



Operating Systems Guide

Technical Manual

Exercise 1 – Operating Systems

Understanding How Operating Systems Work

The operating system defines our computing experience. It's the first software we see when we turn on the computer, and the last software we see when the computer is turned off. It's the software that enables all the programs we use. The operating system organizes and controls the hardware on our desks and in our hands, yet most users can't say with any certainty precisely what it is that the operating system does.

Words and Terms You Should Know:

Operating System	Multi-User	High Speed Cache
RTOS	Multi-Tasking	API
Protected Mode	Multi-Threading	Open Source
Real Mode	Bootstrap Loader	Kernel

Discussion of Fundamentals:

The Basic OS

It's important to realize that not all computers have operating systems. The computer that controls the microwave oven in your kitchen, for example, doesn't need an operating system. It has one set of relatively simple tasks to perform, very simple input and output methods (a keypad and an LCD display), and simple, never-changing hardware to control. For a computer like this, an operating system would be unnecessary baggage, adding complexity where none is required. Instead, the computer in a microwave oven simply runs a single program all the time.

For computer systems that go beyond the complexity of the microwave, however, an operating system can be the key to greater operating efficiency and easier application development. All desktop computers have operating systems. The most common are the Windows family of operating systems (Windows 95, 98, 2000, NT, XP and CE), the UNIX family of operating systems (which includes Linux, BSD UNIX and many other derivatives) and the Macintosh operating systems. There are hundreds of other operating systems available for special-purpose applications, including specialization for mainframes, robotics, manufacturing, real-time control systems and so on.

At the simplest level, an operating system does two things:

- It manages the hardware and software resources of the computer system. These resources include things such as the processor, memory, disk space, etc.
- It provides a stable, consistent way for applications to deal with the hardware without having to know all the details of the hardware.

The first task is important as various programs and input methods compete for the attention of the central processing unit (CPU) and demand memory, storage and input/output (I/O) bandwidth for their own purposes. In this capacity, the operating system plays the role of the good parent, making sure that each application gets the necessary resources while playing nicely with all the other applications, and husbanding the limited capacity of the system to the greatest good of all the users and applications.

The second task, providing a consistent application interface, is especially important if there is to be more than one of a particular type of computer using the operating system, or if the hardware making up the computer is ever open to change. A consistent application program interface (API) allows a software developer to write an application on one computer and have a high level of confidence that it will run on another computer of the same type, even if the amount of memory or the quantity of storage is different on the two machines. Even if a particular computer is unique, an operating system can ensure that applications continue to run when hardware upgrades and updates occur, because the operating system and not the application is charged with managing the hardware and the distribution of its resources. Windows 98 is a great example of the flexibility an operating system provides. Windows 98 runs on hardware from thousands of vendors. It can accommodate thousands of different printers, disk drives and special peripherals in any possible combination.

Within the broad family of operating systems, there are generally four types, categorized based on the types of computers they control and the sort of applications they support. The broad categories are:

Real-Time Operating System (RTOS) - Real-time operating systems are used to control machinery, scientific instruments and industrial systems. An RTOS typically has very little user interface capability, and no end-user utilities, since the system will be a "sealed box" when delivered for use. A very important part of an RTOS is managing the resources of the computer so that a particular operation executes in precisely the same amount of time every time it occurs. In a complex machine, having a part move more quickly just because system resources are available may be just as catastrophic as having it not move at all because the system was busy.

Protected Versus Real Mode – Protected mode operations limit an application to its own memory space, but that space can include memory above the 1MB barrier of real mode. Protected mode gets its name from the fact that programs in this mode are protected from other programs desiring memory. Real mode restricts applications to addressing only the first 1MB of RAM.

All Windows versions after 3.X run in protected mode, which can lead to some problems. For example, when a Windows system is booted into DOS mode, DOS can't load any protected-mode device drivers. In order to use these devices in real mode, real-mode drivers must be loaded. The devices affected may include the CD-ROM, the sound card, and other devices not widely implemented before Windows 95, An additional problem is that loading these drivers to real mode fill up memory very quickly.

Single-User, Single Task - As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time. The Palm OS for Palm computers is a good example of a modern single-user, single-task operating system.

Single-User, Multi-Tasking - This is the type of operating system most people use on their desktop and laptop operating systems today. Windows 98 and the MacOS are both examples of an operating system that will let a single user have several programs in operation at the same time. For example, it's entirely possible for a Windows user to be writing a note in a word processor while downloading a file from the Internet while printing the text of an e-mail message.

Multi-User - A multi-user operating system allows many different users to take advantage of the computer's resources simultaneously. The operating system must make sure that the requirements of the various users are balanced, and that the programs they are using each have sufficient and separate resources so that a problem with one user doesn't affect the entire community of users. Unix, VMS and mainframe operating systems, such as MVS, are examples of multi-user operating systems.

It's important to differentiate here between multi-user operating systems and single-user operating systems that support networking. Windows 2000 and Novell Netware can each support hundreds or thousands of networked users, but the operating systems themselves aren't true multi-user operating systems. The system administrator is the only "user" for either Windows 2000 or Netware. The network support, and all the remote user logins the network enables are, in the overall plan of the operating system, a program being run by the administrative user.

With the types of operating systems in mind, it's time to look at the basic functions provided by the operating systems.

Pulling Itself By Its Bootstraps

When the power to a computer is turned on, the first program that runs is usually a set of instructions kept in the computer's Read-Only Memory (ROM) that examines the system hardware to make sure everything is functioning properly. This Power-On Self Test (POST) checks the CPU, memory, and basic input-output systems for errors and stores the result in a special memory location. Once the POST has successfully completed, the software loaded in ROM (sometimes called firmware) will begin to activate the computer's disk drives. In most modern computers, when the computer activates the hard disk drive, it finds the first piece of the operating system, the bootstrap loader.

The bootstrap loader is a small program that has a single function: It loads the operating system into memory and allows it to begin operation. In the most basic form, the bootstrap loader sets up the small driver programs that interface with and control the various hardware sub-systems of the computer. It sets up the divisions of memory that hold the operating system, user information and applications. It establishes the data structures that will hold the myriad signals, flags and semaphores that are used to communicate within and between the subsystems and applications of the computer. Finally it turns control of the computer over to the operating system.

The operating system's tasks, in the most general sense, fall into six categories:

- Processor management
- Memory management
- Device management
- Storage management
- Application Interface
- User Interface

While there are some who argue that an operating system should do more than these six tasks, and some operating system vendors that build many more utility programs and auxiliary functions into their operating systems, these six tasks define the core of essentially all operating systems. Let's look at the tools the operating system uses to perform each of these functions.

Processor Management

The heart of managing the processor comes down to two related issues: First, ensuring that each process and application receives enough of the processor's time to function properly and, second, using as many processor cycles for real work as is possible. The basic unit of software that the operating system deals with in scheduling the work done by the processor is either a process or a thread, depending on the operating system.

It's tempting to think of a process as an application, but that gives an incomplete picture of how processes relate to the operating system and hardware. The application you see (word processor or spreadsheet or game) is, indeed, a process, but that application may cause several other processes to begin, for tasks like communications with other devices or other computers. There are also numerous processes that run without giving you direct evidence

that they ever exist. A process, then, is software that performs some action and can be controlled -- by a user, by other applications or by the operating system.

It is processes, rather than applications, that the operating system controls and schedules for execution by the CPU. In a single-tasking system, the schedule is straightforward. The operating system allows the application to begin running, suspending the execution only long enough to deal with interrupts and user input. Interrupts are special signals sent by hardware or software to the CPU. It's as if some part of the computer suddenly raised its hand to ask for the CPU's attention in a lively meeting. Sometimes the operating system will schedule the priority of processes so that interrupts are masked, that is, the operating system will ignore the interrupts from some sources so that a particular job can be finished as quickly as possible. There are some interrupts (such as those from error conditions or problems with memory) that are so important that they can't be ignored. These non-maskable interrupts (NMI) must be dealt with immediately, regardless of the other tasks at hand.

While interrupts add some complication to the execution of processes in a single-tasking system, the job of the operating system becomes much more complicated in a multi-tasking system. Now, the operating system must arrange the execution of applications so that you believe that there are several things happening at once. This is complicated because the CPU can only do one thing at a time. In order to give the appearance of lots of things happening at the same time, the operating system has to switch between different processes thousands of times a second. Here's how it happens.

A process occupies a certain amount of RAM. In addition, the process will make use of registers, stacks and queues within the CPU and operating system memory space. When two processes are multitasking, the operating system will allow a certain number of CPU execution cycles to one program. After that number of cycles, the operating system will make copies of all the registers, stacks and queues used by the processes, and note the point at which the process paused in its execution. It will then load all the registers, stacks and queues used by the second process and allow it a certain number of CPU cycles. When those are complete, it makes copies of all the registers, stacks and queues used by the second program, and loads the first program.

All of the information needed to keep track of a process when switching is kept in a data package called a process control block. The process control block typically contains an ID number that identifies the process, pointers to the locations in the program and its data where processing last occurred, register contents, states of various flags and switches, pointers to the upper and lower bounds of the memory required for the process, a list of files opened by the process, the priority of the process, and the status of all I/O devices needed by the process. When the status of the process changes, from pending to active, for example, or from suspended to running, the information in the process control block must be used like the data in any other program to direct execution of the task-switching portion of the operating system.

This process swapping happens without direct user interference, and each process will get enough CPU time to accomplish its task in a reasonable amount of time. Trouble can come, though, if the user tries to have too many processes functioning at the same time. The operating system itself requires some CPU cycles to perform the saving and swapping of all the registers, queues and stacks of the application processes. If enough processes are started, and if the operating system hasn't been carefully designed, the system can begin to use the vast majority of its available CPU cycles to swap between processes rather than run processes. When this happens, it's called thrashing, and it usually requires some sort of direct user intervention to stop processes and bring order back to the system.

One way that operating system designers reduce the chance of thrashing is to reduce the need for new processes to perform various tasks. Some operating systems allow for a "process-lite," called a thread, that can deal with all the CPU-intensive work of a normal process, but generally does not deal with the various types of I/O, and does not establish structures requiring the extensive process control block of a regular process. Finally, a process may start many threads or other processes, but a thread cannot start a process.

So far, all the scheduling we've discussed has concerned a single CPU. In a system with two or more CPUs, the operating system must divide the workload among the CPUs, trying to balance the demands of the required processes with the available cycles on the different CPUs. Some operating systems (called asymmetric) will use one CPU for their own needs, dividing application processes among the remaining CPUs. Other operating systems (called symmetric) will divide themselves among the various CPUs, balancing demand versus CPU availability even when the operating system itself is all that's running. Even if the operating system is the only software with execution needs, the CPU is not the only resource to be scheduled. Memory management is the next crucial step in making sure that all processes run smoothly.

Memory and Storage Management

When an operating system manages the computer's memory, there are two tasks that need to be accomplished. First, each process must have enough memory in which to execute, and it can neither run into the memory space of another process, nor be run into by another process. Next, the different types of memory in the system must be used properly, so that each process can run most effectively. The first task requires the operating system to set up memory boundaries for types of software, and for individual applications.

As an example, let's look at an imaginary system with 1 megabyte of RAM. During the boot process, the operating system of our imaginary computer is designed to go to the top of available memory and then "back up" far enough to meet the needs of the operating system itself. Let's say that the operating system needs 300 kilobytes to run. Now, the operating system goes to the bottom of the pool of RAM, and starts building up with the various driver software required to control the hardware subsystems of the computer. In our imaginary computer, the drivers take up 200 kilobytes. Now, after getting the operating system completely loaded, there are 500 kilobytes remaining for application processes.

When applications begin to be loaded into memory, they are loaded in block sizes determined by the operating system. If the block size is 2 kilobytes, then every process that is loaded will be given a chunk of memory that is a multiple of 2 kilobytes in size. Applications will be loaded in these fixed block sizes, with the blocks starting and ending on boundaries established by words of 4 or 8 bytes. These blocks and boundaries help to ensure that applications won't be loaded on top of one another's space by a poorly calculated bit or two. With that ensured, the larger question of what to do when the 500 kilobyte application space is filled.

In most computers it's possible to add memory beyond the original capacity. For example, you might expand RAM from 1 to 2 megabytes. This works fine, but tends to be relatively expensive. It also ignores a fundamental fact of life -- most of the information that an application stores in memory is not being used at any given moment. A processor can only access memory one location at a time, so the vast majority of RAM is unused at any moment. Since disk space is cheap compared to RAM, then moving information in RAM to hard disk intelligently can greatly expand RAM space at no cost. This technique is called Virtual Memory Management.

Disk storage is only one of the memory types that must be managed by the operating system, and is the slowest. Ranked in order of speed, the memory in a computer system is:

- **High-speed cache** - This is fast, relatively small amounts of memory that are available to the CPU through the fastest connections. Cache controllers predict which pieces of data the CPU will need next and pull it from main memory into high-speed cache to speed system performance.
- **Main memory** - The RAM that you see measured in megabytes when you buy a computer.

Secondary memory - This is most often some sort of rotating magnetic storage that keeps applications and data available to be used, and serves as virtual RAM under the control of the operating system.

The operating system must balance the needs of the various processes with the availability of the different types of memory, moving data in blocks called pages between available memory as the schedule of processes dictates.

Device Management

The path between the operating system and virtually all hardware not on the computer's motherboard goes through a special program called a driver. Much of a driver's function is as translator between the electrical signals of the hardware subsystems and the high-level programming languages of the operating system and application programs. Drivers take data that the operating system has defined as a file and translate them into streams of bits placed in specific locations on storage devices, or a series of laser pulses in a printer.

Because there are such wide differences in the hardware controlled through drivers, there are differences in the way that the driver programs function, but most are run when the device is required, and function much the same as any other process. The operating system will frequently assign high priorities blocks to drivers so that the hardware resource can be released and readied for further use as quickly as possible.

One reason that drivers are separate from the operating system is so that new functions can be added to the driver-and thus to the hardware subsystems-without requiring the operating system itself to be modified, recompiled and redistributed. Through the development of new hardware device drivers, development often performed or paid for by the manufacturer of the subsystems rather than the publisher of the operating system, input/output capabilities of the overall system can be greatly enhanced.

Managing input and output is largely a matter of managing queues and buffers, special storage facilities that take a stream of bits from a device, from keyboards to serial communications ports, holding the bits, and releasing them to the CPU at a rate slow enough for the CPU to cope with. This function is especially important when a number of processes are running and taking up processor time. The operating system will instruct a buffer to continue taking input from the device, but to stop sending data to the CPU while the process using the input is suspended. Then, when the process needing input is made active once again, the operating system will command the buffer to send data. This process allows a keyboard or a modem to deal with external users or computers at a high speed even though there are times when the CPU can't use input from those sources.

Managing all the resource of the computer system is a large part of the operating system's function and, in the case of real-time operating systems, may be virtually all the functionality required. For other operating systems, though, providing a relatively simple, consistent way

for applications and humans to use the power of the hardware is a crucial part of their reason for existing.

Application Interface

Just as drivers provide a way for applications to make use of hardware subsystems without having to know every detail of the hardware's operation, Application Program Interfaces (APIs) let application programmers use functions of the computer and operating system without having to directly keep track of all the details in the CPU's operation. Let's look at the example of creating a hard disk file for holding data to see why this can be important.

A programmer writing an application to record data from a scientific instrument might want to allow the scientist to specify the name of the file created. The operating system might provide an API function named `MakeFile` for creating files. When writing the program, the programmer would insert a line that looks like:

```
MakeFile [1, %Name, 2]
```

In this example, the instruction tells the operating system to create a file that will allow random access to its data (1), will have a name typed in by the user (%Name), and will be a size that varies depending on how much data is stored in the file (2). Now, let's look at what the operating system does to turn the instruction into action.

First, the operating system sends a query to the disk drive to get the location of the first available free storage location. With that information, the operating system will create an entry in the file system showing the beginning and ending locations of the file, the name of the file, the file type, whether the file has been archived, which users have permission to look at or modify the file, and the date and time of the file's creation. Next, the operating system will write information at the beginning of the file that identifies the file, sets up the type of access possible and includes other information that ties the file to the application. In all this information, the queries to the disk drive and addresses of the beginning and ending point of the file will be in formats heavily dependent on the manufacturer and model of the disk drive.

Because the programmer has written her program to use the API for disk storage, she doesn't have to keep up with the instruction codes, data types, and response codes for every possible hard disk and tape drive. The operating system, connected to drivers for the various hardware subsystems, will deal with the changing details of the hardware—the programmer must simply write code for the API and trust the operating system to do the rest.

APIs have become one of the most hotly contested areas of the computer industry in recent years. Companies realize that programmers using their API will ultimately translate into the ability to control and profit from a particular part of the industry. This is one of the reasons that so many companies have been willing to provide applications like readers or viewers to the public at no charge. They know consumers will request that programs take advantage of the free readers, and application companies will be ready to pay royalties to allow their software to provide the functions requested by the consumers.

User Interface

Just as the API provides a consistent way for applications to use the resources of the computer system, a user interface (UI) brings structure to the interaction between a user and the computer. In the last decade, almost all development in user interfaces has been in the area of the Graphical User Interface (GUI) with two models, Apple's Macintosh and Microsoft's Windows, receiving most of the attention and gaining most of the market share. There are other user interfaces, some graphical and some not, for other operating systems as well.

UNIX or Linux, for example, has user interfaces called shells that present a user interface more flexible and powerful than the standard operating system text-based interface. Programs such as the Korn Shell and the C Shell are text-based interfaces that add important utilities, but their main purpose is to make it easier for the user to manipulate the functions of the operating system. There are also graphical user interfaces, such as X-Windows and Gnome that make UNIX and Linux more like Windows and Macintosh computers from the user's point of view.

It's important to remember that in all these examples the user interface is a program, or set of programs, that sit as a layer above the operating system itself. The same thing is true, with somewhat different mechanisms, of both Windows and Macintosh operating systems. The core operating system functions, the management of the computer system, lie in the kernel of the operating system. The display manager is separate, though it may be tied tightly to the kernel beneath. The ties between the operating system kernel and the user interface, utilities and other software define many of the differences in operating systems today, and will further define them in the future.

OS Trends

Two questions exist concerning the path operating systems for desktop and laptop computers will take in the coming years. One concerns the functions that a court might allow to be bundled into an operating system. The other revolves around the ability of a particular philosophy of software distribution to create an operating system useable by corporations and consumers together.

The questions of Microsoft and its Windows operating system are now in appeal in a U.S. court. While the cause of the case lies outside the question of how operating systems work, the remedy ordered by the first judge, a split of the company, would have an impact on how tightly the kernel and utilities, auxiliary programs (such as Web browsers), and other non-core functions could be bound together.

An impact of a different sort might come from Linux, the operating system created and distributed according to the principles of open source. Most operating systems, drivers and utility programs are written by commercial organizations that distribute executable versions of their software -- versions that can't be studied or altered. Open source requires the distribution of original source materials that can be studied, altered and built upon, with the results once again freely distributed.

The continuing growth of the Internet and the proliferation of computers that aren't standard desktop or laptop machines means that operating systems will change to keep pace, but the core management and interface functions will continue, even as they evolve.



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Exercise 1a – Operating Systems Worksheet

Instructions:

Study the entire lesson before answering the following questions. Consider using other information sources as well. Periodicals, reference materials, and the Internet are great resources to find the answers to the technical problems you're going to face when servicing computers.

Name:	
Period:	
Date:	

Speaking of resources... Let's save some of our natural resources. Rather than printing out the entire lesson, print out only the worksheet. Study the lesson on-screen and then record your answers on the worksheet. When you're finished, return the worksheet to your supervisor for evaluation. Be sure to complete this assignment before moving onto the next.

Questions:

Research and develop a detailed definition for each of the following terms. Many words have multiple definitions... Some of which may have nothing to do with the field of Computer Service and Support. Make sure your definition falls within the context of this lesson. Refer to the list of Research Resources and Required Materials as well as other materials you feel are appropriate. Write your definitions on the reverse side of this worksheet or a separate piece of paper with each definition being two sentences or more.

- ✓ Operating System
- ✓ Protected Mode
- ✓ Multi-Tasking
- ✓ Bootstrap Loader
- ✓ GUI
- ✓ Open Source

1. At the simplest level... What two things does an operating system do?
2. To make sure a particular operation executes in precisely the same amount of time every time it occurs. For that reason _____ are used to control machinery, scientific instruments and industrial systems.
3. General Protection Fault (GPF) errors occur when applications invade each other's protected memory locations. This sometimes happens when operating systems operating in _____ mode (above the 1MB barrier).
4. What operating system(s) is an example of a Single-User, Single Task OS?
5. What operating system(s) is an example of a Single-User, Multi-Tasking OS?
6. What operating system(s) is an example of a Multi-User OS?
7. Lists the six tasks performed by an operating system
8. What GUI's does UNIX and Linux use?
9. What is at the kernel of any operating system?



