system.
- Windows 9x creates a folder for each user who logs on to the system. This profile is held in the `\Windows\Profiles` subdirectory. Each profile contains a `USER.DAT` file (the second half of the Registry) that holds the Registry information for that user. It also contains a number of other files that customize the desktop for that user. As with the `SYSTEM.DAT` file, the `USER.DAT` file is backed up as `USER.DA0` each time the Windows 95 system is

rebooted. Under Windows 98, the `USER.DAT` backup is part of the `rb000x.cab` files.

- When the Logged option is selected, the system attempts to start in normal mode, but it keeps an error log file (`BOOTLOG.TXT`) that contains the steps performed and the outcomes. You can read the `BOOTLOG.TXT` file using any text editor, or you can print it out on a working system.
- You can access Safe Mode by pressing the F5 function key when the `Starting Windows 9x` message is displayed onscreen.
- In Safe Mode, the minimal device drivers (keyboard, mouse, and standard-mode VGA drivers) are active to start the system. However, the CD-ROM drive is not active in Safe Mode.
- In Step-By-Step Confirmation mode, the system displays each startup command line by line and waits for a confirmation from the keyboard before moving ahead.
- You can obtain the Step-By-Step Confirmation Mode option by pressing the F8 function key at the Startup menu.
- The Safe Mode Command Prompt Only option performs the same function as pressing Shift+F5 during the bootup process.
- After gaining access to a system by using a boot disk, you should attempt to start Windows by typing the `WIN` command at the command prompt.
- If a Windows NT system employs a SCSI disk drive, a driver file named `NTBOOTDD.SYS` needs to be present in the root directory of the system partition. The `NTLDR` program can also load driver files that have been renamed `NTBOOTDD.SYS` to enable Windows NT 4.0 and Windows 2000 to use drives larger than 8GB (even EIDE drives).
- During startup, the Windows 2000/XP `NTLDR` file causes the system to display a boot selection menu that includes options to start the system in VGA mode and in a Last Known Good Hardware Configuration mode. These modes are the alternative startup modes from Windows NT 4.0, and they have been carried over to the Windows 2000 and Windows XP versions.
- Selecting the Last Known Good Configuration mode option causes the system to start up by using the configuration information that it recorded the last time a user successfully logged on to the system.
- To make a boot disk truly useful, you should include at least a few utilities that can be used to provide initial troubleshooting functions after you have gained access to the system. These functions include partitioning, formatting, file editing, and diagnostic utilities.
- During the Windows setup operation, the software provides an option for creating an emergency start disk. You should use this option for every Windows 9x installation. An emergency start disk can also be created through the Control Panel's Add/Remove Programs icon.
- The Windows 98 version of the emergency start disk is basically a boot disk with key Windows 98 utilities included, to assist in restarting the system when Windows 98 doesn't boot. You can create this disk during the installation process or by accessing the Startup disk tab in the Control Panel's Add/Remove Programs window.
- In addition to the necessary system files required to start the system in a minimal, real-mode condition, the Windows 98 Startup disk provides a number of diagnostic programs and a trio of real-mode CD-ROM drivers (`MSCDEX.EXE` for IDE drives and `BTDCDROM.SYS` and `ASPICD.SYS` for SCSI drives), to enable the CD-ROM drive to operate in Safe Mode.