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Exercise 2 – Disk Operating System

Introduction:

DOS is dead! Well... not really dead. It's not even on life support. Although there aren't a lot of DOS based applications left running in today's PC market, Fortune 500 companies continue to depend on DOS-based devices to deliver their day-to-day services. Arguably, DOS remains one of the most stable OS environments and will continue to be deployed on embedded devices where stability and ease-of-development are paramount. The DOS cow is still giving milk and there are situations where there's no substitute for a DOS command. There are also similarities between the DOS command and other command line or scripting languages used in various operating systems. As part of your technician toolkit, knowing how to write a decent batch file can save you loads of time. It will also teach you how operating systems work at their kernel as well as prepare you to write login scripts, Linux code, and program network routers.

Discussion of Fundamentals:

Way back in the late 1970's (We're talking ancient history here), the IBM Corporation was working on a standard for the PC computer. Giants in hardware design, IBM wanted to out-source the design for the operating system. At that time, there were many different types microprocessor (8-Bit) based computers emerging onto the scene. Some were based on the Zilog Z80 microprocessor while others featured the Intel 8080 and 8085. Still others used the Motorola 6800 or MOS 6505 processors. Since each microprocessor used a different instruction set and were based upon totally different architectures, they all required their own operating system design, and could only use specially designed software to work. There was no standardized architecture and there was no standardized operating system. What a mess.

IBM contacted a very small company that had invented a popular programming language called BASIC and asked them to create an operating system for their PC. Although this company had never written an OS before, the company's president said, "Sure!" They bought an OS called QDOS (Quick and Dirty Operating System) and modified it to work with the IBM PC. That company's president was Bill Gates and that tiny company was Microsoft. Gates released the OS as MS-DOS (Microsoft Disk Operating System) version 1.1 and by today's standard is pretty primitive. Microsoft wasn't the only mover and shaker in the DOS PC world. PCDOS, DRDOS, OpenDOS, FreeDOS, and PTSDOS all competed for the OS market. However, Microsoft continually won the market share with 6.22 being that last version of MS-DOS released in 1994.

You may have heard that the A+ Certification requirements no longer include DOS as part of the examination. Although this is true, you're still expected to know a broad range of command-line programs such as FDISK and FORMAT. You're also expected to know DOS memory usage and how to configure DOS applications to run in a Windows environment. DOS really isn't dead after all.

You'll perform some exercises covering the following topics:

A. DOS Installation – You'll install DOS onto a computer workstation.

B. DOS Filename and Directory Structure – You'll explore the DOS filename and directory structure. When you're finished with this exercise, you will:

- Recognize legal filenames, file name extensions, and how to form an 8.3 filename.
- Write file pathnames using the DOS directory structure.

- C. File and Directory Management** – You'll learn the commands used to manage files and directories in a DOS environment. When you're finished with this exercise, you will:
- View, navigate, create, and delete directories in DOS.
 - Copy, move, rename, and delete files in DOS.
- D. Batch File Processing** – You'll learn how to create and run batch files to manage a workstation in a DOS environment. When you're finished with this exercise, you will:
- Create, edit, and save a batch file.
 - Process a batch file for execution.
- E. External Commands** – You'll learn how to recognize external commands and use them to perform disk management operations. When you're finished with this exercise, you will:
- Use the FDISK command to prepare a hard disk for a file system.
 - Use the FORMAT command to structure a disk so it will accept data.
- F. The DOS Boot Sequence** – You'll learn about the order in which an operating system starts-up. You'll also learn about file attributes and how to change attributes to protect files. When you're finished with this exercise, you will:
- Know the DOS Boot Sequence.
 - Use the ATTRIB command to determine and change file attribute settings.
 - Know the role of the CONFIG.SYS and AUTOEXEC.BAT files.

Words and Terms You Should Know:

- | | | |
|-------------|----------------|------------------|
| • Filename | • Directory | • Command Prompt |
| • Extension | • Subdirectory | • Syntax |
| • 8.3 | • Path | • Batch File |

Research Resources:

Company	Web Site	Description
FreeDOS	http://www.freedos.org/	FreeDOS is ideal for anyone who wants to bundle a version of DOS without having to pay a royalty for use of DOS. FreeDOS will also work on old hardware, in DOS emulators, and in embedded systems. FreeDOS is also an invaluable resource for people who would like to develop their own operating system. While there are many free operating systems out there, no other free DOS-compatible operating system exists.
Digital Logics	http://www.drDOS.com/products.html	As a desktop solution or an embedded application DR DOS is the ideal DOS system, designed for straight forward out-of-the-box implementation into ROM or Flash ROM. DeviceLogics makes these tools and associated documents available in the DeviceLogics OEM Kit.
Paragon Software	http://www.paragon-gmbh.com/n_dos.htm	PTS DOS 2000 Pro operating system - fully compatible to MSDOS 6.22 and Microsoft Windows 3.x
IBM	http://www-3.ibm.com/software/os/dos/	IBM PCDOS - Now, IBM is offering a Year 2000 ready version of the classic operating system – PC DOS 2000.
DOS Ghost	http://www.undercoverdesign.com/dosghost/	MSDOS, DR-DOS, FreeDOS, OpenDOS, PCDOS, PTSDOS, Windows v3.1, WFWG, or other 16 bit OS users will find advice, information, and links to free software at this website for users of the 8088, 8086, 80286, 80386, and newer Intel platform hardware when booting up any version of MSDOS, DR-DOS, FreeDOS, OpenDOS, PCDOS, PTSDOS, W31, or WFWG.

Required Materials:

- Computer Trainer
- MSDOS, PCDOS, FreeDOS, OpenDOS, PTSDOS, or DRDOS Installation Disks
- Computer Trainer with some form of DOS installed
- Two Blank Floppy Diskettes, 1.4MB

Tech Note: It would be great if you could use a computer trainer that you can wipe clean and buildup as you experiment with installing DOS. It's not necessary to install DOS if you can't get your hands on a set of DOS distribution disks. The programming experiments can be completed on any computer that has an existing installation of Windows 9x, Me, NT, 2000, or XP... Providing you have administrator access to the computer. If you're a bit of a Geek... You may be able to create a bootable DOS diskette to perform these tasks with. If you do, please note that you'll have to copy the external commands like FDISK.COM, FORMAT.COM, and ATTRIB.COM to the diskette to do some of the exercises.

Where on Earth can I find a legal MSDOS distribution disk? It might be tough to locate software that was last published in 1994, but you can usually find a set lying around someplace. If not... ask your local computer geek. They've probably got a copy of every OS version that's ever been released since the dawn of the computer age. If all else fails you can download FreeDOS ...and yes you can still purchase versions of DOS off the Internet. Check out the links in the Research Resources list for more details. For your convenience, the BOOTPAK program on the CSS Service disk will create a bootable floppy disk with an evaluation copy of PCDOS installed on it. Regardless of the OS you choose, it will be installed only for a short period of time. You'll remove it once you complete the following exercise.

Procedure:

Complete each of the following steps in this exercise. When you see a ✓... That's an indication that you need to do something. For your convenience, there is an **Exercise Worksheet** attached to the end of this exercise. To save trees... It would be best to print out this worksheet only. You'll use it to record your answers while performing the following steps.

A. Installing DOS

1. ✓ **Install DOS** - If you don't already have DOS installed on a workstation, you're going to have to find the installation disks somewhere and install them. If you can't find installation disks, proceed to the next step.
 - ✓ Check the system BIOS to make sure the Boot Sequence is setup to boot off the A: drive first.
 - ✓ Insert the Setup disk in the A: drive and reboot the computer.
 - ✓ Follow the installation instructions to completely install DOS on the local hard disk drive.
 - ✓ Reboot the computer and change the BIOS so the Boot Sequence is set to boot off the C: drive.
 - ✓ Reboot the computer off the C: drive into DOS.

Tech Tip - If you've got Windows installed on the hard drive, and you don't want to overwrite the drive with DOS you may want to remove the hard drive and replace it with a temporary drive just to practice installing DOS. Once you have DOS installed, you can create a couple of systems disks on floppies using the FORMAT A: /S command. As long as you copy over the FDISK.COM, FORMAT.COM, and ATTRIB.COM programs to the floppy disk, you can make floppy boot disks that will allow you to perform all of the following tasks.

B. DOS Filename and Directory Structure

1. ✓ 8.3 File Naming Convention and Rules

- Every piece of data that's stored on a drive is stored in a file. Each file has a name that is also stored with the file.
- There are two parts to the name of each file... The filename and file extension. The filename portion cannot be any longer than eight characters. The extension is optional, but if used, cannot be longer than three characters long.
- You cannot use spaces or other illegal characters in the filename or extension. Illegal characters include () / \ [] < > + = ; , * or ?.
- The filename and extension are separated by a period or dot.

These rules explain the reason why this file naming convention is called eight-dot-three (8.3).

2. ✓ From a list of file names, determine which comply with 8.3 naming conventions. Record your answers on the ***Exercise Worksheet***.

3. ✓ Drive and Directory Structure Rules:

- When DOS boots-up, a drive letter is assigned to each hard drive partition and removable media drive (floppy, CDROM, Zip, Etc.)
- Each drive letter designation is followed by a colon. For instance, the local hard disk drive is recognized as C: by the operating system. The floppy disk drives are identified as A: or B: and a CDROM is usually identified as the next available drive in the system... In this case D:.
- DOS names for local drives cannot be changed. You cannot have more than two floppy disk drives because DOS was designed to support only two drives.
- DOS uses a hierarchical directory tree to organize its information on the drive. Envision an up-side-down tree where the root of the directory is at the trunk. Directories form like branches as they split into smaller branches making sub-directories. The individual files form at the leaves of the tree.
- Every file is stored in a directory. Some are stored in the root directory while others are stored in subdirectories.
 - Windows uses directories as well, but in Windows they're called folders.
 - Directories within directories are called subdirectories.
 - Any directory can have multiple subdirectories.
 - You cannot have two files with the same name in the same directory.
 - No two subdirectories can have the same name in the same directory.
- The name of the root directory is \ (backslash). C:\ identifies the root directory of the C: drive.
- The path to a directory in the root of a drive is the drive designator, the root symbol, and the name of the directory. For instance, the path to the SYSTEM director on the root of the C: drive is C:\SYSTEM.
- Add a \ (backslash) to narrow the path to a specific subdirectory. For instance, the path to the GAMES subdirectory in the directory SYSTEM in the root of the C: drive would be represented as C:\SYSTEM\GAMES.
- The path to the file INFO.TXT in the GAMES directory would be C:\SYSTEM\GAMES\INFO.TXT.
- The exact location of a file in the directory tree is call its path.

4. ✓ Translate file locations into a path you can type in at a command prompt. Record your answers on the ***Exercise Worksheet***.

Before You Get Started – There are a few ways to get to a command prompt without having to install and run DOS itself. That means you can execute DOS like commands from within Windows itself. However, with every release of Windows, Microsoft has moved further away from the DOS kernel. Therefore, Windows does not run all commands that were part of the original DOS command set. If you want the true experience of DOS... You'll have to install and use it. However, for these exercises you'll be able to use any version of Windows to practice these commands.

Here's how to get to a Command Prompt:

Operating System	Procedure
DOS	Simply boot-up the workstation to the C:\> prompt.
Windows 9x and NT	Reboot and hold down the F8 key to get to the Windows Startup Menu. (Figure 1)
Windows 2000 and XP	Click on the Start Button and select RUN. Type in CMD and click OK. (Figure 2)

C. Directory and File Management

1. ✓ Use whatever procedure you need to get to the command prompt for the operating system you're using. You should see the command prompt **C:\>**.

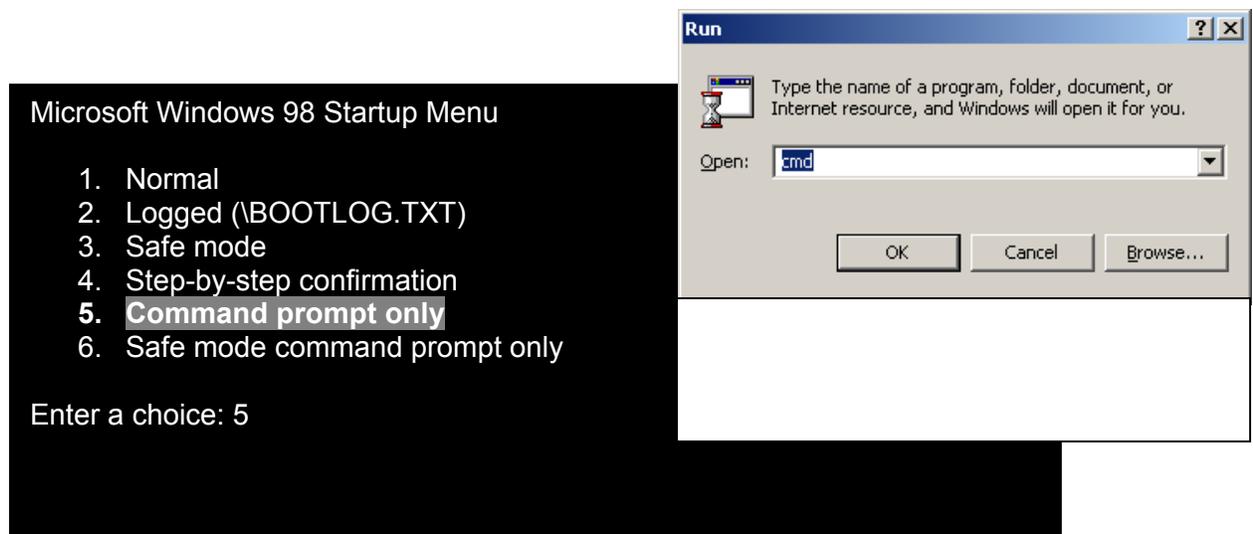


Figure 1. Windows 9x Startup Menu. Selecting 5 will boot up Windows to the command prompt. Windows 2000 and XP do not have the command prompt option.

1. ✓ Let's see what's in the root directory... That's **C:\>**. The most frequently used DOS command of all time is probably the **DIR** (Directory) command. Entering the **DIR** (Directory) command at the DOS prompt reveals the contents of the current directory.

Important Note - Anytime you use a DOS command you need to press the **Enter** key to execute the command. You'll be asked to enter DOS commands in the following steps. The actual commands you'll enter are in **BOLD**. Don't enter the **C:\>** prompt as part of your command line. I've provided the prompt as part of the instruction so you could verify that you're in the correct directory.

- ✓Type **C:\>DIR** at the command prompt and press **Enter**. Although your display may not have the same directory names and files, you should see something similar to this format:

```
C:\>dir
Volume in drive C has no label.
Volume Serial Number is E8EB-2600

Directory of C:\

02/27/2003 09:32p <DIR>      Documents and Settings
10/14/2000 05:07a <DIR>      My Music
02/04/2003 07:37a <DIR>      My Photos
10/17/2000 06:51p <DIR>      My Videos
02/27/2003 09:33p <DIR>      Program Files
03/15/2003 05:48p <DIR>      Temp
03/06/2003 07:39p <DIR>      WINNT
10/18/2003 04:24a 34222      COMMAND.COM
10/18/2003 04:24a 24         AUTOEXEC.BAT
10/18/2003 04:24a 38         CONFIG.SYS

                3 File(s)      74,953,841 bytes
                7 Dir(s)      8,479,186,944 bytes free

C:\>
```

- ✓Examine your directory information closely. This is useful information for you to determine the names of directories (<DIR>) and the size and creation dates of files. You can also determine how much space is left on your hard disk drive. Determine what files and directories are in the root directory of your C: drive and record your finding on the **Exercise Worksheet**.
 - ✓Sometimes it's tough to remember the commands and their proper syntax when you're first starting out. Try typing the command **HELP** at the prompt and press **Enter**. Too Much? Too Fast? Add the filter **MORE** to the command using the pipe symbol (|). Try the command **C:\>HELP | MORE**.
 - ✓If you want to find the help on a specific command all you need to do is type the command, space, backslash, and then a question mark. Type in the command **C:\>DIR /?** for the different options to display directory information. Which option or switch pauses after each screenful of information?
 - ✓Enter the DOS command that will display the directory contents one screenful at a time. Pressing spacebar will show you more. Record your finding on the **Exercise Worksheet**.
 - ✓Enter the DOS command that will display the directory contents in a wide list format. Record your finding on the **Exercise Worksheet**.
2. ✓It's time to move around the directory tree a bit. I know I'll have to use the CD (Change Directory) command to point into other directories, but I haven't a clue what operating system or directory structure you're using as you work through this lesson. I can only guess that it's different than what I'm using. Therefore, I really can't give you precise names of directories to practice this command so I'll have to use generalities.

So... I'll use the directory command to look for a specific directory I want to access. To access the directory, I'll use the CD command followed by a backslash and then the name of the directory I want to change into. For example, to change into the **TEMP** directory, I would type the command **C:\>CD\TEMP**.

- ✓ Choose a subdirectory and point to it with the CD command. Are there subdirectories in the directory you selected? If you don't find any, change back to the root directory and try again. Record your findings on the **Exercise Worksheet**.
 - ✓ To return to the root direction, enter the command **CD**. To move back one directory, type the **CD..** and press **Enter**.
 - ✓ OK... Now the true test of your navigational skills. You can point to a directory by entering CD and the full path to the subdirectory you want to point to. If I wanted to save some keystrokes to change into the DOC subdirectories in the TEMP directory I could type the command **C:\>CD\TEMP\DOC** instead of changing from one directory into the other. A couple steps ago, you collected the names of some subdirectories. Do this using the directory and subdirectory names you've collected.
 - ✓ Point up the directory tree by entering the command **CD..** or **CD** and the name of the directory. For example: **C:\>CD\TEMP**.
 - ✓ Now... You don't always have to type in the full path to change from one directory to the other. Remember that the backslash means root. If you're already in the root... To change into another directory, all you have to do is type in the CD command, a space, and then the name of the directory. For instance, enter the command **C:\>CD TEMP** to point to the **TEMP** directory from the root. You can use this procedure to change into any subdirectory that's in the directory you're already in. Using a space only works when you're going down the tree one directory at a time.
 - ✓ Practice using the CD command as you tour the C: drive. Practice is the only way you become comfortable with moving between directories.
3. ✓ Creating and Deleting Directories is another DOS tool used to manage files and directories. Before you can create a directory, you first need to point to the directory that will hold it. Enter the command **CD** to change to the root directory. In the following steps, you'll learn how to use the MD (Make Directory) command.
- ✓ At the command prompt, enter the command: **C:\>MD CSS**
 - ✓ To see if you were successful use the directory command. Is the **CSS** directory listed?
 - ✓ Change into the **CSS** directory using the **C:\>CD CSS** command. Have you noticed that the command prompt changes to include the directory name?
 - ✓ Make a directory called **DOC** in the **CSS** directory using the command: **C:\CSS>MD DOC**.
 - ✓ Do a **DIR** again. Do you see the **DOC** subdirectory listed?
 - ✓ Have your supervisor check your work.
 - ✓ Return to the root directory and remove the directories you've created.
 - ✓ To remove a directory, enter the command: **C:\>RD CSS**
 - ✓ Press **Y** when asked if you want to "**Delete directory C:\CSS and all its subdirectories?**" This will delete both of the directories that you created in earlier steps. Please note that this only works if the directories are empty of files.

Tech Tip – Hey! You’ve got to be careful when deleting things in DOS. There’s no “undo” or “undelete” feature hidden in DOS kernel. When you delete it... It’s gone baby. Be sure you know what you’re deleting before you press that Enter key.

4. ✓ Managing files in DOS can be convenient and at the same time... deadly. Remember that you’re operating at the system level and any command you enter is executed without question. DOS isn’t going to ask you, “Are you sure?” You can destroy hours of work or make your computer inoperable with the press of a key.

- Wildcards used in managing DOS files.
 - There are two characters used as **wildcards** when working with filenames. The * and ? can be used to represent all or part of a filename when using DOS to work with more than one file at a time. Wildcards work with all DOS commands that use filenames as part of their syntax.
 - The * wildcard can be used to represent any number of characters before or after the dot in a filename. Think of the wildcard as “doesn’t matter” when dealing with filenames. For instance... If you want to use the **DIR** command to list all files with the extension **TXT** you would enter the command **C:\>DIR *.TXT**
 - The ? wildcard replaces a single character in a filename. This is handy when looking for a filename with a specific number of characters. For example, to find all the files with a filename length of **five** characters and the extension **EXE**, you would enter: **C:\>DIR ?????.EXE**

OK... Let’s have some fun. The first thing you’re going to need to do is create a **TXT** file to play with. There’s a couple of ways to do this depending on the operating system you’re using. The goal is to create a file that contains the text, “**Computer Service and Support RULES!**” You’re going to save the file in the root directory of the **C:** drive with the filename **CSS.TXT**.

✓ If you’re using DOS, you’ll need to create this file by typing the command **EDIT** at the command prompt to use the text editor. Actually, **EDIT** also works with Windows but it would probably be easier to use **NOTEPAD** in the Accessories folder to create this file. Go ahead and select an editor to create and save this file as **CSS.TXT** in the root folder of the **C:** drive and then exit the editor.

✓ Open a command prompt as you did before. List the directory content of **C:** using the **DIR** command. Is the file you created there?

✓ Create a directory called **CSS** in the root directory of the **C:** drive.

✓ Now think... What we’re going to do is use the DOS **COPY** command to copy the **CSS.TXT** file from the root into the **C:\>CSS** directory you just created.

✓ Point to the root directory where **CSS.TXT** is currently located.

✓ Enter the command **COPY CSS.TXT C:\CSS...** The correct syntax is **COMMAND SOURCE-PATH DESTINATION-PATH**. If you can’t remember the syntax, all you have to do is enter the command **COPY /?**. That will give you help for the **COPY** command. If you’re successful, DOS will tell you, “1 file(s) copied.”

- ✓ Enter the command `C:\>DIR\` to locate the **CSS.TXT** file in the root directory. Enter the command `C:\>DIR\CSS` to locate the copy in the **C:\CSS** directory. Did you find both the original and copy of the **CSS.TXT** file?
- ✓ Another useful trick is to copy the file while renaming it at the same time. The copy command does this too and it's great for creating back-up files. Point to the **CSS** directory and enter the command: `C:\CSS>COPY CSS.TXT CSS.BAK` . Use the **DIR** command. You should now have two versions of the same file in the **C:\CSS** subdirectory.
- ✓ This brings up another point... Let's say you don't want to copy a file but merely want to change its filename. Here's a new command to learn... **REN** (Rename). First... Make sure you're pointing to the **C:\CSS** subdirectory. Enter the command: `C:\CSS>REN CSS.BAK CSS.DOC` and then check to see if the filename has been changed using the **DIR** command.

Again... Notice that DOS gives you little or no feedback verifying what you've done. The only indicator you'll receive after a command is the command prompt itself. That's why you need to verify all your file management operations with the **DIR** command.

- ✓ Now that you've learned how to create... It's time to learn how to destroy. Oddly enough, the command to delete is **DEL**. Let's cleanup what you've done to the C: drive so far. Point to the `C:\>CSS` directory and enter the command: `C:\CSS>DEL CSS.DOC`. I hope you realize that you could also do this from the root directory by using the full path with the **DEL** command. Enter the command: `C:\>DEL C:\CSS\CSS.TXT` to delete the **CSS.TXT** file from any subdirectory you're pointing to. Use the **DIR** command to make sure the files are now gone.
- ✓ Point to the root directory and remove the CSS subdirectory with the **RD** (Remove Directory) command. Enter the command: `C:\>RD CSS`. Use the **DIR** command to make sure the CSS directory is removed. **You cannot remove a directory unless it is empty.**
- ✓ Also locate the **CSS.TXT** file in the root directory and delete it. Now we're back to where we started.
- ✓ Type the command `C:\>DIR` and verify that the CSS directory has been removed. If it hasn't, you did something wrong in this section. Try again otherwise the experiment in the next section won't work.

D. Batch File and Batch File Processing

Generally speaking, batch files (files with the BAT extension such as AUTOEXEC.BAT) are text files that can contain a list of multiple DOS commands to be executed. For example, you could write a BAT file to copy multiple files, point to another directory, or do anything else you can do using the Command or DOS Prompt. It's very easy to create BAT files using a text editor like EDIT or NOTEPAD. In the following steps, I'll also introduce you to a way of using filters (!) to control output.

1. ✓ Creating, Editing, and Saving a Batch File

- ✓ Make your way to the command prompt again.
- ✓ If you're in DOS... You're already there when you boot-up.
- ✓ If you're in Windows 9x, you can boot-up while pressing F8 to boot to the "Command prompt only" selection from the Windows Startup Menu. You can also go to the

Command Prompt from within Windows 9x by selecting the Command Prompt icon in the Accessories folder.

- ✓ If you're using Windows 2000 or XP you can execute the CMD program from the Run feature on the Start button.
- ✓ Although you can use an editor, there is a way to create files without using one. What we're going to do is copy the console input to a file. Make sure you're in the root directory and enter the command: C:\>**COPY CON DIRBUILD.BAT** and then very carefully type in the following command lines:

```
ECHO Running CSS Directory Builder
ECHO =====
ECHO
CD\
MD CSS
MD\CSS\DOC
MD\CSS\IMAGE
MD\CSS\HTML
CD C:\CSS
DIR C:\CSS /W
PAUSE
DIR C:\ | MORE
^Z
```

Please note that "**^Z**" is a single character produced by pressing **CTRL+Z**.

- ✓ To examine what you've done, here's a new DOS command to study. Enter the command: C:\>**TYPE DIRBUILD.BAT** to view the file you just created. Compare the file to the program listing above. If it doesn't match, you'll have to edit the file with **EDIT** or **NOTEPAD** to make the appropriate changes or start over with **COPY CON** the previous step. Be sure to save the file with the extension **BAT**.

2. ✓ Processing a Batch File for Execution

- ✓ To execute the batch file you just created, you simply type the name of the file at the command prompt. Enter the command: **DIRBUILD.BAT** and observe the display carefully. This is what you should notice: "**Running CSS Directory Builder**" appears on the screen. The batch file creates the **CSS** subdirectory in the root of the C: drive. It then creates three subdirectories called **DOC**, **IMAGE**, and **HTML** in the **CSS** subdirectory. The batch file will then display the directory contents of the **CSS** directory in **wide** format and then **pauses** until you hit the space bar. It then concludes by displaying the contents of the root directory giving you only one screen at a time with the **MORE** filter.
- ✓ Complete the batch file exercise as directed in the **exercise worksheet**.

E. External Commands

So far, you've been using DOS commands that are held within the DOS kernel. These are also called internal commands because the kernel doesn't have to look outside its own program to find the command. In MSDOS, all internal commands are contained in the file COMMAND.COM. For all intents and purposes, COMMAND.COM is the kernel of the MSDOS operating system.

OS programmers try to keep the kernel as small as possible so it runs as fast as possible. Therefore, they put the most frequently used commands inside the kernel and the other as external files. Commands like EDIT, FDISK, FORMAT, ATTRIB, DISKCOPY are external commands. You can see them as files using the DIR command if you're in the right directory.

Executable files have the extension COM or EXE. There are lots of external commands offering some great utilities, but there are two commands you'll need to use as a technician:

FDISK - Before you install an operating system, you must first create a primary partition on the hard disk (disk 1) on your computer, and then format a file system on that partition. The FDISK tool is an MS-DOS-based tool that you can use to prepare (partition) a hard disk. You can use the FDISK tool to create, change, delete, or display current partitions on the hard disk, and then each allocated space on the hard disk (primary partition, extended partition, or logical drive) is assigned a drive letter. Disk 1 may contain one extended partition, and a second hard disk may contain a primary or extended partition. An extended partition may contain one or more logical MS-DOS drives. FDISK is only used in DOS, Win98, and WinMe operating systems.

When you run the FDISK tool on a hard disk that is larger than 512 megabytes (MB), you are prompted to choose one of the following file systems:

FAT16: This file system has a maximum of 2 gigabytes (GB) for each allocated space (partition) or drive letter. For example, if you use the FAT16 file system and have a 6-GB hard disk, you can have three drive letters (C, D, and E), each with 2 GB of allocated space.

FAT32: This file system supports drives that are up to 2 terabytes in size and stores files on smaller sections of the hard disk than the FAT16 file system does. This results in more free space on the hard disk. The FAT32 file system does not support drives that are smaller than 512 MB.

FORMAT - After you use the FDISK tool to partition your hard disk, use the FORMAT tool to format those partitions with a file system. The file system File Allocation Table (FAT) allows the hard disk to accept, store, and retrieve data. Windows 95 OEM Service Release 2 (OSR2), Windows 98, Windows 98 Second Edition, Windows Millennium Edition (Me), and Windows 2000 support the FAT16 and FAT32 file systems. The FORMAT tool is also used to format removable media like floppy and zip disks.

When you run the **FDISK** and **FORMAT** commands, the Master Boot Record (MBR) and file allocation tables are created. The MBR and file allocation tables store the necessary disk geometry that allows hard disk to accept, store, and retrieve data.

First a bit of caution... Since the FDISK command alters the MBR, you should NEVER execute this command unless you want to wipe out the entire contents of the partition on the hard disk drive. It doesn't really erase the information on the drive, but certainly makes the partition unusable until it's formatted again. FDISK is a great tool for wiping the disk clean to start over before performing a new installation of an operating system. Don't play with it though or you could regret it.

FORMAT is another dangerous tool. Formatting the hard drive will remove all the data on it. However, the FORMAT command is extremely useful for formatting floppy diskettes.

- ✓ Insert a floppy diskette (that you want erased) in the A:
- ✓ Type the command C:\>**FORMAT A:**

The process could take a few minutes to complete, but when it's done you have a formatted disk that's ready for data. There are some option switches you need to be aware of when using this command.

- ✓ Type the command C:\>**FORMAT /?** Determine which switch is used to format a diskette and copy over system files to make a bootable floppy diskette.
- ✓ Create a system diskette using the appropriate **FORMAT** command.
- ✓ Make a directory called DOS in the root directory of the A: drive.
- ✓ Use the **COPY** command to copy over the following files to the DOS directory on the floppy diskette:
 - FORMAT.COM
 - SETVER.EXE
 - EDIT.COM
 - FDISK.COM
 - SMARTDRV.EXE
 - HIMEM.SYS
 - ATTRIB.EXE
 - EDIT.HLP
- ✓ Use the Edit command to create an AUTOEXEC.BAT file. Make sure the file includes the program lines in the sample AUTOEXEC.BAT file below.
- ✓ Use the Edit utility to create a CONFIG.SYS file. Make sure the file includes the program lines in the sample CONFIG.SYS file below.

Depending of the OS you're using, there might be switches for creating a system disk, doing a quick format, or selecting a file system to use. **This disk is very important.** Once you've created a system disk, keep it in a safe place. You'll use this diskette during various parts of the course including PC troubleshooting. You should have at least two boot disks in your tool kit at all times.

F. The DOS Boot Sequence

When DOS boots-up, there are a series of files that are loaded in a particular sequence to build up the operating system in the computer's memory. The boot sequence is IO.SYS first and then, MSDOS.SYS, CONFIG.SYS (If it's there), COMMAND.COM, and finally AUTOEXEC.BAT. Although all of these files are in the root directory, I bet you could only see three of them. At the command prompt:

- ✓ Enter C:\>**DIR**. Which of the files listed above are displayed?
- ✓ Enter C:\>**DIR /?** Determine the switch used to display system files?
- ✓ Enter the directory command used to view the system files. Do you see others now?

IO.SYS and MSDOS.SYS are system files that are *hidden* and set to *read only* to keep users from fiddling around with the. If these files are deleted, the computer will no longer boot-up. This is a useful tool for technicians as well. The command **ATTRIB** can be used to change the attributes of files to mark any file as *hidden*, *read only*, *archive* or *system*. All Windows operating systems support file attributes and can be set using the command prompt or the Windows file properties function.

- ✓ Enter C:\>**DIR**. Can you see the file **CONFIG.SYS**?
- ✓ Enter C:\>**ATTRIB /?** Determine the switch used to mark a file as *hidden*.
- ✓ Enter C:\>**ATTRIB +H CONFIG.SYS**.
- ✓ Enter C:\>**DIR**. Can you still see the file **CONFIG.SYS**? I hope not.
- ✓ Enter C:\>**ATTRIB -H CONFIG.SYS**.

- ✓ Enter C:\>**DIR** and make sure the file **CONFIG.SYS** is again visible.
- ✓ Enter C:\>**ATTRIB** to list the attribute settings for all the files in the root directory.

You can edit two of the of the system files to change the configuration of how DOS boots and what files are executed during and after the system boot is completed. Using either the DOS utility EDIT or Windows Notepad, you can change CONFIG.SYS and AUTOEXEC.BAT to further automate the boot process.

AUTOEXEC.BAT – Stands for Automatically Executed Batch file and is run at the end of the boot process. This is a good place to put commands that you enter at the start of each computing session. For instance, you enter a command to enter the date and time or run a memory-resident program like EMM386.EXE.

Here's an example of a bare bones AUTOEXEC.BAT file:

```
A:\DOS\SMARTDRV.EXE /X
@ECHO OFF
path a:\dos
PROMPT $p$g
SET TEMP=A:\DOS
```

Tech Note: EMM386.EXE and SMARTDRV.EXE is an expanded memory management utility built into DOS and Windows 3.X. It's required to access the memory areas between 640K and 1024K. HIMEM.SYS is memory manger used in DOS, Windows 3.X, Windows 9x, and ME to access extended memory (1024K and above).

CONFIG.SYS – Whenever the computer boots it looks for the CONFIG.SYS file (if it exists) and executes any commands that it contains. Typically, the two commands found in the CONFIG.SYS file are BUFFERS = and FILES =. The technician can alter these values to specify the buffer size and increase the number of files that can be open at the same time. Here's a typical DOS CONFIG.SYS file:

Things you should remember about the boot process.

- CONFIG.SYS is not required for DOS (or Windows) to start up.
- COMMAND.COM displays the DOS command prompt, contains the internal DOS commands, and is required for DOS and Windows 3.X to boot.
- EMM386.EXE enables expanded memory and the use of upper memory and system memory.
- The boot sequence for a DOS system is IO.SYS, MSDOS.SYS, CONFIG.SYS, COMMAND.COM, and AUTOEXEC.BAT.
- DOS Memory is divided into conventional memory (640K), expanded or upper memory (394K), and extended memory (above 1,024K) areas.
- To boot to a DOS command prompt, only the IO.SYS, MSDOS.SYS, and COMMAND.COM files are required.

Here's an example of a bare bones CONFIG.SYS file:

```
DEVICE=C:\DOS\SETVER.EXE
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH
FILES=30
DEVICE=C:\DOS\SMARTDRV.EXE /DOUBLE_BUFFER
STACKS=9,256
```



Operating Systems Guide

Technical Manual

Exercise 2a – DOS Worksheet

Instructions:

Complete the entire exercise and record the results of your experimentation on this worksheet. Consider using other information sources as well. Periodicals, reference materials, and the Internet are great resources to find the answers to the technical problems you're going to face when servicing computers.

Name:	
Period:	
Date:	

Speaking of resources... Let's save some of our natural resources. Rather than printing out the entire lesson, print out only the worksheet. Study the lesson on-screen and then record your answers on the worksheet. When you're finished, return the worksheet to your supervisor for evaluation. Be sure to complete this assignment before moving onto the next.

Questions:

- ✓ Research and develop a detailed definition for each of the following terms. Many words have multiple definitions... Some of which may have nothing to do with the field of Computer Service and Support. Make sure your definition falls within the context of this lesson. Refer to the list of Research Resources and Required Materials as well as other materials you feel are appropriate. Write your definitions on the reverse side of this worksheet or a separate piece of paper with each definition being two sentences or more.
 - ✓ Filename
 - ✓ Extension
 - ✓ 8.3
 - ✓ FDISK
 - ✓ Subdirectory
 - ✓ Path
 - ✓ Command Prompt
 - ✓ Syntax
 - ✓ Batch File
- ✓ Which of the MSDOS commands below would remove all the command (COM) files from the A: drive?
 - C:\>DEL *.COM
 - A:\>ERASE *.COM
 - C:\>DELETE A:*.COM
 - C:\>DEL A:*.COM
- ✓ Which of the MSDOS commands below would redirect all information being typed into the computer to the printer?
 - DIR > PRN
 - COPY CON PRN
 - CON > PRN
 - COPY PRN CON
- ✓ Which of these MSDOS commands would provide a wide listing of files on the A: drive when the default drive is C?
 - DIR A:
 - DIR/W
 - DIR A:/W
 - A:DIR/W
- ✓ Which of these MSDOS commands would be used to copy only files with the extension "BAS" from the C: drive to the A: drive?
 - COPY A: ??????.BAS C:
 - COPY C:*. * a:

- C. COPY C: ??????.BAS A:
- D. COPY C:*.BAS A:

6. ✓ Which of the following is **not** a valid MSDOS command if B: is the default drive?
- A. COPY B:*.*
 - B. DIR B:*.DAT
 - C. DEL *.*
 - D. REN SAM.TST SAM1.TST

Exercise:

This section is used to record the data that's collected during the exercise. Each section number refers to a specific step in the exercise. As you work through each task, record your results here when instructed to do so.

B2 Circle those file names that do not comply with the 8.3 naming convention.

- | | | |
|---------------|-------------|--------------|
| DUKEM.EXE | WHO?.TXT | H/WASGN.TXT |
| DR.SMITH.GIF | INDEX.HTML | Kittycat.jpg |
| WhatsOnTV.DOC | LAB_1.TXT | SYSTEM.INI |
| FILE#1.COM | CSS-PMI.DOC | TEST[1].DWG |

B4 Translate the following path descriptions to a path statement that can be entered at a command prompt.

- ✓ The file **CONFIG.SYS** that's located in the **root** directory of the **C:** drive.
- ✓ The file **FORMAT.COM** located in the directory **UTILITY** that's on floppy disk drive **A:**
- ✓ There's a file called **INTRO.DOC** in the subdirectory **WORD** that's in the **DOCUMENT** directory in the **root** directory of the **C:** drive.

C2 Do you have the following files in your root directory (C:\>)? List the directories you see there.

AUTOEXEC.BAT	YES	NO
CONFIG.SYS	YES	NO
COMMAND.COM	YES	NO

- ✓ What is the DOS command used to display the directory contents one screenful at a time?
- ✓ What is the DOS command used to display the directory contents in a wide list format?
- ✓ How do the standard and wide list formats differ?

C3 Select a directory in C:\ and point to it with the CD command. Write down the complete path and list the subdirectories you find there.

D2 Create a batch file called EXEFINDR.BAT. This program will look through all directories and sub directories looking for all EXE files. The program will report all directories, file size, and the number of files in each directory. It will also sort the files before it displays them one screen at a time. After your program is tested and working, copy the code to this exercise worksheet. **Have your supervisor check your work.**

HINT: Use HELP to figure out which switches to use for the DIR command. Depending on the size of your drive, your program may take awhile to execute. If the hard drive is clicking away... It's working. Pressing **Ctrl-C** (Break) will allow you to exit a running batch file.



Operating Systems Guide

Technical Manual

Exercise 3 – Windows 9x

Introduction:

Every good technician needs to know Windows 9x from a user's perspective. Although it's an older version, it is the foundation upon which you'll build your Windows experience. Practically everything you'll learn with Windows 9x will directly transfer to later releases of the OS. As a computer service and support technician, you're expected to be a guru of technology ...not only with PC hardware, but with operating systems and application software as well. You have to be an expert printer troubleshooter and a savvy Microsoft Word user as well. This may not seem reasonable, ...but that's just the way it is. You might be wondering why we're skipping over Windows 3.X. Well, Windows 3.X really isn't an operating system. It's more like an operating environment or shell that DOS uses as an interface. Although it's the precursor to Windows, it's more a kin to DOS than it is to the Windows OS.

Exercise Objective:

You need to be comfortable and confident with the Windows interface or you'll lose credibility as a technician. If you walk up to service a PC and have trouble moving or resizing a window... That's not going to instill a lot of confidence in your customer. The creators of the A+ Certification exams understand this, so the exams test you on Windows user-level stuff, such as file manipulation, shifting between open applications, accessing the proper toolbar to find formatting tools, and so on. While you probably already know much of this information, these labs will help you review and perhaps catch a few bits and pieces you might have missed along the way.

You'll perform some exercises covering the following topics:

- A. Windows 9x Installation** – You'll install Windows 9x onto a computer workstation.
- B. Windows 9x Directory Structure** – You'll explore the Windows 9x directory structure. When you're finished with this exercise, you will:
 - Know how to use Windows Explorer
 - Be familiar with the contents of the Windows and Program Files folders
- C. The Windows Desktop** - You'll work with certain features of the Windows desktop. When you're finished with this exercise, you will:
 - Be familiar with and comfortable using the Windows taskbar
 - Be able to run programs from the Start menu
 - Know how to customize the Start menu and taskbar
 - Know how to change settings for the Recycle Bin
- D. Control Panel** - You'll practice working with the Control Panel. When you're finished with this exercise, you will:
 - Be familiar with some commonly used applets in the Control Panel
 - Know how to make a Startup Disk
- E. System Tools** – You'll practice working with the System Tools applet. When you're finished with this exercise, you will:
 - Be familiar with the tools available in the System Tools applet
 - Know how to use the Disk Cleanup, System Information, ScanDisk, and Disk Defragmenter tools
- F. The Registry** – You'll familiarize yourself with the Registry and REGEDIT. When you're finished with this exercise, you will:
 - Know how to access the Registry using REGEDIT

- Know the functions of the six Registry Keys

G. Virtual Memory – you'll practice configuring your system's virtual memory. When you're finished with this exercise, you will:

- Configure virtual memory using the System applet in Windows

H. The Boot Process – you'll explore the scope and sequence of the Windows 9x boot process. When you're finished with this exercise, you will:

- Determine what files are used during the boot process.
- Determine the sequence in which files are loaded during a Windows 98 boot.