- You can use the `EXTRACT` command to pull necessary files from the cabinet (`.CAB`) files on the Windows 98 distribution CD-ROM.
- Setup disks are the equivalent of the Windows 9x Startup disk. Windows NT 4.0 generates a three-disk set, and Windows 2000 creates a four-disk set. Unlike the Windows 9x Startup disk, the Setup disks do not bring the system to a command prompt. Instead, they initiate the Windows Setup process.
- Both Windows NT 4.0 and Windows 2000 provide for an emergency repair disk (ERD) to be produced. The ERD is different from the Setup disks in that it is intended for use with an operational system when it crashes. It is not a bootable disk and must be used with the Setup disks or the Windows distribution CD.
- The emergency repair disk provides another repair option in the event that Safe Mode and the Windows 2000 Recovery Console do not enable you to repair the system. If you have already created an ERD, you can start the system with the Windows 2000 Setup CD or the Setup floppy disks and then use the ERD to restore core system files.
- To create setup disks in Windows NT 4.0, you must install the Windows NT distribution CD-ROM in the system and type `WINNT /ox` at the command prompt.
- In Windows 2000, you must place the distribution CD in the drive and launch the `MakeBootDisk` utility to create the four disk images for the Windows 2000 setup disks. You can also create a setup disk from the command prompt by using the `MAKEBT32.EXE` file for Windows 2000. You can also make these disks by selecting Start, Run; clicking Browse; and then selecting the CD-ROM drive. Then select the `BOOTDISK` option, followed by the `MAKEBT32.EXE` command.
- In Windows NT 4.0, you can create an ERD after the operating system installation by using the Repair Disk program (`RDISK.EXE`). To do so, select Start, Run; enter the `CMD` command in the Run dialog box; and then type `RDISK` at the command prompt.
- In the Windows XP operating system, the emergency repair disk has been replaced with an emergency startup tool called the Automated System Recovery (ASR). The ASR tool can be used to back up and restore the system state information, along with all the files stored on the system volume. As with the Windows NT/2000 emergency repair disk, the ASR feature is considered to be the last resort to use when you have been unable to recover the system using other methods, including Safe Mode, Last Known Good Configuration mode, and the Recovery Console.
- The Windows 2000 Setup routine prompts you to create an ERD during the installation process. You can also create an ERD by using the Windows 2000 Backup utility, which you can find by selecting Programs, Accessories, System Tools, Backup.
- You can find the Add New Hardware icon under the Control Panel option of the Settings menu. You can also access it through the Hardware tab of the System Properties page.
- If the Add New Hardware Wizard does not detect the hardware, you can attempt to locate the device in the wizard's list of supported devices. The only other option for installing hardware devices is to obtain for the device an OEM disk or CD-ROM that contains Windows 9x drivers. If the driver disk/CD-ROM does not have an AutoStart function, you need to click the Have Disk button and supply the file's location to complete the installation process.

- To determine what devices Windows NT, Windows 2000, or Windows XP supports, you must consult the Hardware Compatibility List for the version of Windows NT/2000/XP being used.
- To find new or updated drivers for a specific device, you should contact the product vendor's Web site and search for your specific network operating system. Typically, you need to know the specific make and model of your device. In most cases, you can download the appropriate device drivers directly from the vendor's Web site or obtain them through mail.
- If drivers for the device being installed are not listed in the Hardware Compatibility List, there is a good chance the device will not operate, or will not operate well, in the Windows NT environment. If this is the case, the only recourse is to contact the device's manufacturer for Windows NT drivers. It is a good idea to check the manufacturer's Web site for updated drivers that you can download.
- Some Windows 9x applications may share support files (such as .DLL files) with other applications. In these instances, the Uninstall utility produces a dialog box that asks about deleting the shared files. The best response is to keep the file to avoid disabling the other applications. If the files are to be deleted, you should make a backup before running the Uninstall utility so that the files can be replaced if needed.
- For applications that don't feature the automatic installation function, or if the AutoPlay function is disabled, the software must be installed manually. You do this by clicking the Have Disk button. A dialog box then asks for the name and location of the application's installation file. Most software suppliers provide a SETUP.EXE file or an INSTALL.EXE file to handle the installation and configuration process for their software.
- One of the optional Windows components that you may not choose to install is the Accessibility options group. This group contains programs that modify the operations of the Windows keyboard and audio and video output for use by those who have physical conditions that inhibit their use of the computer.
- When Windows is restarted in MS-DOS mode, a batch file named DOSSTART.BAT runs automatically. This file is used to load real-mode DOS drivers for items such as mouse devices, sound cards, or joysticks.
- If an MS-DOS application takes up the entire screen in Windows 9x, you should press Alt+Enter to switch the application into a window. The Alt+Tab key combination switches the display to another application.
- Some applications grab an entire screen, covering the toolbar and Start menu, when maximized. When this situation occurs, you need to resize the application's window through the Screen tab to access the toolbar. You can press Ctrl+Esc at any time to access the Windows 9x Start menu.
- In Windows 98, Microsoft includes a Make Compatible utility that can be used to establish compatibility between the application and operating system. You can execute this utility by selecting Start, Run and then typing `mkcompat.exe` in the Run dialog box.
- In versions of Windows before Windows 2000, applications copy similar versions of shared .DLL files and other support files into the `\windows` folder. When a new application overwrites a particular .DLL file that another application requires for proper operation, a problem is likely to occur with the original software package.
- To access the MS-DOS emulator in Windows 2000 or XP, you can select Start, Run; type the

command `CMD` or `COMMAND` in the Run dialog box; and then click the OK button.

- All printing activities in both Windows 9x and Windows 2000 are controlled through the Windows Print Manager, which you can find in the My Computer folder or access by selecting Start, Settings, Printers. You can also access the Print Manager via the Control Panel.
- To print an open file in Windows 9x, move to the application's File menu and select the Print option. If the file is not open, you can still print the file in Windows 9x. Under the My Computer icon, right-clicking a selected file produces a Print option in a pop-up menu. You can use this right-clicking method to print files from Windows Explorer. You can also print files by dragging and dropping them onto a printer icon in the Printers folder, in the Network Neighborhood, or on the desktop.
- You can change the settings for any printer through the My Computer icon on the desktop or by selecting Start, Settings, Printers. The process is the same for both routes: Simply double-click the Printer folder, right-click the desired printer, and select the printer's Properties entry from the pop-up menu.
- Because the print spooler service runs in its own 32-bit virtual environment, printer hangups do not lock up a system. The print jobs in the queue are completed unless they are deleted from the list.
- If a physical printer is connected to a remote computer, referred to as a *print server*, the remote unit must supply the printer drivers and settings to control the printer. Likewise, the print server must be set up to share the printer with the other users on the network.
- To install a network printer, click the Network Neighborhood icon on the desktop, select the

remote computer's network name, select the remote unit's printer name, right-click on the printer icon, and select the Install option. After the remote printer is installed, the local computer can access it through the Network Neighborhood icon.

- If a printer is not recognized as a model supported by the Windows 9x driver list, you can install an OEM driver from a device manufacturer's installation disk that contains the `OEMSETUP.INF` file.

## 3.0 DIAGNOSING AND TROUBLESHOOTING

The 3.0 domain requires the ability to apply knowledge to diagnose and troubleshoot common problems relating to Windows 9x/Me and Windows NT/2000/XP. In particular, the technician must be able to recognize and interpret the meaning of common error codes and start-up messages from the boot sequence and identify steps to correct the problems, determine when to use common diagnostic utilities and tools and select the appropriate steps needed to resolve the problems, and be able to recognize common operational and usability problems and determine how to resolve them. The main points are as follows:

- As with suspected hardware-related problems, you begin troubleshooting startup and other operating system problems by talking to the person who reported the problem. Remember that one of your first tasks is to eliminate the user as a possible cause of the problems.
- A memory speed mismatch or mixed RAM problem might produce a `Windows Protection Error` message during the installation process. This error indicates that the operating system is having timing problems that originate from the RAM used in the system.

- You should check the Hardware Compatibility List to ensure that your hardware is compatible with Windows 2000 or XP. If any part of your hardware is not listed, contact the hardware vendor to determine whether it supports Windows 2000 or XP before starting the installation.
- To determine the current version of a Windows operating system running on a computer, right-click the My Computer icon, select the Properties option from the pop-up menu, and select the General tab of the System Properties page.
- You can repair a system after a `Missing Command Interpreter` error by restoring the boot record and operating system files to the hard disk. To do so, you normally copy or extract the files from a clean boot disk to the hard drive. In a FAT environment, if the boot disk contains a copy of the `FDISK` command, you can use the `FDISK /MBR` command to restore the hard drive's master boot record, along with its partition information.
- The special function keys available during the Windows 9x startup are F5 (Safe Mode), F6 (Safe Mode with network support), F8 (Step-by-Step Confirmation mode), and Shift+F5 (safe mode, command-prompt only).
- If a `HIMEM.SYS` error occurs, you can use the System Editor to check the syntax and correctness of the entry in the `CONFIG.SYS` file, if present. With Windows 9x, the `HIMEM.SYS` statement must be present in the Windows directory and must be correct for the operating system to run.
- The following conditions produce a bad or missing `COMMAND.COM` error message: The `COMMAND.COM` file cannot be found on the hard drive, and no bootable disk is present in the A: drive; the `COMMAND.COM` file is not located in the hard drive's root directory (this message is likely to occur when you are installing a new hard drive or a new MS-DOS version); and you inadvertently erase the `COMMAND.COM` file from the hard drive.
- You can use the MS-DOS `ATTRIB` command to verify that the hidden system files have been successfully copied to the disk (that is, `Attrib -r -s -h c:\IO.SYS` and `Attrib -r -s -h C:\MSDOS.SYS` to make them visible and to remove their read-only and system status).
- To restore the `COMMAND.COM` file from the command line, you can start the system from the startup disk and use the Copy command to transfer the file manually.
- In a FAT environment, if the boot disk contains a copy of the `FDISK` command, you can use the `FDISK /MBR` command to restore the hard drive's master boot record, along with its partition information.
- As with the manual copy procedure, the `COMMAND.COM` file's Read-only, System, and Hidden attributes must be removed for the file to be manipulated within the system.
- If the system locks up and does not start, the swap file may have become corrupted, or the virtual memory setting may have been changed to Disabled. In either case, you must reinstall Windows 9x to correct the problem.
- You should check the device or driver files referenced in `Missing INI Files` error messages to make certain that they have been properly identified and that their location and path are correct. If they are not, you can use the System Editor to make the necessary changes by installing the specified device driver in the designated `.INI` file.
- Errors in the `CONFIG.SYS` and `AUTOEXEC.BAT` files produce the `Error in CONFIG.SYS Line XX` and `Error in AUTOEXEC.BAT Line XX` messages. The line specified by the `XX` in the error message contains a syntax (spelling, punctuation, or usage)