Discussion of Fundamentals:

Preparing for the CompTIA A+ Operating Systems exam is tough. Covering from DOS up to the latest and greatest operating system on the market, there will be questions you'll have to answer about the various operating systems. You can learn most of what you have to know from working with two or three operating systems... Windows 98 is one of them.

Technical Specifications of Windows 9x and Windows NT				
Specification	Win 95 (OSR2)	Win 98	Win NT 4.0*	Windows Me*
Min. RAM	16MB	16MB	32MB	32 MB
Min. Hard Disk	50MB	80MB	100MB	420MB
Min. CPU	486-25MHz	486-66MHz	Pentium 100	Pentium 150
Networking Protocols	NetBIOS	NetBIOS	NetBIOS	NetBIOS
	IPX	IPX	IPX	IPX
	TCP/IP	TCP/IP	TCP/IP	TCP/IP
	DHCP	DHCP	DHCP	DHCP
	Dialup Network	Dialup Network	Dialup Network	Dialup Network
File System	FAT16	FAT16 or FAT32	FAT16 or NTFS	FAT16, FAT32 or NTFS

We'll explore NT and Me just as a comparison for now. NT is more aligned with Windows 2000 than 98 because it requires a login to operate. On the other hand, Windows Me is more like Windows 98 Third Edition than a new product all its own. It was designed as a home user version of Windows 2000 and was more or less considered a band-aid until Windows 2000 could be released. As operating systems are released reliability and security is improved. New features are also added. Here's a list of features that compare the different 9x releases:

More on File Systems - The main purpose of the file system is to store and retrieve data from the computer's hard disk. The file system is the plan for how the data is organized, optimized, and retrieved on hard drive. Hard drives store information on platters. Platters are metal disks that are coated with a magnetic substance. Straight from the factory, a hard disk drive is organized by platter sides, tracks, and sectors. It's sort-of like a huge parking garage without the lines for parking. To continue with the analogy, the file system determines the numbering system for the parking spaces, the size of the spaces, and the paths for cars to get to them.

The file system does the same thing, but for data. The file system organizes the space into clusters that can be addressed by the computer. The addresses for the data, the size of the clusters, and the sides, tracks, and sectors of the hard drive media are all stored in the File Allocation Table (FAT).

DOS and Windows are the most widely used operating system in the United States and many other parts of the world, so its file system is pretty much the standard that most other operating systems can read from.

FAT16: This file system has a maximum of 2 gigabytes (GB) for each allocated space (partition) or drive letter. That's because only 16 bits are used to address each data clusters (Each cluster holds 32-Bytes) on the hard drive ($2^{16} = 65,536 \times 32 = 2\text{GB}$). For example, if you use the FAT16 file system and have a 6-GB hard disk, you can have three drive letters (C, D, and E), each with 2 GB of allocated space.

FAT32: This file system supports drives that are up to 2 terabytes in size and stores files on smaller sections of the hard disk than the FAT16 file system does. FAT32 uses larger 32-bit addresses in the File Allocation Table (FAT) to provide access to partitions and files larger than 2GB. It also provides adjustable cluster sizes making storage of small files more efficient. This results in more free space on the hard disk. The FAT32 file system does not support drives that are smaller than 512 MB.

This exercise deals with Windows 9x meaning... Windows95, Windows95 (OSR2), Windows98, and Windows98 Second Edition. It's important to realize that there are subtle differences between these operating systems, but the basic functions are the same. Some of these features also apply to Windows ME. Here's a listing of the technical specification differences between the Windows versions:

Windows 9x Versions				
Feature	Win 95 OSR2 (Win			
	Win 95a (Retail)	95b/OEM)	Win 98	Win 98 SE
ACPI Support	N	N	Y	Y
Active Desktop	N	N	Y	Y
Backup Utility	N	N	Y	Y
Dial-Up Networking	Y	Y	Y	Y
Disk Management	N	N	Y	Y
DVD Support	N	N	N	Y
FAT32	N	Y	Y	Y
FAT32 Conversion	N	N	Y	Y
Internet Connection Sharing	N	N	N	Y
Multiple Monitors	N	N	Y	Y
OnNow Support	N	N	Y	Y
Task Scheduler	N	N	Y	Y
USB Support	N	Y	Y	Y
Windows Update Utility	N	N	Y	Y

Words and Terms You Should Know:

- SYSTEM.DAT
- USER.DAT
- Cookies
- INF files
- OSR2
- Taskbar
- System Tray
- TrueType Font
- OEM
- History Folder
- Registry
- Virtual Memory

Research Resources:

Company	Web Site	Description
Microsoft	http://www.microsoft.com/windows98/	Microsoft's technical support site for Windows 98.
	http://support.microsoft.com/	Microsoft's technical support site for Windows operating systems and application software.

Required Materials:

- Computer Trainer
- Windows 95, 98, 98SE, or Millennium OS
- Computer Trainer with Windows 95, 98, 98SE, or Millennium installed
- One 3½" Blank Floppy Diskette, 1.4MB

Tech Note: You'll need to use a computer trainer that you can wipe and buildup as you experiment with different installation methods for Windows 9x. The troubleshooting experiments can be completed on a Computer Trainer that has an existing installation of Windows 9x providing you have administrator access to the computer.

Where on Earth can I find a legal Windows 9x distribution disk? Microsoft no longer distributes nor supports Win9x. If you don't have a bootable CDROM (OEM) version of Windows 9x on hand, check with your system administrator or local Techno Geek. They're bound to have a few copies lying around. You'll only install the OS for a short period of time. You'll remove it once you complete the following exercise. If all else fails, you can do much of this exercise using later releases of Windows.

Procedure:

Complete each of the following steps in this exercise. When you see a ✓... That's an indication that you need to do something. For your convenience, there is an **Exercise Worksheet** attached to the end of this exercise. To save trees... It would be best to print out this worksheet only. You'll use it to record your answers while performing the following steps.

A. Installing Windows 9x

1. ✓ If you don't already have a workstation with Windows 9x or Millennium installed, you'll have to install it to perform the following exercises. If you can't get your hands on a version of Windows 9x, review the installation process, fill out the worksheet, and then proceed to the next section. During the setup process you will be asked for some information. You may need to contact your system administrator to get some of this information. Be sure to have the following:

Windows 9x CD: The CD is inside the Windows 9x folder.

Product Key: You can find the Product Key on the back of the Windows 9x folder.

- ✓ Complete the OS installation information table on the **Exercise Worksheet**.
2. ✓ Before you start installing the OS, you need to know if your existing hardware can handle the OS. Record the configuration information of the workstation in the tables in the **Exercise Worksheet**. Compare it to the system requirements for the OS you're installing.
3. ✓ Here's the simplest method for installing the operating system. The more features included with a new OS means a longer setup time. Installation will take awhile... Perhaps an hour or so, but you need the experience to become proficient enough to solve and OS installation problem you encounter.
 - ✓ **Simplest Installation Method:** Install the complete OS on a clean system, using all defaults.
 - The machine should have only a basic video card, RAM, CPU, keyboard, mouse, floppy drive, CD-ROM drive, and hard drive installed.
 - Don't use a computer that requires RAID drivers or anything fancy—just use a plain vanilla PC.
 - Answer "Yes" to everything except networking.

Tech Tip - If you're very clever, you can determine most of this information without having to open up the computer cabinet. If you watch the monitor screen very carefully during system boot, you may be able to get the following information about your system:

- Video Card Manufacturer and Model
- Processor Manufacturer, Model, and Speed
- RAM Capacity
- Hard Disk Drive Manufacturer and Model
- CDROM Drive Manufacturer and Model

You have to be fast though. If you miss the information as it flashes on the screen, you might have to reboot the computer over and over to get all the information you're looking for. Once you have the drive models, you can lookup their capacity on the WWW.

4.√ **Install Windows 9x** – Check the system BIOS to make sure the Boot Sequence is setup to boot off the CDROM drive first.

5.√ **Update the OS and Device Drivers** - One of the first things you should do right after you install an operating system is update it. Install the latest service packs, updates, and device drivers to make your installation both reliable and secure. All system upgrades are available on the Microsoft website. The Windows 9x auto-update feature is no longer supported by Microsoft's website. However, you can search their update files on there website to get what you need. Often, the only place you can find device driver upgrades are from the device manufacture. It's critical that you perform this update as soon as you have a working installation of the OS. Because you may not have access to a computer network, smart techs carry these files with them on service disk CDROM.

B. Windows 9x Directory Structure

Let's look at the internal directory structure of Windows 9x.

1.√ Start by opening Windows Explorer. You can find it under Programs on the Start menu.

This program does more or less the same things as My Computer, but it looks and acts more like the old Windows 3.x File Manager. Besides giving you practice with another tool, Windows Explorer's handy directory tree on the left-hand side makes it much easier to see the Windows 9x directory structure. When you first look at Windows Explorer, notice that Desktop shows up right at the top of the list on the left side. Convenient, but in fact the real directory structure looks nothing like this.

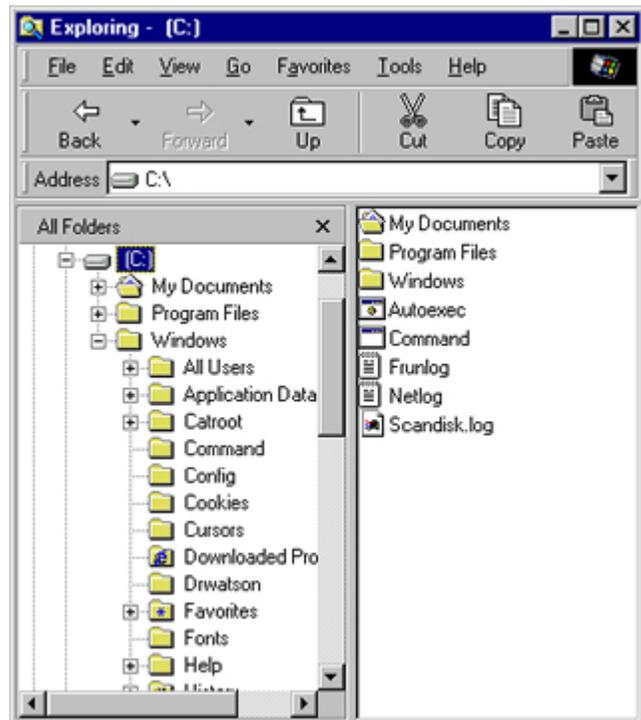


Figure 1. To see what the Windows directories really look like, first look at the C: drive.

- ✓To see what the Windows directories really look like, first look at the C: drive (see **Figure 1**). Notice the little minus sign (-) to the left? Click it to collapse the C: drive folders.
- ✓Now you should see a little plus sign (+). Click it to expand the C: drive back to the way *it* looked when you first opened Windows Explorer.
- ✓All Windows 9x systems have at least two folders: Program Files and Windows. By default, applications install in Program Files. But first... Let's look in the Windows folder. Expand the Windows folder and look at the subfolders.

Tech Tip: If you are using web view, Windows 98 systems require you to click a text link called Show Files in order to see any files in the Windows folder.

- ✓Notice the column headers in **Figure 2**. Click each (Name, Size, Type, Modified) of these to sort by that value. Click them again to sort in reverse order. Sort by Type and see if you can locate these file types: **INI** **BMP** **TXT** **EXE**

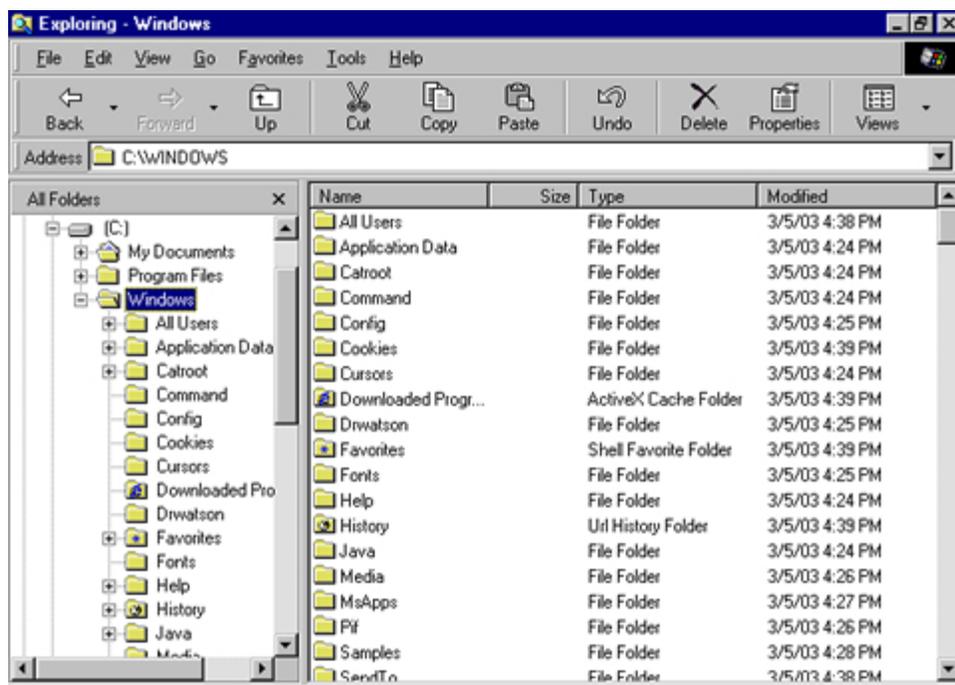


Figure 2. Click each (Name, Size, Type, Modified) of these to sort by that value.

- ✓Locate the SYSTEM.DAT and USER.DAT Registry files.
- ✓Locate W1N386.SWP, the Windows virtual memory swap file.
- ✓Open the WINDOWS\COMMAND subdirectory. This folder stores all the DOS-equivalent command-line programs.
- ✓Find FDISK.EXE and FORMAT.COM.
- ✓Find EDIT.COM.
- ✓Open the WINDOWS\COOKIES subdirectory. The cookie folder is the only place that a Web site may place data. Cookies store usernames, personalization data—anything that a Web site may want to know about you should you return to it.

Tech Tip - The cookies folder gets pretty filled on most systems and is a good place to go when you want to delete excess files, although if you do so, the next time you go to your favorite web site you may find you have lost all your personal settings.

- ✓Open the WINDOWS\CURSORS subdirectory. Here's where Windows stores the many different cursors you may use.
- ✓Open the WINDOWS\DESKTOP subdirectory. Is this...? Yes it is! The Windows desktop in reality is just another subfolder under Windows. If you save a file to your desktop, you're really just saving it in this folder,
- ✓You should see some of the same icons you see on your desktop. Notice that you do not see the My Computer, Recycle Bin, and Network Neighborhood icons, Microsoft has some magical way of placing those icons on the desktop. In a networking environment, users can share their desktops in order to transfer files among themselves. In order to share your desktop, you need to know the location of this folder, and now you do.
- ✓Open the WINDOWS\FAVORITES subdirectory. This folder stores the Web sites you save as Favorites in Internet Explorer. You can edit the contents of your Internet Explorer Favorites from this folder.
- ✓Open the WINDOWS\FONTS subdirectory. Like the name says, Windows stores all its fonts here. Note that fonts have one of two extensions: .FON or .TTF. FON files are old-style screen fonts. TTF files are modern TrueType fonts. Try opening a font to see what it looks like.
- ✓Open the WINDOWS\HELP subdirectory. This is the default location for all HLP (help) files. Open one to see what program uses it.
- ✓Open the WINDOWS\HISTORY subdirectory. This is the Internet Explorer History list of visited Web sites—a nice place to spy on what Web sites a person has visited! Most newer web browsers have a History option that shows you the same information from within the browser.
- ✓Open the WINDOWS\INF subdirectory. INF files make up the cornerstone of hardware installation.
- ✓To install any device in Windows, that device must have an INF file. The INF file tells Windows what drivers to load, what updates to place into the Registry, and what resources the device wants to use. All versions of Windows come with INF files for a broad cross-section of devices, Any new device loaded has the INF file copied here.
- ✓Open the WINDOWS\MEDIA subdirectory. This is the default location for sounds and audio clips. Double-click a file with a .WAV or .MID extension to hear sounds,
- ✓Open the WINDOWS\PIF subdirectory. Windows stores all Program Information Files (PIF) here. PIF files are used to support DOS programs.
- ✓Open the WINDOWS\SYSTEM subdirectory. This subdirectory is the heart of Windows 9x. Here you can see the core operating system files: GDI.EXE, KRNL386.EXE, and USER.EXE. This folder also stores almost all of the DLL files used by Windows.

✓ Many Windows 9x systems also have a \WINDOWS\SYSTEM32 folder. This folder stores DLLs and other support files for programs designed to run under both Windows 98 and Windows NT/2000 systems.

✓ Now collapse the Windows folder and expand the Program Files folder (see **Figure 3**). This is the default location for applications installed on your system. (Remember to scroll down if you can't see the end of the list,)

✓ Try opening a subfolder—Accessories is a good one—and find some real programs. Look for the .EXE extension.

✓ Do you see WORDPAD.EXE, or maybe MSPAINT.EXE? Double-click one to start the program. Now that you know this, you never again have to rely solely on desktop icons or the Start menu.

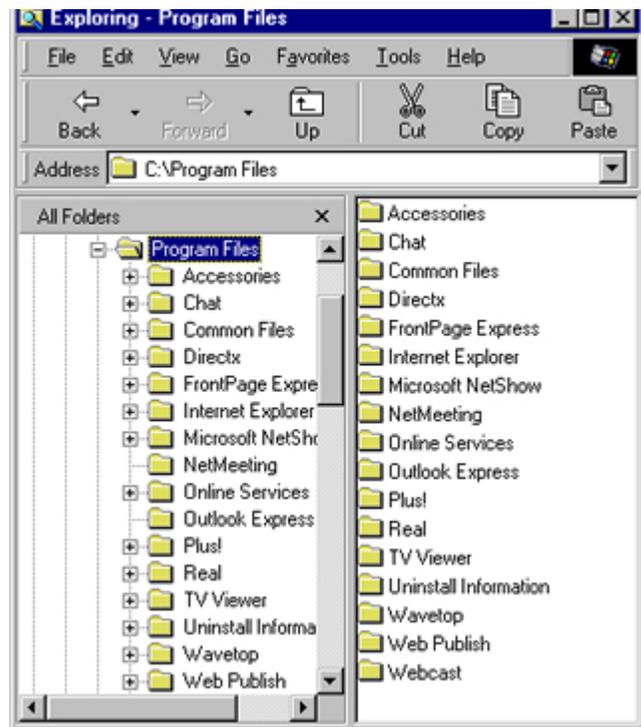


Figure 3. The Program Files folder is the default location for applications installed on your system.

✓ Close the program you just opened.

✓ Make a list of the applications in your Program Files Folder recording them on the **Exercise Worksheet**.

✓ Collapse the Program Files folder.

C. The Windows Desktop

1. ✓ The taskbar, by default, runs along the bottom of all Windows 9x desktops (although you may move it to any side: top, bottom, left, or right). The taskbar handles a number of critical jobs. Most important, it displays the Start button, probably the most frequently clicked button on all Windows systems. When you look at the taskbar, you'll notice the Start button in the far-left corner,

✓ Click the Start button.

✓ Clicking the Start button opens the Start menu, which is where Microsoft in its wisdom chose to put the Shut Down command. It also lists programs loaded on the system, which you can start by selecting them from the menu, and it has a Settings entry that provides access to the Control Panel and Printers applets.

✓ Move your mouse up to the Programs menu, but don't click it. As the mouse moves, notice how other menus appear.

✓ When the Programs menu appears, move your mouse to the Accessories menu.

✓ Locate the Notepad program and click it. Notepad should open in a window, and you should see a button appear on the taskbar. Most running programs show up on the taskbar in this way.

- ✓ Close the Notepad program by clicking the button with the “X” in the upper right-hand corner of the Notepad window. Look again at the taskbar to see that Notepad no longer appears there.
- 2. ✓ Now look all the way to the right of the taskbar. This side of the taskbar is known as the system tray.

At the very least, you’ll see the current time in the system tray, although on most Windows systems, you’ll also see a number of small icons. These icons represent programs running in the background.

You often see icons in the system tray for network status, volume controls, and virus programs, and laptops may have additional icons for battery state and PC Card status. All kinds of icons show up there. What shows up in your system tray depends on your version of Windows, what hardware you use, and what programs you have loaded.