- error that prevents it from running. Syntax errors can also produce an `Unrecognized command in CONFIG.SYS` message. These errors are caused by missing or corrupt files referenced in the `CONFIG.SYS` or `AUTOEXEC.BAT` files. To correct these errors, use one of the system's text editors, such as `SYSEDIT`, to correct the designated line in the file, reload the indicated file with a known-good copy, and restart the computer.
- You can enter Step-by-Step Confirmation mode by pressing the F8 function key at the Startup menu.
  - Starting Windows 9x from the command prompt by using `WIN /D` is often helpful for isolating different areas of the operating system as possible problem sources. This command can be used to prevent different functions from being executed during the startup procedure.
  - The `BOOTLOG.TXT` file contains the sequence of events conducted during the startup of the system. The original `BOOTLOG.TXT` file is created during the Windows 9x setup process. You can update the file by pressing the F8 key during startup or by starting Windows 9x with a `WIN /b` command. The `BOOTLOG.TXT` file is not updated automatically each time the system is started.
  - If a Windows 9x startup problem disappears when the system is started by using any of the Safe Mode options, you should use the System Configuration utility (`MSCONFIG.EXE`) to isolate the conflicting items. You might need to enter this command from the command line. Select the Diagnostic Startup option from the System Configuration Utility's General tab to interactively load device drivers and software options. If the problem does not go away, you can use the Advanced button on the General tab to inspect lower-level configuration settings, such as real-mode disk access settings and VGA standard video settings.
  - You can start the Device Manager from the `MSCONFIG` View option. This permits the protected-mode device drivers to be inspected. You should examine the `MSINFO-Problem Devices` section (which you access by selecting Start, Programs, Accessories, System Tools, System Information, Components, Problem Devices) to check for possible problem-causing devices. Other items to check include missing or corrupted system files (which you check by using the System File Checker utility), corrupted Registry entries (which you check by using the Registry Checker), viruses (which you check by using a virus-checking program), and hardware conflicts (which you check by using the CMOS configuration screens).
  - A Windows 98 system may contain up to five backup copies of the Registry structure. If the system fails to start up after you install a new software or hardware component, you can run the Registry Checker utility by using the `/Restore` option (that is, `ScanReg /Restore`) to return the Registry to its previous condition. Simply type `ScanReg /Restore` at the command prompt to view a list of available backup copies. Generally, you should select the most recent version for use.
  - When an attempt to install Windows NT, Windows 2000, or Windows XP fails, a Stop screen error normally results. Stop errors occur when Windows NT or Windows 2000 detects a condition from which it cannot recover. The system stops responding, and a screen of information with a blue or black background is displayed. Stop errors are also known as Blue Screen errors, or as the Blue Screen of Death (BSOD).
  - If the Windows NT/2000/XP system fails to start up after you install a new software or hardware component, the `BOOT.INI` and `NTLDR` files could be missing or have become corrupted. If you receive the message `Kernel File Is Missing OR NTLDR`

Could Not Be Found, the partition boot sector is okay, but the `NTLDR` file is probably corrupt.

- All the startup files, including `NTDETECT` and `NTOSKRNL`, can be restored from an ERD.
- You can use the Recovery Console to restore the Windows 2000 Registry. Every time you back up the System State data with the Windows 2000 Backup utility, a copy of the Registry is placed in the `\Repair\RegBack` folder.
- You can run the Recovery Console from the distribution CD for both Windows 2000 and Windows XP. To do so, start the system with the distribution CD in the drive and choose the option to Repair (Press the R key) the installation.
- The commands that can be used with the Recovery Console include most of the MS-DOS–based commands.
- The Windows 2000 emergency repair process is designed to repair the operating system only; it is not helpful in repairing application or data problems.
- The Windows XP System Restore utility enables administrators to roll back the Windows XP Professional operating system to a previous operational state and configuration—without affecting any user’s personal data. This feature extends the Last Known Good Configuration mode by allowing the system to be rolled back to predetermined restore points.
- To activate the Windows XP System Restore Wizard, select Start, All Programs, Accessories, System Tools and then select the System Restore option from the menu.
- You can identify and eliminate any lost clusters that take up space on a drive by using the ScanDisk utility. A heavily used, heavily fragmented hard drive can affect the system’s virtual memory and produce memory shortages. You can run the Disk Defrag utility to optimize the storage patterns on the drive.
- If a Windows 9x/Me system is running a FAT16 drive, you can free additional space by converting it to a FAT32 drive by using the `CVT1.EXE` command of the Drive Converter (FAT32) utility. The smaller sector clustering arrangement available through FAT32 frees wasted space on the drive. The drawback of performing this upgrade is that you risk losing data if a failure occurs in the conversion process.
- If a Windows 9x/Me system locks up, or if an application stalls, you can often regain access to the Close Program dialog box by pressing `Ctrl+Alt+Del`. When the Close Program dialog box appears, you can close the offending application and continue operating the system without rebooting.
- You can use `Alt+F4` to close active windows. Pressing this key combination in an application stops the application and moves to the next active application in the task list. If you press `Alt+F4` when no applications are active, the Windows Shut Down menu appears, enabling you to conduct an orderly shutdown or restart of the system.
- The Dr. Watson utility is useful for detecting application faults. When it is activated, Dr. Watson intercepts software actions, detects failures, identifies applications, and provides detailed descriptions of failures. The information is automatically transferred to the disk drive and stored in the `\Windows\Drwatson\*.WLG` file. You can view and print the information stored in the file from a word processor.
- Within a multiuser system, you cannot recover an item that has been deleted by another user because the Recycle Bin is maintained on a user-by-user basis. If one user deletes something, only

that user can recover it. You must log on as the user who deleted the items. Files and folders deleted from a floppy disk or network drive are permanently deleted and cannot be recovered.

- You can access application properties by right-clicking on the application's desktop icon or by right-clicking its entry in the Start menu, My Computer, or Windows Explorer.
- Windows 2000 and XP may suffer the same types of application problems described for the Windows 9x/Me versions: incorrect application properties (filename, path, and syntax), missing or corrupt Registry entries, and conflicting DLL files.
- By default, Windows 2000 and Windows XP do not display hidden or system files in Explorer. To see hidden or system files, you need to open Windows Explorer, click Tools, click Folder Options, click the View tab, and select the Show Hidden Files and Folders option.
- In Windows NT/2000/XP, the Close Program dialog is referred to as the Task Manager. This utility can be used to determine which applications in the system are running or stopped, as well as which resources are being used.
- You can also use the Windows NT/2000/XP Task Manager to determine the general microprocessor and memory usage levels.
- You can access the Windows 2000/XP Task Manager by pressing Ctrl+Alt+Del or Ctrl+Shift+Esc. Ctrl+Shift+Esc moves you directly into Task Manager, and Ctrl+Alt+Del opens the Windows Security menu screen, which offers Task Manager as an option.
- To check print spooler problems, you can examine the system for adequate hard-disk space and memory. If the EMF Spooling option is selected, you should disable it, clear the spooler, and try to print. To check the printer driver, right-click the Printer icon, select the Properties option, and click the Details option. Then reload or upgrade the driver if necessary.
- When printing cannot be carried out across a network, you should verify that the local computer and the network printer are set up for remote printing. In Windows, this procedure involves sharing the printer with the network users. The local computer that the printer is connected to, referred to as the *print server*, should appear in the Windows 9x Network Neighborhood window of the remote computer.
- If a local computer cannot see files and printers at the print server station, file and print sharing may not be enabled there.
- The correct format for the UNC network path-name is `\\computer_name\shared_device_name`.
- Computer viruses are destructive programs designed to replicate and spread on their own. Viruses are created to sneak into personal computers. Sometimes these programs take control of a machine to leave a humorous message, and sometimes they destroy data.
- After viruses infiltrate one machine, they can spread into other computers through infected disks that friends and coworkers pass around, or through local and wide area network connections.
- Common practices that increase the odds of a machine being infected by a virus include use of shareware software, software of unknown origin, and email attachments. One of the most effective ways to reduce these avenues of infection is to buy shrink-wrapped products from a reputable source.
- The Disk Cleanup utility can be used to remove certain types of normally disposable files and optional components from the system to clear