- ✓ Double-click the various icons in your system tray to see what they do.
- 3. ✓ Now you’ll customize your environment a little.
 - ✓ Click the Start button and choose Settings.
 - ✓ Select Taskbar & Start Menu and click to run the applet.
 - ✓ You should see two tabs: Taskbar Options and Start Menu Programs. Together these tabs enable you to customize many aspects of these components.
 - ✓ Try changing the settings of each option on the Taskbar Options tab. Make a note of what each one controls on the **Exercise Worksheet**.

- Always on top
- Auto hide
- Show small icons in Start menu
- Show clock

- ✓ Now click the Start Menu Programs tab, You’ll see several buttons you can use to alter the program selection that appears when you open the Start menu.
- ✓ Use the Remove button to remove Notepad from the Start menu. Before you remove it, make a note of where the program is stored on the **Exercise Worksheet**.
- ✓ Use the Add button to put Notepad back in the Accessories menu, or if you prefer, in the main Programs menu.
- ✓ Now click the Advanced button and discover the Start menu’s secret: it’s a special subfolder within your Windows folder. The Start menu entries are just shortcuts that Windows displays in a special way. I use this feature to move my frequently used programs to the “upper menu” that displays above Programs when you click the Start button—I just put the shortcuts in the top level of the Start menu folder.
- ✓ As the tab tells you, the Clear button tells Windows to “forget” what you’ve been doing, which it otherwise records for your convenience in the Documents entry of the Start menu. If you share a computer with others, this can be a useful cleanup tool,

4. ✓As you know, a file is not actually erased from your hard drive or other storage media when you delete it. Windows 9x and Windows 2000 add an even higher level of protection in the form of the Recycle Bin. When you delete a file in Windows, a copy of the file moves into the Recycle Bin, It stays there until you empty the Recycle Bin, restore the folder or file, or until the Recycle Bin grows larger than a preset amount.

✓To access the Recycle Bin settings, right-click the Recycle Bin icon and select Properties. The Recycle Bin's Properties settings look different depending on the version of Windows you have, but they all basically work the same way.

Tech Tip - Remember that everything in Windows has a Properties setting, which you can always access by right-clicking the object and selecting Properties. You may also access Properties by highlighting the object and pressing Alt-Enter. If a hard drive starts to run low on space, the Recycle Bin is one of the first places to check.

✓Note that 10% is the default amount of drive space to use for the Recycle Bin. Change this to 5% and close Properties.

D. Control Panel

1. ✓Open the Control Panel. There are two standard ways to do this:

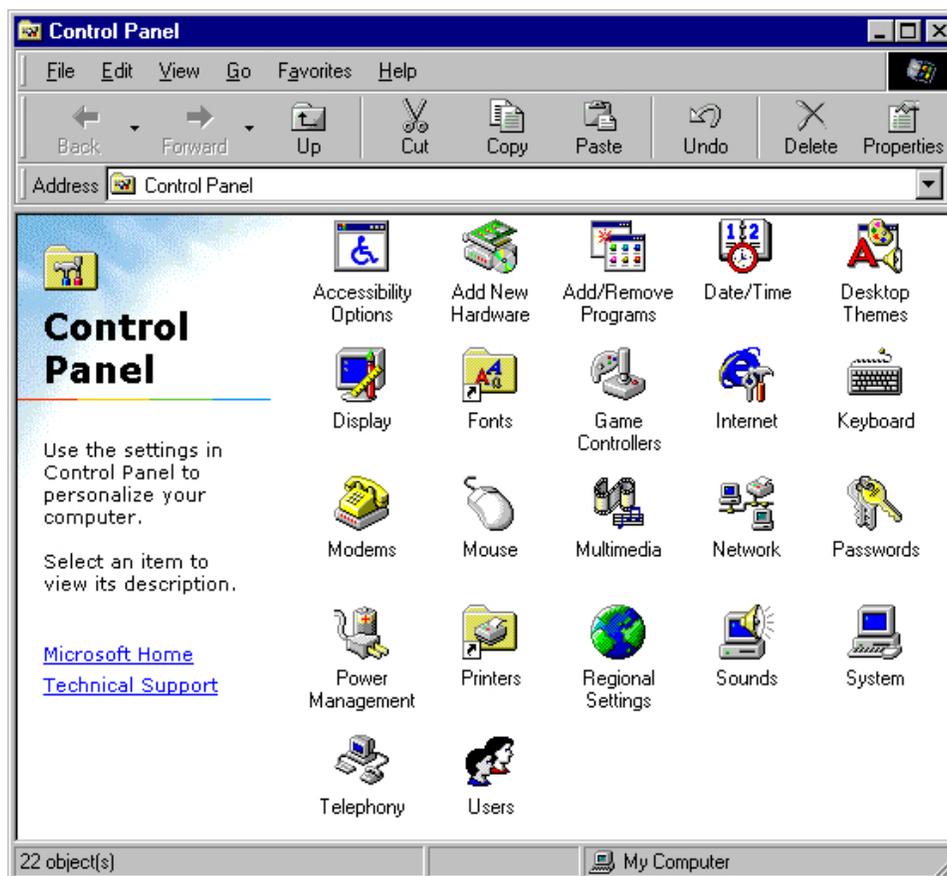


Figure 4. Click the Start button, scroll up to Settings, and select Control Panel. The Control Panel dialog box opens.

✓Click the Start button, scroll up to Settings, and select Control Panel. The Control Panel dialog box opens (see **Figure 4.**).

- ✓ Double-click the My Computer icon on your desktop and then double-click the Control Panel icon.
 - ✓ First you'll create a Startup Disk that you can use to boot your system in case of a problem. Insert a blank floppy disk labeled "Windows 98 Startup Disk" into your floppy drive.
 - ✓ Double-click the Add/Remove Programs icon in the Control Panel.
 - ✓ Select the Startup Disk tab.
 - ✓ Click the Create Disk button.
 - ✓ Whether or not you have already inserted a floppy disk, you will see a dialog box instructing you to do so and warning you that the contents of that floppy will be erased when you create the startup disk. Double-check your floppy disk and then click OK.
 - ✓ Store your new boot disk in a place where you can find it easily in an emergency.
2. ✓ Return to the Control Panel and double-click the Display icon.
3. ✓ Examine each of the following Display tabs to see what it controls and experiment with making changes. Don't forget to note the current settings first.
- ✓ **Background** This is where you can add wallpaper to your desktop. The default folder for these images—which must be BMP or GIF (Win98 only) files—is C:\Windows.
 - ✓ **Screen Saver** This is where you change the screen saver settings. Note that you can preview your choice. Two important features in a corporate environment are the timer and password protection. If a screen saver has customizable features, you can click the Settings button to adjust them.
 - ✓ **Appearance** This tab lets you change the look of your system, including the colors and fonts used to display windows and menus. It lets you save groups of settings as schemes.
 - ✓ **Effects** This tab is where you can change your desktop icons and toggle on and off various visual effects.
 - ✓ **Settings** This is the most "techy" of the tabs. It enables you to control the number of colors your display uses and the screen resolution (for instance, 640x480). Also, if you click the Advanced button, you can access any special features of your particular monitor/video card, including the refresh rate. Be sure you know what you're doing before you change these settings!
- Tech Tip** - If you click the Apply button after making a change instead of the OK button, the Display applet will remain open after the change takes effect—very useful when you need to experiment a bit.
4. ✓ Close the Display applet and double-click the Keyboard icon in the Control Panel. One thing you might not have guessed is that you can adjust your cursor's blink rate here.
- ✓ Try changing the key repeat rate and delay settings. A minor adjustment here can really help a heavy-fingered user.

5. ✓ Close the Keyboard applet and double-click the Mouse icon.
 - ✓ **Buttons tab** This tab lets you assign actions to the different buttons (and if you have one, the scroll wheel) of the mouse.
 - ✓ **Pointers tab** This tab lets you change the mini icons that represent your mouse pointer, such as the arrow, hourglass, and so on.
 - ✓ **Motion tab** This tab lets you adjust the speed and tracking features of your mouse. I always adjust these settings when I install a new mouse.
5. ✓ Now that you've tweaked your mouse performance, close that applet and double-click the Sounds icon.
 - ✓ Scroll through the Events menu and see which ones have sounds assigned to them. Are you using the Windows defaults?
 - ✓ Select the Asterisk event. You should see the WAV file associated with this event in the Name field below.
 - ✓ Click the little arrow button to the right of the filename to play the sound.
 - ✓ Now click the Browse button and select a different WAV file to associate with that event.
 - ✓ Click Apply to save your choice.
 - ✓ Highlight the Asterisk event and play the new sound. Don't like it? Change it back.
 - ✓ Click the drop-down menu arrow next to the Schemes field. Notice there is a Windows Default sound scheme, but if you want to alter a few sounds, you can save your new set of sounds as a separate scheme just like you could with the color and font selections in the Display applet.
 - ✓ Finally, open the Date/Time applet in the Control Panel. This applet has been around since the dawn of time, more or less, when computers didn't automatically adjust themselves for Daylight Saving Time.
 - ✓ Practice adjusting the date and time. Notice you can do this either by scrolling with the arrows or by highlighting the fields. This feature can come in handy if you travel and want to change the time zone on a portable computer.

E. System Tools

1. ✓ Click the Start button, then select Programs Accessories System Tools.
 - Compression Agent
2. ✓ You should see the following:

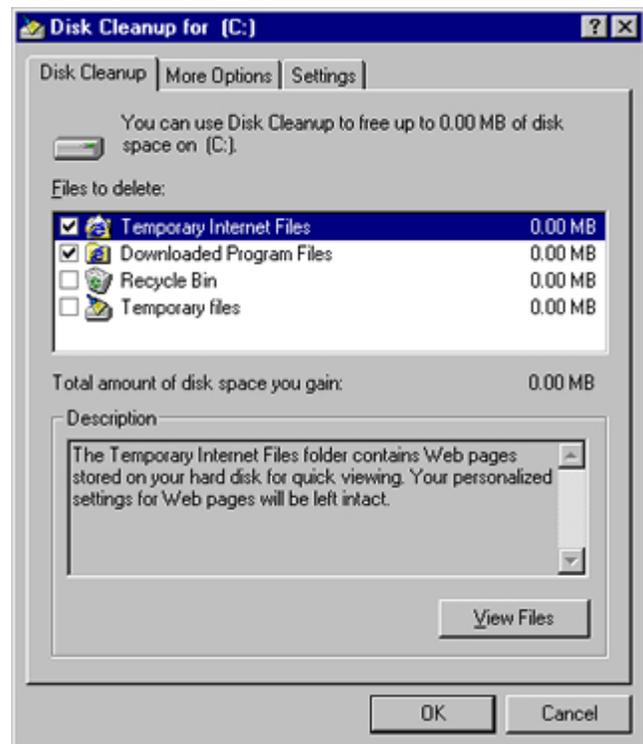


Figure 5. Starting with Windows 98, Microsoft introduced a built-in disk cleanup program called, cleverly enough, Disk Cleanup.

- Disk Cleanup
- Disk Defragmenter
- Drive Converter
- Drive Space
- ScanDisk
- Scheduled Tasks
- System Information

3. ✓ Let's examine a few of these, starting with Disk Cleanup (see **Figure 5**).

Starting with Windows 98, Microsoft introduced a built-in disk cleanup program called, cleverly enough, Disk Cleanup. Frankly, most third-party disk cleanup tools do a far better job, but it's not a bad little program and it does perform a very important function...it helps you get rid of the many "junk" files Windows regularly puts on your system. These junk files fall into one of six categories:

- Application temporary files that failed to delete
- Installation temporary files that failed to delete
- Internet browser cache files
- Files in the Recycle Bin
- Internet cookie files
- Identical files in separate locations

✓ Open Disk Cleanup. How much disk space does Windows think you can clear up? Record this information on the **Exercise Worksheet**.

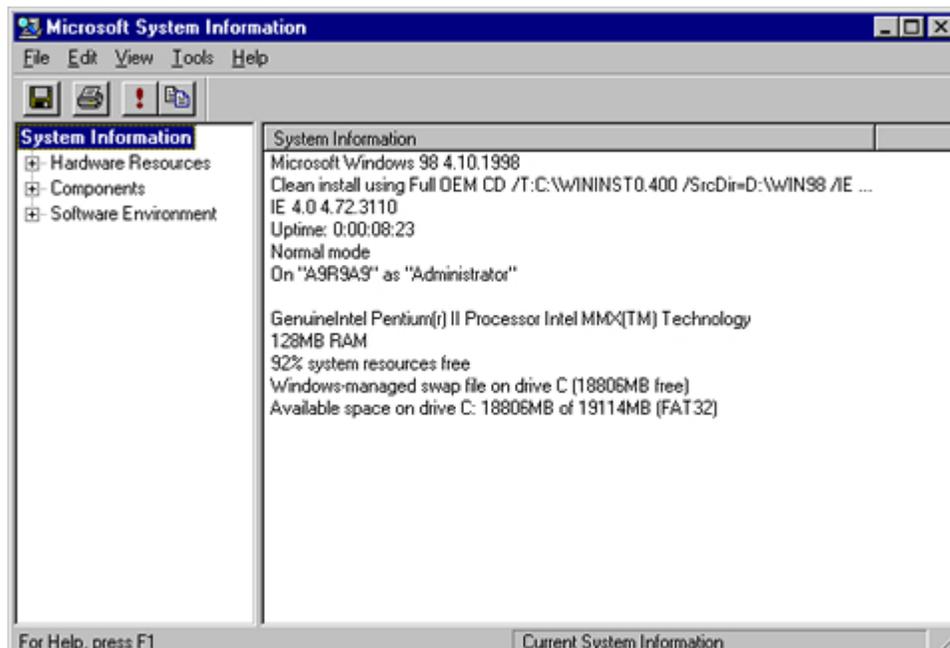


Figure 6. The System Information tool is like a read-only Device Manager that shows you resource and driver information.

✓ Highlight Temporary Internet Files and click the View Files button. Anything there you really need? If not, select that category and click OK to have Disk Cleanup remove the files.

4. ✓ Now open the System Information tool (see **Figure 6**). This tool is like a read-only Device Manager that shows you resource and driver information. Record this information on the **Exercise Worksheet**.

- ✓ Make a note of the version of Windows you are running.
- ✓ Make a note of the amount of RAM you have.
- ✓ Make a note of the percentage of free system resources.
- ✓ Make a note of the available space on drive C:

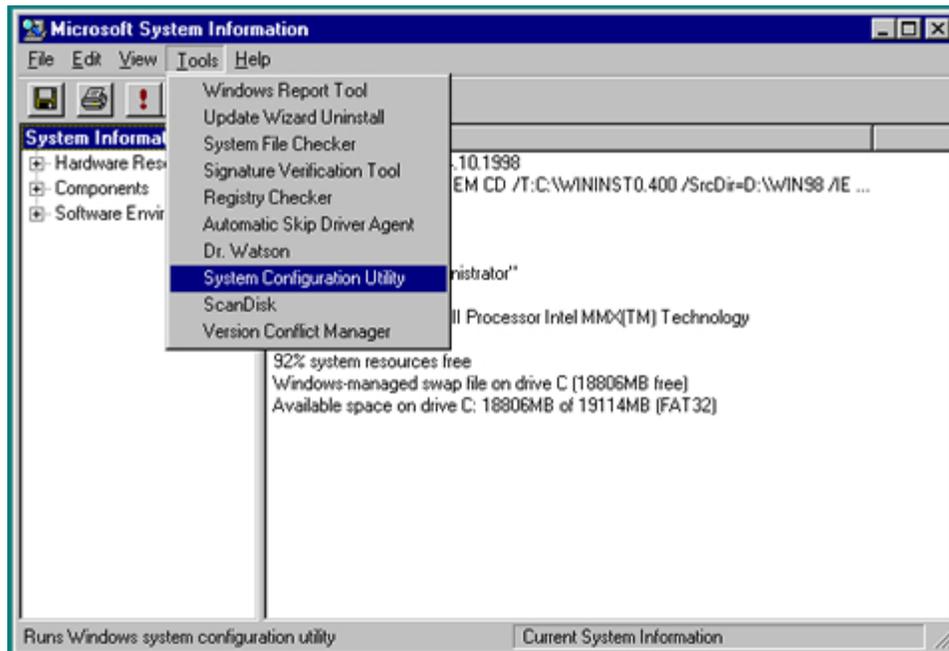


Figure 7. The Tools menu in System Information

Tech Tip: If you need to run a Windows utility but you're not sure where to find it, look under the Tools menu in System Information (see **Figure 7.**).

5. ✓ Now open ScanDisk. This disk-scanning program checks for errors, just like the old Scandisk utility used to. Disk scanning is one of the two most important drive maintenance functions you can perform.
 - ✓ Go ahead and run the program. Any errors?
6. ✓ Finally, open the Disk Defragmenter (see **Figure 8.**). Experienced PC techs still refer to it as "defrag," which was the name of the old DOS disk defragmentation utility. Although the look of defrag has changed over Windows versions, it still does the same job.

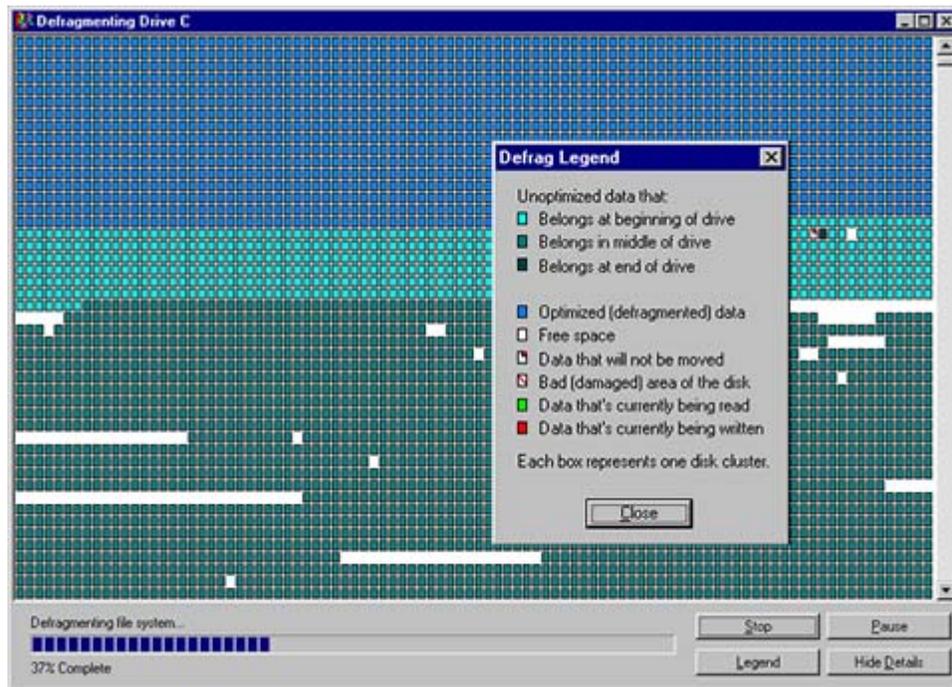


Figure 8. Depending on how long it's been since you last defragmented a drive and the size of the drive you're defragging, it is often advisable to start this operation when you're off to lunch or finished using your computer for the day. If you're not in a hurry... Go ahead and run Disk Defragmenter.

F. The Registry

The Registry is almost never accessed directly. It is meant to work in the background, quietly storing all necessary data for the system and being updated only by the actions of a few menus and installation programs. Unfortunately, the reality is that a technician will need to manipulate the Registry from time to time. When you want to access the Registry directly, you must use the Registry Editor (REGEDIT). Remember that the Registry is a binary file. You cannot edit it with EDIT, Notepad, or any other text editor as you can with SYSTEM.INI.

1. ✓ To start the Registry Editor (shown in **Figure 9.**), click the Start button, select Run, and type REGEDIT.
2. ✓ Once you open REGEDIT, you'll see six main subgroups or root keys. You should know the function of each, Try to match each root key with its function:
 - **HKEY_CLASSES_ROOT** This key stores all of the personalization information for all users on a PC. This subtree contains software configuration data of all the software that is installed on the computer.
 - **HKEY_CURRENT_USER** This is Registry data stored in RAM to speed up system configuration. A snapshot of all hardware in use is stored here. It is updated at boot and when any changes are made in the system configuration file.