additional disk space. You can access the Disk Cleanup utility through the System Tools entry by selecting Start, Programs, and Accessories.

- In Windows 2000 and Windows XP, significant events (such as system, application, and security events) are routinely monitored and stored. These events can be viewed through the Event Viewer utility.
- The Windows 2000 Event Viewer displays significant events. Information events are denoted by a lowercase *i* in a cloud, whereas warning and error events are identified by an exclamation mark (!) and an X, respectively.

## 4.0 NETWORKS

The 4.0 domain requires knowledge of network capabilities of different Windows operating system versions and ways to connect to networks, including the purpose of the Internet, the Internet's capabilities, basic concepts relating to Internet access, and generic procedures for system setup. In particular, this domain expects the technician to be able to identify the networking capabilities of Windows and, given configuration parameters, configure the operating system to connect to a network. It also states that the technician should be able to identify the basic Internet protocols and terminologies, as well as procedures for establishing Internet connectivity. In a given scenario, the technician should be able to configure the operating system to connect to and use Internet resources. The main points are as follows:

- In later versions of MS-DOS, Microsoft added the `SHARE.EXE` command to provide file-sharing and -locking capabilities for files on a local hard-disk drive. These capabilities enabled multiple users to access the same file at the same time in a networked or multitasking environment.
- Valid computer names in Windows 9x/Me can be up to 15 characters in length and cannot contain any blank spaces.
- In Windows 2000 and XP, using the TCP/IP protocol, computer names can range up to 63 characters in length and can be made up of the letters A through Z, numbers 0 through 9, and hyphens.
- The local system can assign a logical drive letter to the remote unit or folder. This process is referred to as *mapping the drive letter* to the resource. This mapping enables non-Windows 9x applications running on the local computer to use the resource across the network.
- Establishing the map to a resource is a simple matter of entering the required path and share name in the dialog box, using the UNC format (`\\host_name\drive_path\shared_resource_name`).
- The Reconnect at Logon option must be selected in the Map Network Drive page for the drive mapping to become a permanent part of the system. If the option is not selected when the user logs off, the mapped drive information disappears and needs to be remapped for any further use.
- The Control Panel's Network screen provides configuration and properties information about the system's networks. The system's installed network components are listed under the Network Configuration tab.
- Clicking the Add button in the Network Configuration page brings up the Select Network Component Type screen.
- In an older, purely Windows network, the set of rules that governed the exchange of data between computers was the NetBEUI protocol. NetBEUI works in most purely Windows networks, so no other protocol is needed.

- NetBEUI is required to support dial-up RAS through a modem. RAS uses the NetBEUI protocol to navigate through a network after you have dialed in to it. Both the calling client and the receiving server in the LAN must be running NetBEUI. If either computer does not have this protocol active, the client can connect with the LAN but cannot navigate through it.
- It might be easier to run the Windows PING utility from the command prompt and attempt to connect to the network than to run the manufacturer's diagnostic utilities to verify that the LAN hardware is functioning properly. In a LAN environment, you need to know the IP address, or the name of a remote computer in the network, to which you direct the PING.
- If a network cannot be seen in the Network Neighborhood or a network cannot be browsed from this utility, you should check the network protocols and drivers. You check network adapters and protocols through the Control Panel's Network icon.
- If you can browse a network but cannot access or use certain resources in remote locations, either sharing is not turned on in the remote unit or the local unit does not have proper access rights to that resource. To use the remote resource across the network, the system's File and Print functions must be turned on, and its Share function must be enabled.
- In Windows 9x/Me peer-to-peer systems, resource sharing is performed at the user level. The user can use the File and Print Sharing button on the Network applet's Configuration tab to enable resource sharing on the local computer.
- Turning on the Windows File and Print Sharing functions places the local resources in the network's Browse listing.
- Many connectivity problems originate in the Physical layer. You should check to see that a computer is physically connected to the network and that the status light is glowing (normally green). The presence of the light indicates whether the NIC sees any network traffic.
- You begin the troubleshooting process for a connectivity problem by checking the TCP/IP properties under the Network icon. Next, you should check the current TCP/IP settings by using the command-line IPCONFIG /ALL (or in Windows 9x, the WINIPCFG) utility to display the current IP settings, which offers a starting point for troubleshooting. Then you can use the PING utility to send test packets to other local computers you have found. The results of this action indicate whether the network is working.
- You can use the NET VIEW command to see whether a remote computer is available.
- Many routers do not pass the broadcast traffic generated by DHCP clients. If a client cannot obtain an IP address from a DHCP server that is located on the other side of a router, the network administrator must enable the forwarding of DHCP packets (also referred to as the BOOTP protocol) or place a DHCP server on each side of the router.
- The NetBIOS and IPX protocols must be bound together to be able to navigate a Novell network from a computer that uses a Windows operating system. This is accomplished by enabling the NetBIOS bindings in the IPX protocol properties in the Network Properties page.
- The ODI file is the Novell network shell that communicates between the adapter and the system's applications. Older versions of NetWare use a shell program called NETX. These files should be referenced in the AUTOEXEC.BAT or NET.BAT files.

- ▶ In Windows 2000 and Windows XP systems, you must install the Client Service for NetWare (CSNW) option to enable the Windows client to communicate with NetWare servers. CSNW requires that the IPX/SPX protocol be installed on the client.
- ▶ The language of the Internet is TCP/IP. No matter what type of computer platform or software is being used, the information must move across the Internet in TCP/IP format. TCP/IP calls for data to be grouped together, in bundles called *network packets*. A TCP/IP packet is designed primarily to permit message fragmentation and reassembly.
- ▶ TCP/IP is considered one of the most secure of the network protocols. Because no one actually owns TCP/IP, it was adopted as the transmission standard for the Internet. It was so widely accepted by the Internet community that virtually every network operating system supports it, including Apple, MS-DOS/Windows, Unix, Linux, OS/2, and even networked printers. It can also be used on any topology (for example, dial-up, Ethernet, token ring).
- ▶ In Windows, you can set TCP/IP settings by selecting Start, Settings, Control Panel; clicking the Network icon; selecting TCP/IP Adapter; and clicking Properties. In Windows XP, you select Start, Control Panel, Network and Internet Connections, Network Connections.
- ▶ Services that most ISPs deliver to their customers include Internet identity through IP addresses, email services through POP3 and SMTP servers, Internet news service through Usenet archive servers, and Internet routing through DNS servers.
- ▶ DHCP is an Internet protocol that can be used to automatically assign IP addresses to devices on a network that uses TCP/IP. DHCP simplifies network administration because software, rather than an administrator, assigns and keeps track of IP addresses.
- ▶ Browsers enable pages to be displayed graphically, using a mixture of text, graphics, audio, and video files. They translate the HTML files that are used to create the Web and that ultimately link the various types of files together.
- ▶ FTP is used to upload and download information to and from the Internet. FTP is a client/server type of software application.
- ▶ Most public FTP sites allow anonymous authentication for access to the site. Anonymous authentication is an interaction that occurs between the local browser and FTP host, without involving the remote user (that is, no usernames or passwords are required to gain access).
- ▶ In Windows 9x/Me, applications can cooperatively share dial-up connections through TAPI. TAPI provides a universal set of drivers for modems and COM ports to control and arbitrate telephony operations for data, fax, and voice traffic.
- ▶ Selecting the Advanced button on the modem's Properties Connection tab permits you to add any extra settings desired for an installed modem. For example, an M0 setting should turn off the volume on your modem so that it is quiet when you connect to the Internet. You can click the OK button to return to the Modem Properties page.
- ▶ Although DNS is the naming service used by the Internet, it is not the only name-resolution service used with PCs. In the case of Windows LANs, the Microsoft-preferred naming system historically was WINS. WINS can be used to translate IP addresses to NetBIOS names within a Windows LAN environment. Since the advent of Windows 2000, the preferred name resolution method is DNS.