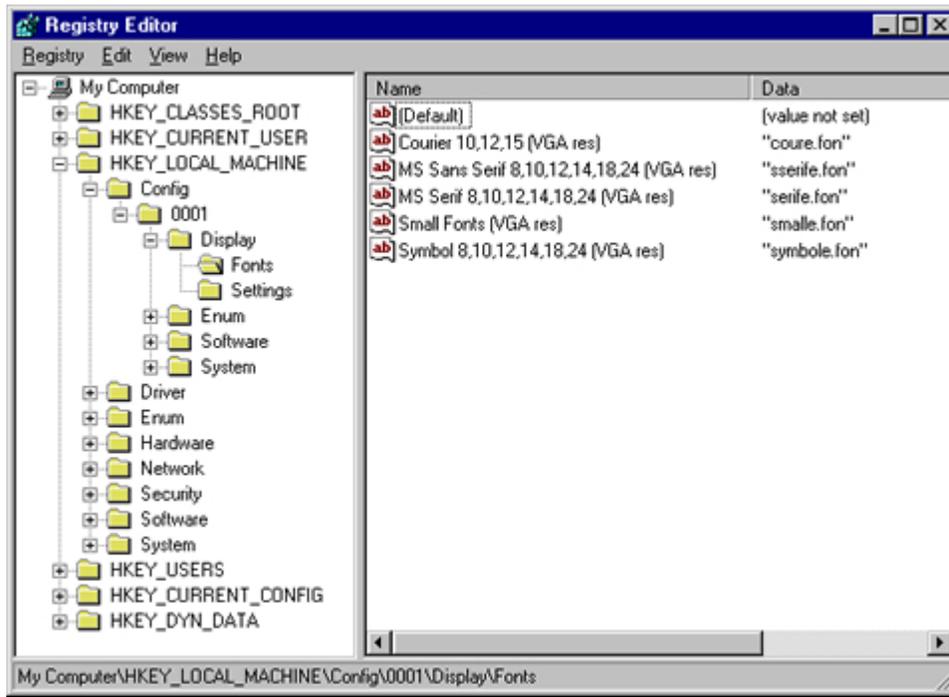


Figure 9. Once you open REGEDIT, you'll see six main subgroups or root keys. You should know the function of each, Try to match each root key with its function.

- **HKEY_LOCAL_MACHINE** Contains all configuration data for the local computer, including hardware and operating system data such as bus type, system memory, device drivers, and startup control data. Applications, device drivers, and the operating system use this data to set the computer configuration. This key stores the current user settings, such as fonts, icons, and colors, on systems that are set up to support multiple users. The data in this subtree remains constant regardless of the user.
 - **HKEY_USERS** If there are values in HKEY_LOCAL_MACHINE that have more than one option, such as two different monitors, this key defines which one is currently being used.
 - **HKEY_CURRENT_CONFIG** This key defines the standard class objects used by Windows 9x. A class object is a named group of functions,
 - **HKEY_DYN_DATA** This contains all the data for a system's non-user-specific configurations. This includes every device in your PC, including devices that you have removed.
6. ✓ Open the HKEY_CLASSES_ROOT key, and note that there are more subkeys underneath it. A subkey also has other subkeys and/or values.

Notice that REGEDIT shows keys on the left and values on the right, just as Windows Explorer shows directories on the left and files on the right.

7. ✓ Okay, now we'll actually change something in the Registry. Be sure to follow the directions exactly!

- ✓First, minimize all of your open windows and look at your Recycle Bin. Unless someone's been messing with your system, it should be named "Recycle Bin," but whatever it's called, write it down exactly as it appears.
- ✓Now close REGEDIT and then run it again (for a fresh copy). You should see My Computer highlighted at the top of the left pane.
- ✓Select Edit Find to search for "Recycle Bin" (or whatever your Recycle Bin is called).
- ✓In the Find what field, type the exact name. Check the Match whole name only box. Only perform a Find once. There are other things with that name that you don't want to change.
- ✓When REGEDIT finds the file, right-click it and select Modify.
- ✓You should see the name "Recycle Bin" in the Value Data field. Try changing it to something else, like "Junk".
- ✓Click OK.
- ✓Close REGEDIT and minimize all of your windows to see your desktop. Any changes?
- ✓Do a Refresh (press F5). Now you should see the name you just chose.
- ✓For more practice, repeat this exercise to change the name back to "Recycle Bin."

Again, The registry is nothing to play around with. A mistyped character can crash the OS with the only chance of recovery... A complete OS reinstallation. Taking precautions is prudent... Backing up the registry before you fiddle with it is prudent. The best way to backup the system Windows 9x registry is using the Emergency Recovery Utility (ERU) program. This program is specifically designed to work with the Windows 9x Registry.

G. Virtual Memory

1. ✓You configure virtual memory from the Performance tab in System Properties. There are two ways to get there:

Method One

- ✓Right-click the My Computer icon on your Desktop.
- ✓Select Properties.
- ✓Select the Performance tab.

Method Two

- ✓Open the Control Panel and double-click the System icon.
- ✓Can you name three ways to open the Control Panel?
- ✓Record you answer on the **Exercise Worksheet**.
- ✓Select the Performance tab.

2. ✓On the Performance tab, click the Virtual Memory button.
3. ✓Choose the Let me specify option.

The grayed-out areas below it will now become white (available to you). Make a note of the amount of space available on the C: drive on the **Exercise Worksheet**.

4. ✓ Choose a Minimum size that you would like for Virtual Memory. About 200MB should do for now. Make sure that it is less than the available hard drive space.
5. ✓ Make the Maximum size the same as the Minimum size.
6. ✓ Click the OK button. Windows will give you a warning saying that things might not work, that cats and dogs are going to start living together, whatever. Ignore the warning. You can always boot your system in Safe Mode and change things back.
7. ✓ Your system now thinks it has more RAM. Play with the settings (just don't go too wild!) to see what works best for you.

Tech Tip: The Performance tab of the System properties dialog box under the Control Panel allows user configuration of temporary or permanent swap files. When Windows manages virtual memory, it usually uses a temporary swap file that can grow to take over all empty (contiguous) space on a hard drive. Specifying the virtual memory settings creates a permanent swap file, both limiting the amount of drive space. Windows will take over and saving the time it takes to create the temporary swap file during each session.

If you have multiple drive letters on your hard drive, choose one with very little activity and use it as your virtual memory.

H. The Boot Process

The Boot Process of the Windows 9x operating system is very different from that of DOS. The DOS boot process is much simpler and straightforward. Both Windows 9x and DOS have different files that are used to start the operating systems. While DOS has a few files that load the startup programs, the Windows 9x boot process is much more involved and requires the use of many more files. The main reason for the extra steps and files that are required by Windows 9x is because of the added features it offers. In addition, many of the features that are supported in Windows 98, like specific device drivers, or VxDs, for example, are not part of DOS.

Here's what happens when Windows 9x boots-up:

1. The computer's BIOS Performs a Power On Self-Test (POST).
2. The computer's Plug and Play BIOS configures and PnP devices.
3. The partition table of the drive is accessed and the boot record activates the IO.SYS file.
4. The Windows 9x boot sequence starts in real mode.
5. The MSDOS.SYS is checked for any Windows parameters (such as BootMulti or BoortMenu) to facilitate different boot options.
6. The message Starting Windows 95 displays or the Windows 98 splash screen is displayed. The system pauses for two seconds to wait for a function key to change the boot path.
7. If file compression is in use, DRVSPACE.BIN loads.
8. The Registry (SYSTEM.DAT) is checked, and if it's valid, it loads.
9. Windows 9x performs hardware detection and identifies any new hardware.
10. IOS.SYS processes the commands in the CONFIG.SYS and AUTOEXEC.BAT files if they exist.
11. The boot sequence switches to protected mode.
12. WIN.COM executes.
13. The VMM32.VXD file and all virtual devices included in the Registry or the SYSTEM.INI file load.
14. Windows 9x core components (Kernel, GDI, and User) load, along with Explorer and network support.

15. Any applications in the startup(RunOnce) section of the Registry start.
16. The boot sequence ends.

Tech Note: The first place Windows looks for static VxD virtual device driver is in the SYSTEM.INI file. A VxD is a special type of device driver that has direct access to the operating system kernel. This allows it to interact with system and hardware resources at a very low level without taking up a lot of the system resources.

The boot process is the same for all versions of Windows 9x. The only primary distinction between Window 9x and ME is that Windows ME terminated support for real mode operations. Therefore, during DOS sessions, ME does not create a real mode virtual machine (VM) like it does in Windows 95 and 98. Windows 95 and Windows 98 only used real mode to be backward compatible with DOS and Windows 3.X.



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Exercise 3a – Windows 9x Worksheet

Instructions:

Complete the entire exercise and record the results of your experimentation on this worksheet. Consider using other information sources as well. Periodicals, reference materials, and the Internet are great resources to find the answers to the technical problems you're going to face when servicing computers.

Name:	
Period:	
Date:	

Speaking of resources... Let's save some of our natural resources. Rather than printing out the entire lesson, print out only the worksheet. Study the lesson on-screen and then record your answers on the worksheet. When you're finished, return the worksheet to your supervisor for evaluation. Be sure to complete this assignment before moving onto the next.

Questions:

1. ✓ Research and develop a detailed definition for each of the following terms. Many words have multiple definitions... Some of which may have nothing to do with the field of Computer Service and Support. Make sure your definition falls within the context of this lesson. Refer to the list of Research Resources and Required Materials as well as other materials you feel are appropriate. Write your definitions on the reverse side of this worksheet or a separate piece of paper with each definition being two sentences or more.

Cookies
INF files
Taskbar

System Tray
TrueType Font
ScanDisk

History Folder
Registry
Virtual Memory

2. ✓ Windows 98 creates a permanent swap file when you choose to specify virtual memory settings in the system's Performance dialog box.

- A. True
- B. False

3. ✓ The Windows Registry is made up of which set of files?

- A. USER.BAT, SYSTEM.BAT, SYSTEM.INI, WINDOWS.INI
- B. SYSTEM.INI, WIN.INI, HKEY.DAT, REG32.DAT
- C. USER.DAT, SYSTEM.DAT
- D. SYSTEM.INI, WIN.INI

4. ✓ Where will windows look to before finding a 32-bit virtual device driver to replace a static VxD?

- A. SYSTEM.INI
- B. WIN.INI
- C. VMM32.DLL
- D. KRNL328.EXE

3. ✓ The best way to back up the Windows 9x system registration files (Registry) is with the _____ utility.
- A. BACKUP.EXE
 - B. ERU.EXE
 - C. REGEDT32.EXE
 - D. LFNBK.EXE
4. ✓ FAT32 has the advantage over FAT16 due to which of the following reasons?
- A. Files can be larger than 2GB
 - B. The hard disk drive can have multiple 2GB partitions
 - C. Hard disk data clusters are fixed in length
 - D. FAT32 features an active bootable file system
5. ✓ Windows 95, 98, and ME all create a Real Mode VM during a DOS session.
- A. True
 - B. False

Exercise Data:

This section is used to record the data that's collected during the exercise. Each section number refers to a specific step in the exercise. As you work through each task, record your results here when instructed to do so.

A1. Record the OS installation information below.

OS INSTALLATION INFORMATION	
Parameter	Value
Name:	*
Company:	*
Product Key:	
Computer Name:	*
Computer Description:	*
User Name:	*
User Password:	*

*** See your supervisor or your systems administrator to obtain this information**

A2. Record your machine's hardware specs.

SYSTEM HARDWARE SPECS	
Value	Specification
MHz	Processor Speed
MB	RAM
GB	Hard Drive Capacity

List the manufacturer and model numbers for the devices you have installed on the workstation.

Manufacturer	Model	Device
		Microprocessor
		Graphic Interface Card
		Sound Card
		Network Interface Card
		Other

B1. Make a list of the applications in your Program Files Folder.

C3. Try changing the settings of each option on the Taskbar Options tab. Make a note of what each one controls.

Parameter	Description of Control
Always on top	
Auto hide	
Show small icons in Start menu	
Show clock	

Make a note of where the Notepad program is stored before you remove it.

E3. Open the System Information tool retrieve the following resource and driver information.

Parameter	Value
Windows Version	
Amount of RAM	
Free System Space	
Available Space on Drive C:	

G1. Name three ways to open the Control Panel.

1.
2.
3.

G3. Before configuring the virtual memory, make a note of the space available on the C: drive:



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Exercise 4 – Windows 2000 (XP)

Introduction:

You'll notice that operating systems build upon the successes in previous versions. In fact, Windows 2000's claim to fame is that it's "Built on NT Technology." Therefore, there will be some similarities between the operation and maintenance of Windows 2000, Windows 9x, Windows ME, and Windows NT. However, there are some distinct differences you need to be aware of. New features provide for greater ease of use and better control over the OS. Both Windows 2000 and Windows XP have some great troubleshooting and maintenance tools built right in.

Although the OS Technologies portion of the CompTIA A+ exam is really a Windows 98 exam, you'll also see questions on Windows 2000, XP, and NT. The next version of the exam will shift away from Windows 98 towards XP and even a little Linux. For right now... Let's focus on Windows 2000 and introduce a little bit of Windows XP.

Exercise Objective:

You'll perform some exercises covering the following topics:

- A. Hardware Compatibility** – You'll practice the first step in a Windows 2000 installation. It's necessary to check the hardware for compatibility. You will...
- become familiar with the basic hardware requirements of Windows 2000.
 - check existing hardware to see if it's on the Microsoft Hardware Compatibility List.
- B. Windows 2000 Installation** – You'll experiment with different installations of Windows 2000. You will...
- make Windows 2000 boot disks.
 - install Windows 2000 onto several different hardware configurations.
 - convert a FAT partition to NTFS.
 - install and configure an expansion card on a Windows 2000 system.
- C. Windows 2000 Troubleshooting Tools** - You will practice working with Windows 2000 troubleshooting tools. You will...
- use Event Viewer.
 - use System Monitor.
 - use Device Manager.
 - use Safe Boot Mode.
- D. Windows 2000 Maintenance** - You will practice working with the Windows 2000 maintenance tools. You will...
- use Performance Logs and Alerts.
 - use Disk Defragmenter, ScanDisk, and Disk Cleanup.
 - create an Emergency Repair Disk.
 - use Recovery Console.
- E. The Registry Revisited** – You'll learn more about the Windows Registry and how it's used to alter the way Windows operates. During this exercise you will:
- Understand what the Windows registry does.
 - Backup a registry key or backup the entire registry.
 - Edit the registry to alter key values.
 - Restore the registry to its original configuration.

Discussion of Fundamentals:

Computer technicians generally perform three essential services in a Windows 2000 environment:

Installation Troubleshooting Maintenance

Techs install new systems, install hardware in existing systems, and then troubleshoot those systems when things go wrong. Techs work closely with users to maintain their systems, performing such tasks as defragmenting hard drives, running the Disk Cleanup tool, and in some environments, regularly backing up essential data. Network administrators and network technicians (such as Network+ certified techs) handle many other duties, such as running cables, adding and configuring users and groups, and so on. This lab naturally focuses on the duties of computer technicians.

Techs build machines, install operating systems, configure hardware and operating systems, and fix computers when they go down. It's what we do. It's who we are. Let's do a quick rundown of the duties.

Installation for computer technicians involves two basic functions:

- Building Windows 2000 computers from the ground up
- Adding and configuring new hardware in an existing Windows 2000 PC

Windows 2000 requires you to learn some new tactics and techniques to accomplish these tasks well.

Introducing NT File System (NTFS)

The Windows NT File System (NTFS) supports all Windows NT/2000/XP operating systems. FAT16 and FAT32 file systems can still be used in the Windows NT/2000/XP operating system environments, but there is no access to the security and network features NTFS can provide.

The file system, NTFS4 was first use with the Windows NT operating system. When Windows NT was first release, the file system was simply referred to as NTFS. There were significant improvements with the release of Windows 2000 and Windows XP. Therefore, NTFS for Windows NT was renamed NTFS4 and NTFS5 for Windows 2000 and Windows XP.

The main reason behind the development of the NTFS file system was that the FAT16 and FAT32 file systems were simply unable to support a global enterprise-level operating system. They didn't provide the control needed to keep the operating system resources secure. Nearly all of the advancements deal with increased security for networked computer systems. NTFS provides support for added features like file and directory security by using Discretionary Access Control Lists (DACL) and System Access Control Lists (SACL). DACL and SACL can perform operations on a file and monitor events that will trigger the logging of actions performed on a file. NTFS also allows the system administrator to set local permissions on files and folders that specify which groups and users have access to them. This includes setting the level of access that is permitted. This could not be done using either version of FAT.

NTFS file and folder permissions apply both to users working at the computer where the file is stored and to users accessing the file over the network when the file is in a shared folder. With NTFS, share rights can also be set that operate on shared folders in combination with file and folder permissions. FAT only supports share rights.

NTFS provides added support to more efficiently recognize and address large hard disks and volumes that exceed the size limitations that a FAT16 or FAT32 file system could handle. In fact, the NTFS file system was designed so that it will be able to map disks up to sizes that will not even be seen in the next 20 years.

NTFS is capable of managing global and enterprise level operating systems. The term "Global" is a key limitation with the FAT16 and FAT32 files systems. The FAT file system uses the ASCII 8-bit character set for its file name and directory structure. It was not capable of supporting file names in any other language except English. NTFS uses the Unicode 16-bit character set for its name scheme, which allows NTFS users to work in their native language. This is an important feature as is the ability to efficiently organize large hard disks and volumes. In fact, the NTFS file system was designed to handle disk capacities that will not be seen for decades to come.

The Windows NT/2000/XP operating systems were designed to appeal to the corporate market. Features like security and being able to access large volumes of data are a necessity to large corporations and businesses. NTFS has a built-in feature is called Fault Tolerance where it keep track of changes to the file system and stores them in transaction logs. If the system crashes, NTFS can examine the log file and use it to restore the disk to a consistent state with minimal data loss. FAT has no provision for fault-tolerance. If a system crashes while creating or updating files and directories, the FAT on-disk structures can become corrupted. This situation can result in the loss of valuable data that is being modified, as well as a general corruption of the drive and the loss of much of the hard disk data. This risk is unnecessary and clearly unacceptable for the corporate market.

Words and Terms You Should Know:

- HCL
- Device Manager
- Counter
- Properties
- FAT 32
- NTFS
- Defragment
- ScanDisk
- ERD

Research Resources:

Company	Web Site	Description
Microsoft	http://www.microsoft.com/windows2000/default.asp	Microsoft's technical support site for Windows 2000.
Microsoft	http://www.microsoft.com/hcl	Access the Hardware Compatibility List on Microsoft's Web site and check for your hardware.
Microsoft	http://www.windowsupdate.com	Windows update download center. This service scans your workstation, determines the required updates, and then downloads and installs the update.

Required Materials:

Computer Trainer
Windows 2000 OS (Professional, Server, or Advanced Server) Distribution Disk
Expansion Interface Cards (To verify the Hardware Compatibility List)
Computer Trainer with Windows 2000 or Windows XP installed
Four Blank Floppy Diskettes, 1.4MB

Procedure:

Complete each of the following steps in this exercise. When you see a \surd ... That's an indication that you need to do something. For your convenience, there is an **Exercise Worksheet** attached to the end of this exercise. To save trees... It would be best to print out this worksheet only. You'll use it to record your answers while performing the following steps.

Tech Note: You'll need to use a computer trainer that you can wipe and buildup as you experiment with different installation methods for Windows 2000. The troubleshooting experiments can be completed on a Computer Trainer that has an existing installation of Windows 2000 or Windows XP providing you have administrator access to the computer.

Where on Earth can I find a legal Windows 2000 distribution disk? Microsoft still supports Windows 2000 and you can still purchase a copy if you want. However, you can probably locate a legitimate copy of the OS by checking with your system administrator or local Techno Geek. They're bound to have a few legal copies lying around. It's important to know that the OS will only be installed for a short period of time. Once you've completed the following exercise, you'll remove the OS from the system.

If you hurry... You can still order a beta version of Windows 2003 Server from Microsoft for just the charge of shipping.

If all else fails, you can do much of this exercise using Windows XP. If you can't find a copy of Windows 2000 to practice installing, start this exercise determining the Hardware Compatibility of the machine that you're working with. Read through the section on Installing Windows 2000 and then proceed to lesson on Windows 2000 Troubleshooting Tools. You can perform the remaining lessons using Windows XP if you have to. In any case, you need to be familiar with this information.

A. Hardware Compatibility

1. ✓ First, you must determine whether the hardware you have can actually handle the Windows 2000 operating system. The minimum recommended specs for Windows 2000 are a 300+ MHz processor, 64MB of RAM, and a 2GB hard drive with about 600MB of free space. Record your computer trainers hardware specifications on the attached **Exercise Worksheets**.
2. ✓ Second, you must make sure Windows 2000 will work properly with the specific components you want to install. To do this, you must access the Microsoft Hardware Compatibility List (HCL).
 - ✓ Assemble a list of your sample PC's hardware. Write down not only the manufacturer and model, but also the chip numbers/letters you find on any expansion cards.
 - ✓ Access the Hardware Compatibility List on Microsoft's Web site (<http://www.microsoft.com/hcl>) and check for your hardware. Record the Hardware Compatible List specification for your computer trainer on the exercise worksheet.
 - ✓ If you have a Windows 2000 CD-ROM, you can also access a local copy—look in the SUPPORT folder on the CD-ROM for the HCL.TXT file. If possible, however, access the HCL on the Web, simply because it is more likely to be up-to-date.
3. ✓ Don't despair if the HCL does not contain your hardware. Many components work just fine under Windows 2000 without being on the HCL. In that case, however, do check the manufacturer's Web site to get updated drivers for the non-HCL components. Make a note of any non-HCL components:

B. Installing Windows 2000

1. ✓ During the setup process you will be asked for some information. You may need to contact your supervisor or the system administrator to get some of this information. Be sure to have the following:

Windows 2000 CD: The CD is inside the Windows 2000 folder.

Product Key: You can find the Product Key on the back of the Windows XP folder.

Internet information: If you plan to connect to the Internet, you may need to provide some more information. You can configure your settings during the setup process or you can postpone this until after Windows 2000 is set up.

If you received an offer for a new Internet account when you purchased your computer, or if you already have an Internet account, you should contact your Internet service provider (ISP) for this information.

Network Information: If your computer currently is connected to a network, get the following information before you run Setup:

- Name of your computer.
- Name of the workgroup or domain.
- If your computer is a member of a domain, you will also need your domain user name and password.
- TCP/IP address (if your network doesn't have a DHCP server).

✓ Complete the installation information table on the ***Exercise Worksheet***.

2. ✓ First make a set of boot disks. Windows 2000 does not have classic boot disks in the way that Windows 9x does. Instead, Windows 2000 has a very intelligent install/repair process. It looks for a preinstalled copy of Windows 2000, and if it detects one it shifts from an install mode into a repair mode. Most Windows 2000 systems come with four setup disks, but if you don't have them, they are simple to make. You will need four 1.44MB floppy disks.

✓ If you're running Windows 9x on the computer and want to update to Windows 2000, use the MAKEBOOT.EXE utility on the Windows 2000 CD-ROM. You can find it in the \BOOTDISK folder.

✓ If you want to create the disks from a Windows NT/2000 system, use MAKEBT32.EXE (it's also in the \BOOTDISK folder).

✓ If you're really... really geeky, you can make a pseudo-boot floppy. Just copy these files from the root directory of your system drive onto a blank floppy disk:

NTLDR
NTDETECT.COM
BOOT.INI
NTBOOTDD.SYS (if it's there)

Tech Tip: These setup disks are identical—you can use one set to support all Windows 2000 Professional

Windows 2000 will boot from this pseudo-boot floppy, but it still needs a fully functional Windows 2000 boot partition. As a precaution, If you have two hard disk drives you could installed Windows 2000 on the D: drive. This is an easy way to boot up your machine if the C:

drive ever fails. It's also useful if any files become corrupted—even if your system and boot partition are the same. This won't be on the A+ exams, but it sure does come in handy!

3. ✓ Here are five installation variations for you to try. This will take awhile... Hours and hours as a matter of fact, but you need the experience to become proficient enough to solve and OS installation problem you encounter.

✓ **First Installation Variation:** Install the complete OS on a clean system, using all defaults.

- The machine should have only a basic video card, RAM, CPU, keyboard, mouse, floppy drive, CD-ROM drive, and hard drive installed.
- Don't use a computer that requires RAID drivers or anything fancy—just use a plain vanilla PC.
- Answer "Yes" to everything except networking.

✓ **Second Installation Variation:** Install the complete OS on a clean system, but try partitioning the hard drive as FAT32, rather than NTFS.

- Once you have the OS installed, convert the FAT partition to an NTFS partition using the Convert utility at a command prompt.
- At the command prompt, type **CONVERT [drive:] /FS:NTFS [/V]**.
 - drive: specifies the drive to convert to NTFS.
 - /FS:NTFS specifies that the volume be converted to the NTFS file system.
 - /V specifies verbose mode. All messages will be displayed during conversion.
- For example, to convert the volume on drive E: from FAT to NTFS and display all messages, type **CONVERT E: /FS:NTFS /V**.
- You cannot convert a drive you are currently accessing. If the Convert utility cannot lock the drive, it will offer to convert it the next time the computer restarts.

✓ **Third Installation Variation:** Install the complete OS on a fully packed system that includes a network card.

- Before doing the Windows 2000 installation, see how many devices you can add on to the system. Throw everything into the mix: sound, SCSI, hopped-up video card, network card, USB controller, FireWire card, and so on.
- If you're a glutton for punishment or have way too much time to kill, try installing Windows 98 on the same PC. Any differences in installation?

✓ **Fourth Installation Variation:** Create a dual-boot system by installing Windows 2000 onto a PC that is currently running Windows 9x on a FAT32 partition.

- To create a dual-boot system you need to leave the Windows 9x OS in place, so you must install Windows 2000 in a folder that does not contain the Windows 9x files. The default locations—C:\WINDOWS for Windows 9x and C:\WINNT for Windows 2000—should work most of the time.

✓ **Fifth Installation Variation:** Add an expansion card to a functional Windows 2000 PC.

- Use all the normal installation procedures: unplug an ATX system, avoid ESD, have the current drivers handy, and so on.

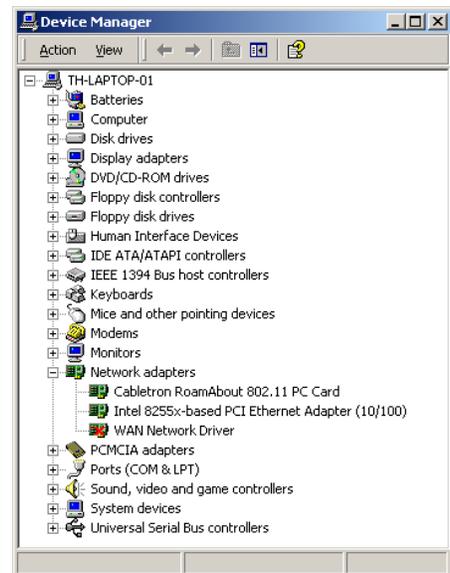


Figure 1. Notice there are no error marks. Error marks (?) indicate device problems that need to be corrected.

- Whatever card you have handy will do, even if it does not show up on the HCL. In fact, you should install a couple of cards that do not appear on the HCL just so you know what happens when Windows refuses to join in any reindeer games!
- Once you have the card(s) installed, boot to Windows and check Device Manager. You can access Device Manager in Windows 2000 by double-clicking the System applet in the Control Panel.

A happy system will look something like **Figure 1**. If it doesn't, then it's time to move on to the next lab and read up on troubleshooting.

- ✓ Update the OS and Device Drivers. One of the first things you should do right after you install an operating system is update it. Install the latest service packs, updates, and device drivers to make your installation both reliable and secure. All system upgrades are available on the Microsoft website. Windows 2000 includes an auto-update that informs the user if an update is available and then permits them to download and install the update. Often, the only place you can find device driver upgrades are from the device manufacture. It's critical that you perform this update as soon as you have a working installation of the OS. Because you may not have access to a computer network, smart techs carry these files with them on service disk CDROM.

C. Windows 2000 Troubleshooting Tools

Troubleshooting tools available in Windows 2000 include Event Viewer, System Monitor, and Device Manager, among others. You can access almost every essential tool for techs by double-clicking the Administrative Tools icon in the Control Panel and selecting Computer Management (**Figure 2**). Open the Computer Management applet.

1. ✓ Look at the left-hand side of the applet window and find Event Viewer. Event Viewer shows you a running commentary of system events, including the boot process, application loads, and more. Click the plus sign (+) to expand it. You'll see at least three of the following logs: Application, Directory Service, File Replication Service, Security, and System. Record the description that appears in the right-hand pane for each:



Figure 2. This is how you get to the Computer Management applet.

2. ✓ Click System and find an entry marked Error with a white X in a red circle next to it. **Figure 3** shows a failed service at startup, as reported by Event Viewer. Double-click an error listed in Event Viewer to see its details. **Figure 4** shows the information about the print failure shown in **Figure 3**.

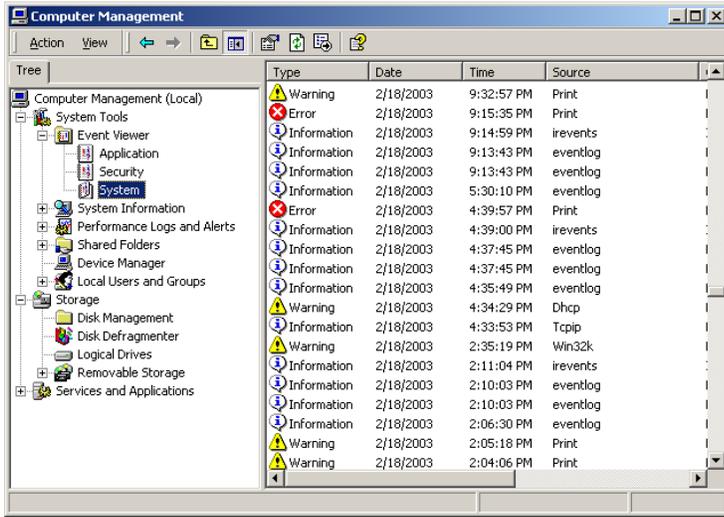


Figure 3. What you're looking for when checking the event viewer is red and yellow. These errors and warnings may need your attention or there at least an indication of possible problem areas.

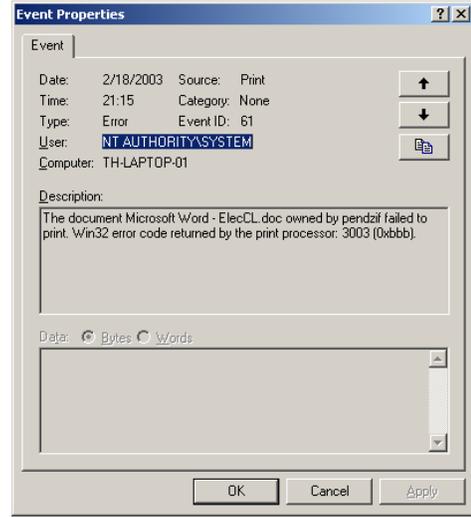


Figure 4. Double-Clicking on an error or warning reveals detailed information about the problem.

3. ✓ Collapse Event Viewer and expand Device Manager. You should see a list of all your device types in the right pane. Device Manager gives you the status, including resource usage, of all your hardware. You can disable problem devices directly in Device Manager.

✓ Expand the Mice and other pointing devices entry and double-click the specific device (either one if you have two installed). You should see a Properties dialog box with two tabs: General and Driver.

✓ On the General tab, find the manufacturer and location. Record your results on the **Exercise Worksheet**.

✓ Click the Troubleshooting button and step through the process so you are familiar with how this application works. Since there is no actual problem, select the Skip this step option as you go through the windows.

✓ Locate the Device Usage field at the bottom of the General tab and click the drop-down arrow to see the Do not use this device (disable) selection. This is how you would disable the mouse if that were necessary.

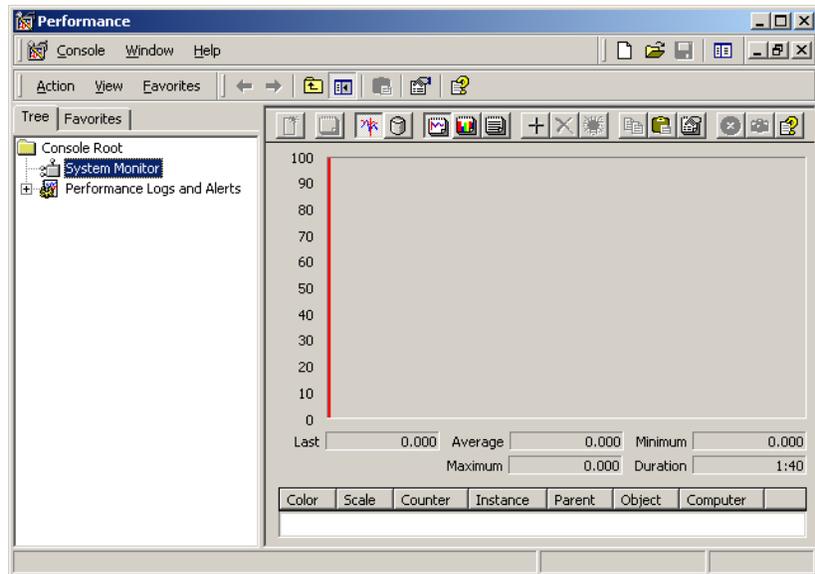


Figure 5. System Monitor.

✓ Now select the Driver tab. Record the mouse driver's provider, date, and version:

- ✓ You will return to the Computer Management applet in the next lab, but for now, close it and return to the Control Panel because you're going to investigate the System Monitor. One task that techs often get tagged by administrators to perform is monitoring a system that users have reported as problem-prone or buggy. Set the System Monitor to run real-time CPU and RAM use data as follows:

✓ In the Control Panel, select Administrative Tools and open the Performance applet.

✓ Highlight System Monitor on the Tree tab (**Figure 5**).

✓ Click the plus sign (+) button above the graph on the right. This will let you add counters for various Performance objects.

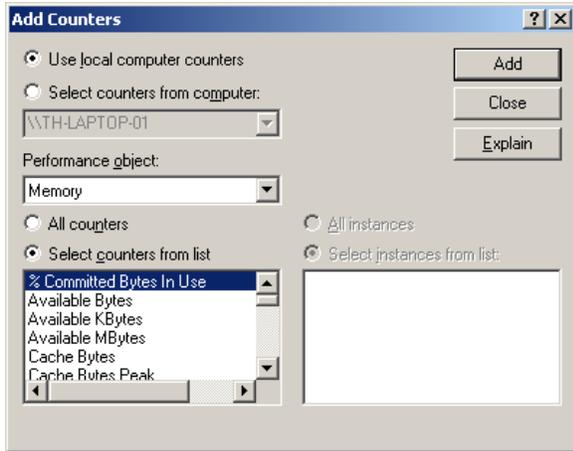


Figure 6. Memory Options

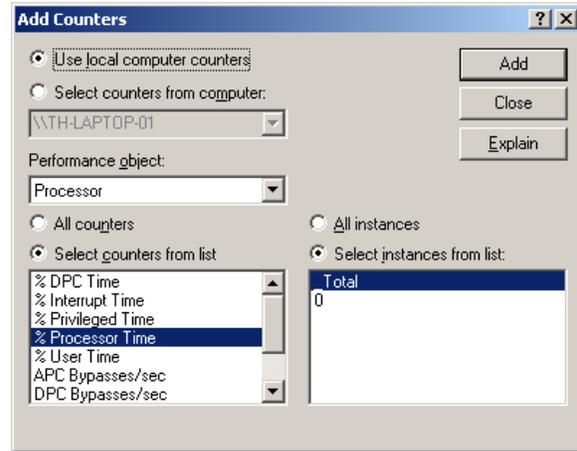


Figure 7. Processor Options

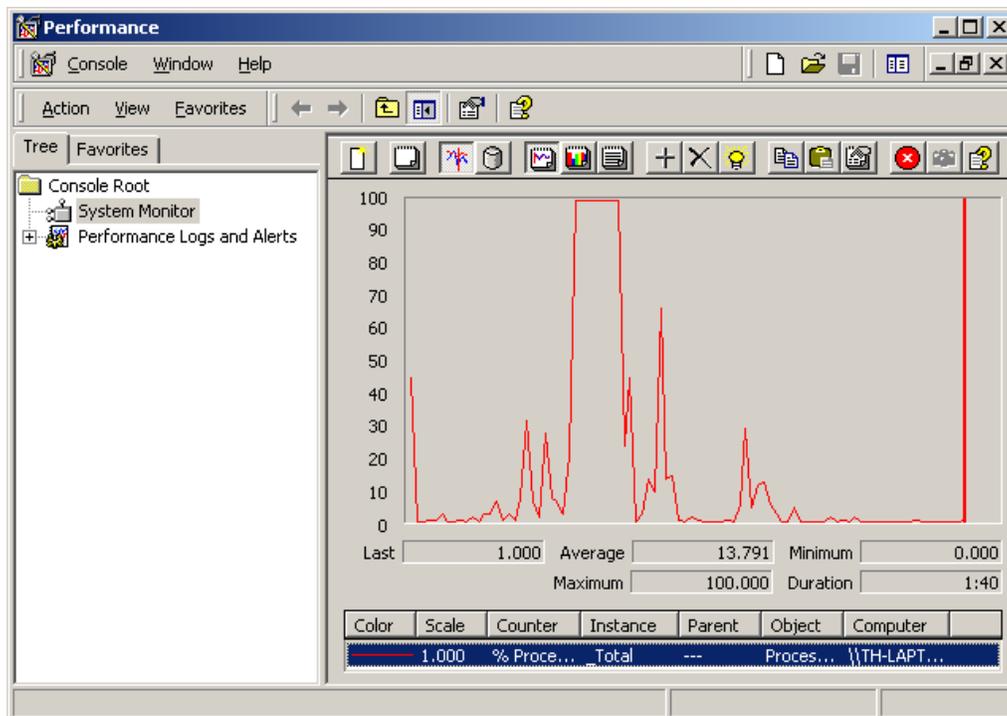


Figure 8. The System Monitor in Action

- ✓ Try adding a counter under Memory (**Figure 6.**).
- ✓ Now add a counter under Processor (**Figure 7.**).
- ✓ Watch System Monitor run while you open and close applications, surf the Web, and so on to simulate real use. **Figure 8.** shows a fairly typical display—it might be a bit hard to read in print, but it should look fine on your monitor.

Safe Boot Mode

Windows supports several Safe Boot options that load a minimal set of drivers. You can use these options to start Windows so that you can modify the registry or load or remove drivers.

To use a Safe Boot option, follow these steps:

1. ✓ Restart your computer, and when the Boot menu appears, press **F8**.
2. ✓ When the **Windows Advanced Options** menu appears, select an option, and then press ENTER.
3. ✓ When the Boot menu appears again, with the words "Safe Mode" displayed in red at the bottom, select the installation you want to start, and then press ENTER.

WARNING: Do not select a Microsoft Windows NT 4.0 installation.

Description of Safe Boot Options

- **Safe Mode (Safeboot_Option=Minimal):** A minimal set of device drivers and services to start Windows.
- **Safe Mode with Networking (Safeboot_Option=Network):** A minimal set of device drivers and services to start Windows plus the drivers necessary to load networking.
- **Safe Mode with Command Prompt (Safeboot_Option=Minimal):** This is the same as Safe mode, with the exception that Cmd.exe is started rather than Windows Explorer.
- **Enable VGA Mode:** This starts Windows in 640 X 480 mode using the current video driver (not Vga.sys). This mode is useful for cases in which the display was configured at a setting the monitor cannot display.

Tech Note: If you're going to use Safe mode and Safe mode with Networking load the Vga.sys driver instead.

- **Last Known Good Configuration:** This starts Windows using a previous good configuration.
- **Directory Service Restore Mode:** This mode is valid only for Windows domain controllers. It performs a directory service repair.
- **Debug Mode:** This option enables debug mode in Windows. Debugging information can be sent across a serial cable to another computer running a debugger. This mode is configured to use COM2.
- **Enable Boot Logging:** When the computer is started with any of the Safe Boot options except Last Known Good Configuration, logging is enabled. The Boot Logging text is recorded in the Ntbtlog.txt file in the %systemroot% folder. An environment variable is set when you use one of the Safe Boot options. The environment variable is "Safeboot_Option." This variable is set to either Network or Minimal.

The default Microsoft VGA driver is used for display (640 X 480 X 16 colors). You must

log on in all modes (either by a domain or the local SAM, depending on which Safe Boot mode you choose).

D. Windows 2000 Maintenance

1. ✓ Double-click the Administrative Tools icon in the Control Panel and select Computer Management. This time expand Performance Logs and Alerts. This snap-in enables Windows 2000 to create a written record of just about anything that happens on your system. You should see three entries: Counter Logs, Trace Logs, and Alerts.

✓ Do you want to know if someone is trying to log onto your system when you're not around? Right-click Counter Logs and select New Log Settings. Give the new setting a name—call it anything you want. Click OK to see a screen similar to the one shown in **Figure 9**.