- An ISP establishes an Internet access account for each user. These accounts are based on the users' account names and passwords, which are requested each time the users log on to the accounts. Forgetting or misspelling either the username or password results in the ISP rejecting access to the Internet. Most accounts are paid monthly. If an account isn't paid up, the ISP may cancel the account and deny access to the user. In either of these situations, if the user attempts to log on to the account, he or she is repeatedly asked to enter the username and password until a predetermined number of failed attempts has been reached.
- All TCP/IP utilities are controlled by commands that are entered and run from the command prompt.
- The `TRACERT` utility enables you to display the route, and a hop count, taken to a given destination. You can manually set the route taken to a particular address by using the `ROUTE` command.
- The `IPCONFIG` utility can be used with two important option switches: `/renew` and `/release`. These switches update and release IP settings received from a DHCP server.
- `NSLOOKUP.EXE` is a Windows 2000/XP TCP/IP utility that can be entered at the command prompt to query Internet (DNS) name servers interactively. It has two modes: interactive and noninteractive. In interactive mode, the user can query name servers for information about various hosts and domains. Noninteractive mode is used to print just the name and requested information for a host or domain. `NSLOOKUP` is available only when TCP/IP has been installed.
- Although a number of utilities are useful in isolating TCP/IP problems, the most widely used utilities are `PING` and `TRACERT`.
- The `PING` utility sends ICMP packets to a remote location and then waits for echoed response packets to be returned. You can use `PING` to test both the name and IP address of the remote unit.
- The `TRACERT` utility traces the route taken by ICMP packets sent across a network. Routers along the path return information to the inquiring system, and the utility displays the hostname, IP address, and round-trip time for each hop in the path.
- The blocks of Internet access addresses that ISPs provide to their customers are called Internet Protocol addresses, or IP addresses. The IP address makes each site a valid member of the Internet.
- Sections of a network can be grouped together into subnets that share a range of IP addresses. These groups are referred to as intranets.
- The 127.x.x.x IP address range is a special block of loopback addresses reserved for testing network systems. The U.S. government owns some of these addresses for testing the Internet backbone. The 127.0.0.1 address is reserved for testing the bus on the local system.
- The IP address 255.255.255.255 is a special reserved address called the broadcast address. It is used to communicate with all the nodes on a subnet simultaneously.
- Some networks employ a firewall as a gateway to the outside. A firewall is a combination of hardware and software components that provide a protective barrier between networks with different security levels.
- Administrators configure firewalls so that they will pass data to and from only designated IP addresses and TCP/IP ports.

- Subnets are created by masking off (hiding) the network address portion of the IP address on the units within the subnets. This, in effect, limits the mobility of the data to those nodes within the subnets because they can reconcile only addresses from within their masked range.
- The subnet mask setting is a required TCP/IP configuration parameter that tells a TCP/IP host how to interpret IP addresses. It defines the portions of the IP address that represent a network number and which portions make up the host ID.
- The World Wide Web (WWW) is a menu system that ties together Internet resources from around the world. These resources are scattered across computer systems everywhere. Web servers inventory the Web's resources and store address pointers, referred to as links, to them.
- A uniform resource locator (URL) is used to access services on the Internet; it is composed of two parts: the Internet resource that's to be accessed and the name of the server.
- HTTP, or Hypertext Transfer Protocol, is a client/server protocol used to send and receive files on the Internet.
- A special application, called the File Transfer Protocol (FTP), is used to upload and download information to and from the WWW. FTP is a client/server type of software application.
- One of the most widely used Internet functions is the electronic mail (email) feature. This feature enables Internet users to send and receive electronic messages to and from each other over the Internet.
- The Secure Socket Layer (SSL) protocol is used to authenticate users or e-commerce servers on the Internet and to encrypt or decrypt messages (particularly credit-card purchases) using a security process called public-key encryption. SSL encrypts data that moves between the browser and the server.
- Telnet is a service that enables you to "telephone-net" into another computer so that you can utilize the resources of the computer in a command-line interface environment.
- Scripts are executable applications that provide interactive content on Web sites. They are also capable of retrieving information in response to user selections. However, the user may not have to do anything to run a script program; scripts are simply embedded in the Web site that they access.