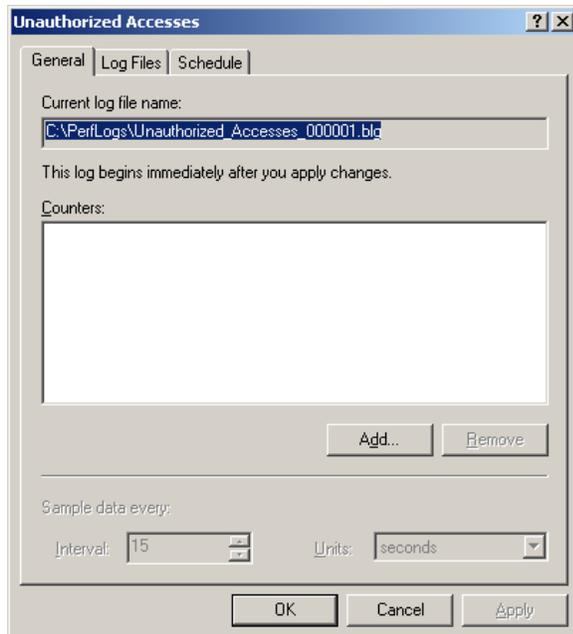


Figure 9. How to Build a New Event Log

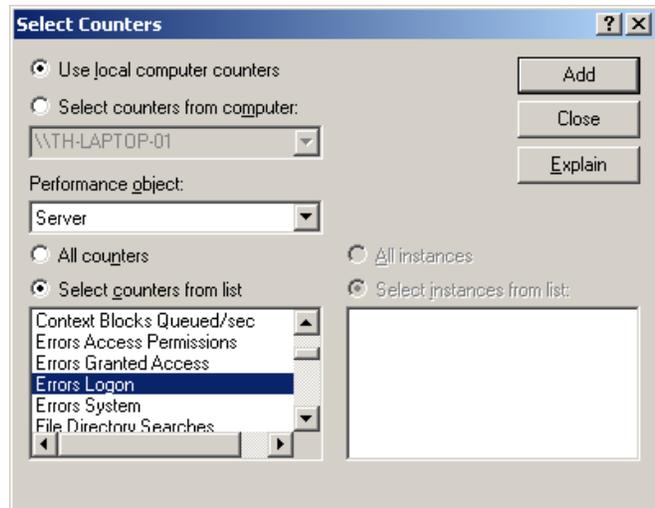


Figure 10. Good Settings

- ✓ To create a new log, first click Add, and then select the Use local computer counters radio button.
- ✓ Next, select the Memory setting from the Performance object pull-down menu.
- ✓ Finally, highlight Available MBytes so your dialog box looks like **Figure 10**.
- ✓ Select Add, and then Close.
- ✓ Click Schedule and set up when you want the log to run—probably for the next 15 minutes or so.
- ✓ Click Log Files to see the name of the file and where it's being saved—probably C:\PerfLogs (see **Figure 11**.) Go back to the General tab and click OK.
- ✓ After the time period you set, open the Performance Console in Administrative Tools and select the System Monitor.

- ✓ Right-click anywhere in the graph area and select Properties.
- ✓ Click the Source tab and use the Browse button to locate your log file. Select the time range you want to see by dragging the small bar to the left. It should look like **Figure 12**.
- ✓ Now click the Data tab and select Add (see **Figure 13**). You'll only have one option—your log file—so just click Add again to see it appear.

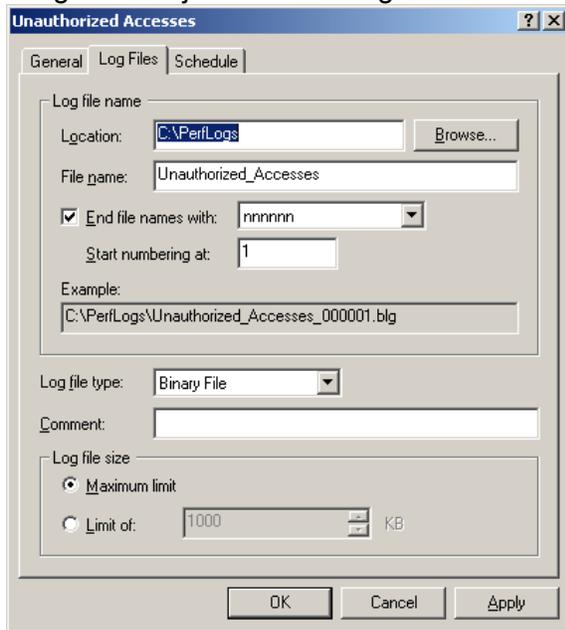


Figure 11. Log Location

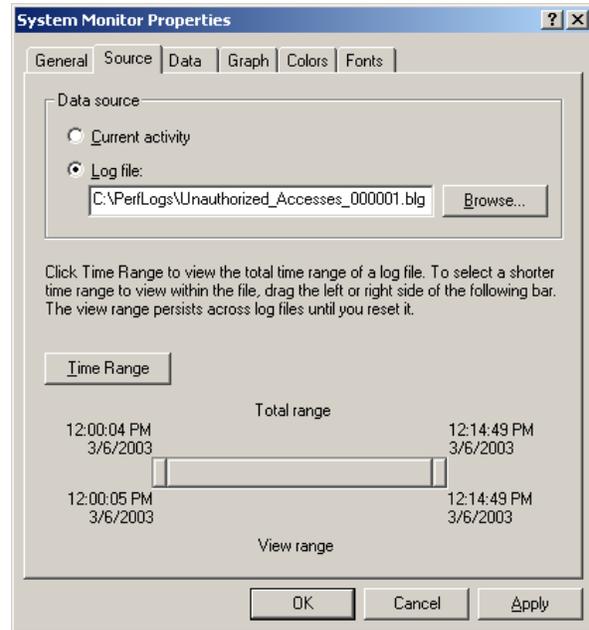


Figure 12. Selecting the time range.

- ✓ Now click OK. Do you see any bumps in the graph? Somebody has been unsuccessfully trying to log onto your system!

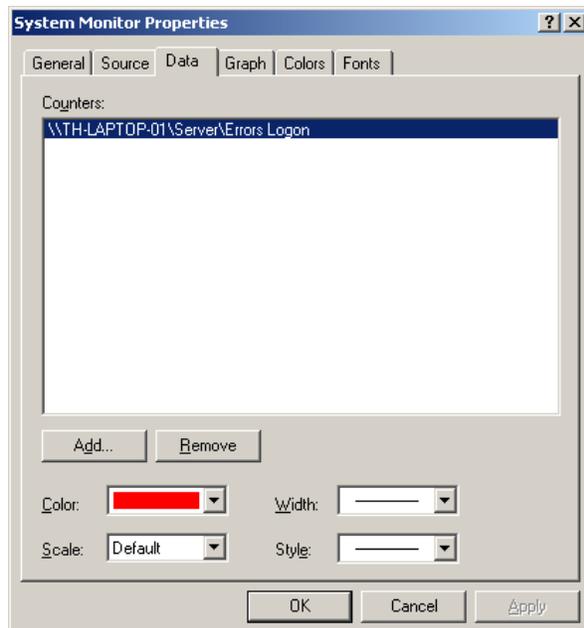


Figure 13. It's nearly ready to test.

2. ✓ Now let's run through three tools used for an important PC tech function: routine maintenance.

To keep your system running in an optimized condition, you should run the Disk

Defragmenter on a regular basis. Access this tool by selecting the drive you wish to defragment in My Computer. Right-click it and select Properties. Select the Tools tab and click the Defragment Now button (see **Figure 14.**).

- ✓The occasional check for disk errors is also important. Access the ScanDisk tool from the Tools tab by clicking the Check Now button.
- ✓As with Windows 9x, it is a good idea to run a disk cleanup periodically in Windows 2000 to remove all the junk. This tool is also in the drive Properties dialog box, on the General tab. Click the Disk Cleanup button to run this applet (see **Figure 15.**).

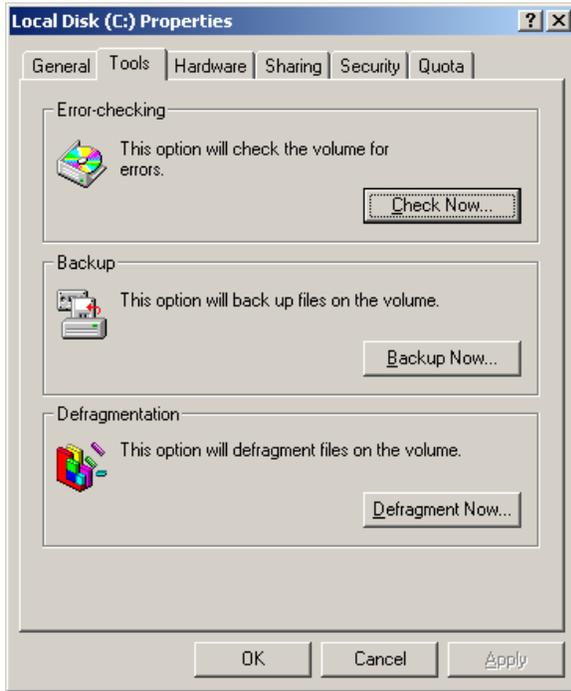


Figure 14. The Local Disk Properties box provides you with tools to check, backup, and defragment a drive.

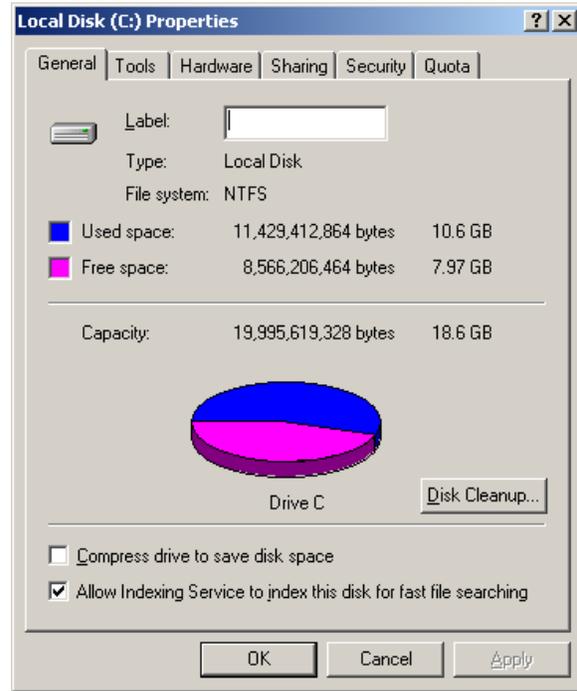


Figure 15. The button for disk cleanup is found on the General tab when you open the disk properties.

3. ✓Just as with Windows 9x, the secret to troubleshooting Windows 2000 is preparation. Performing critical system file backups is part of this preparation. While Windows 9x really needs third-party utilities such as Hyper-Q's Q-Recovery, Windows 2000 Backup provides almost all the tools you need, although you may want to use third-party utilities to create system, e-mail, browser, and personal data backups. Open Backup from the Start menu by selecting Programs > Accessories > System Tools Backup (see **Figure 16.**).

- ✓Let's first create an Emergency Repair Disk (ERD).

This disk saves critical boot files and partition information and is our main tool for fixing boot problems. It is not a bootable disk nor does it store very much information—the ERD does not replace a good system backup. It works with a special folder called `WINNT\REPAIR` to store a copy of your registry. It's not perfect, but it gets you out of most startup problems. Always make a new ERD before installing a new device or program. You should also have a bootable system disk in case you can't get a computer to boot off the hard drive.

- ✓Click the Emergency Repair Disk button. A small pop-up window appears.

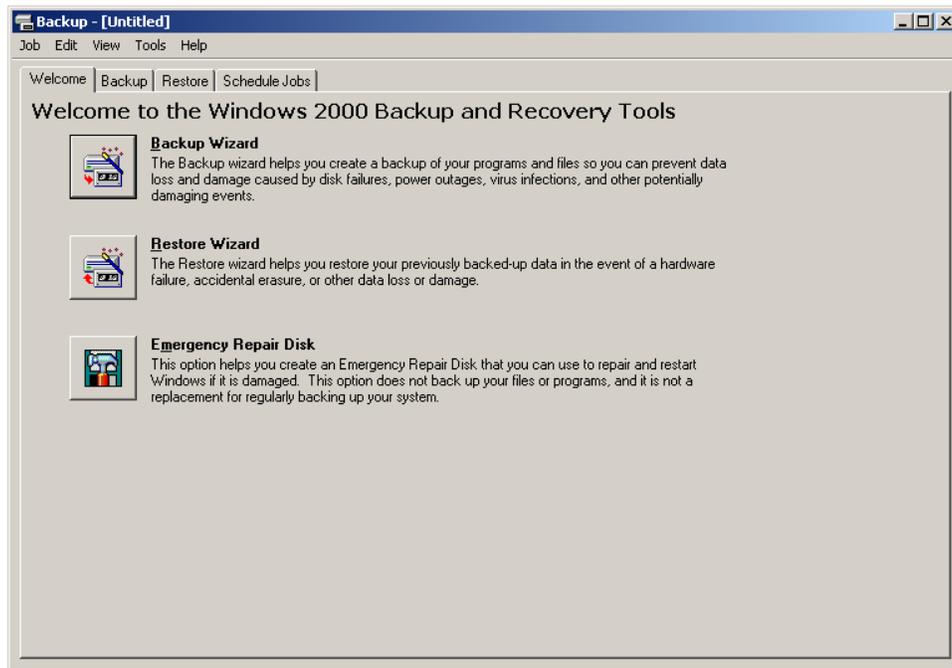


Figure 16. Backup and Recovery Tools are found in the System Tools folder.

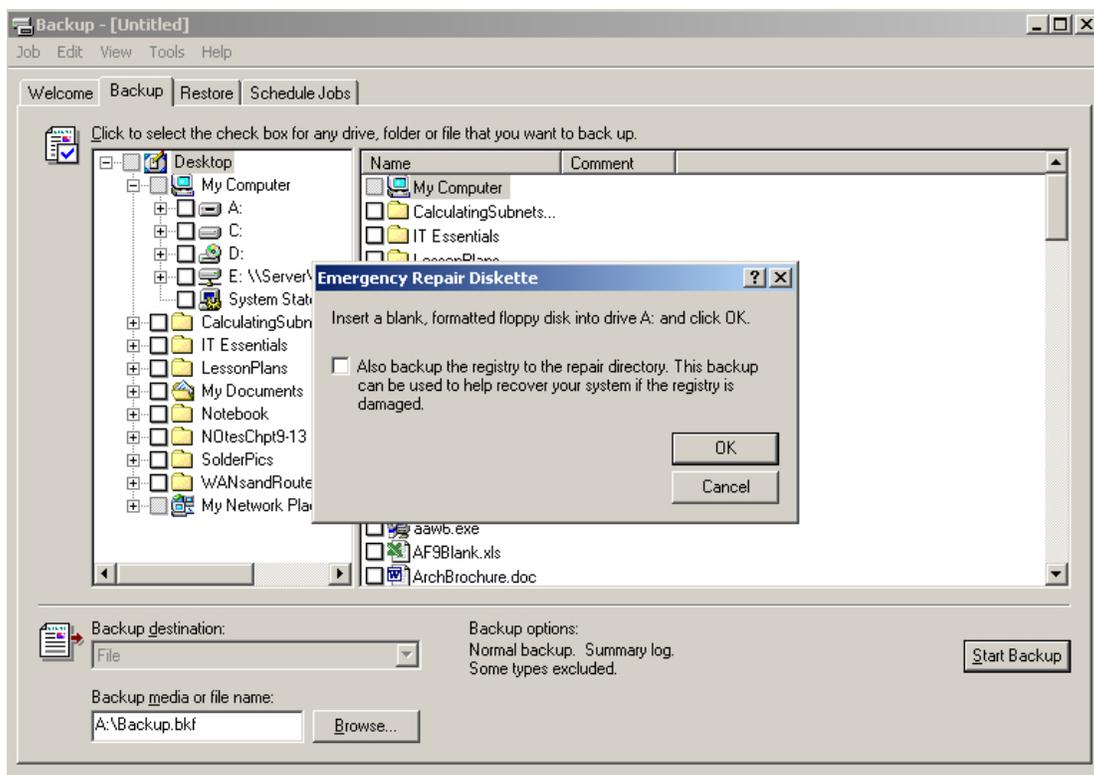


Figure 17. To create an ERD, you'll need to use the Emergency Repair Disk utility that's found in the Backup program.

- ✓ As instructed, insert a blank floppy disk into your floppy drive. Also select the check box, as shown in **Figure 17**, and click OK. That's it! Your ERD is now ready to save you if you need it.

- ✓We're not quite done with Backup. Go back to the Welcome screen and click the Backup Wizard button. When the Backup wizard starts, click Next to see the screen shown in **Figure 18**.

You have three options here. You are not going to run any of them right now, but you should be familiar with them. The first two are fairly self-explanatory: you can back up everything or you can just back up system-critical files. You have three options here. You are not going to run any of them right now, but you should be familiar with them. The first two are fairly self-explanatory: you can back up everything or you can just back up system-critical files.

The Only back up the System State data option enables you to save "other" system-critical files. With Windows 2000 Professional that's not much more than making an ERD with the registry backup. But the A+ Certification exams may still test you on it. Where this third option really makes sense is for Windows 2000 Server systems, because it saves Active Directory information (which your Windows 2000 Professional system does not store) as well as other critical, server-specific functions.

- ✓Close the Backup wizard without doing anything. Notice that the Backup applet is now displaying the Backup tab. Close the Backup applet as well.

3. ✓Now it's time to set up the unique and powerful Recovery Console—a new feature in Windows 2000. The Recovery Console is as close as Windows 2000 gets to the Windows 95/98 Safe Mode command prompt only feature.

- ✓First, you need to install it. Log onto the system with an administrator account.

- ✓Grab your Windows 2000 installation CD-ROM and drop it in your system. If the AutoPlay function kicks in, just click the No button.

- ✓Get to a Windows 2000 command prompt by typing CMD into the Start Run dialog box. (CMD is the 32-bit super command prompt for Windows NT and 2000. It acts exactly like the old COMMAND.COM.)

- ✓When you get to the command prompt, switch over to the CD-ROM drive letter.

- ✓When you get to the CD-ROM drive letter, type in this command:

\\386\WINNT32 /CMDCONS

- ✓Just follow the instructions on the screen. From now on, every time the system boots, you will see a boot menu like the one shown in **Figure 19**.

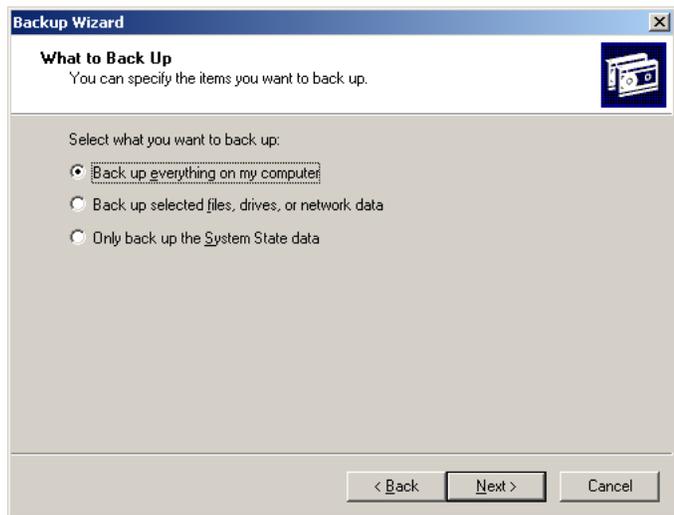


Figure 18. The Backup Wizard will guide you through the process of backing up drives.

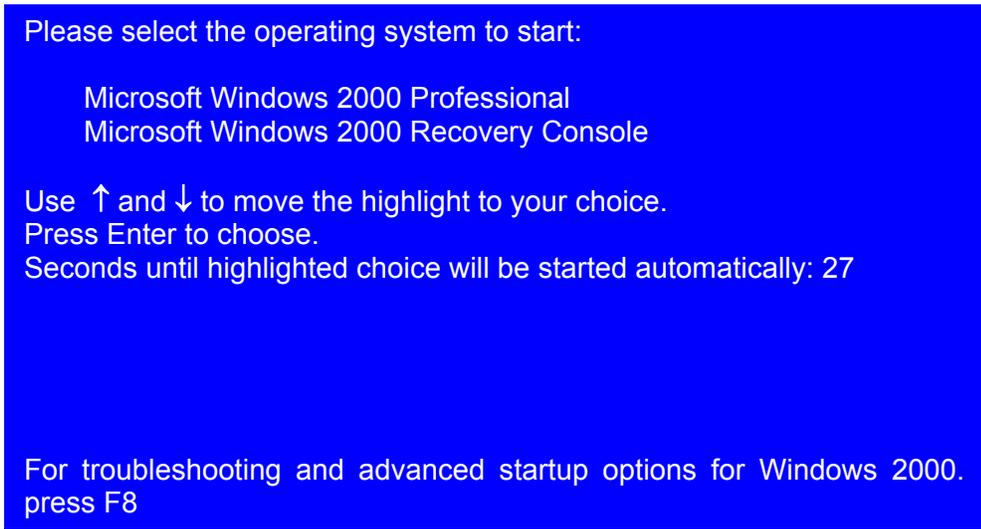


Figure 19. Boot menu after installing the Recovery Console

Tech Tip: If you don't like looking at this screen, set the BOOT.INI timeout to a smaller number.

✓ Reboot your system and select the Recovery Console (see Figure 19.).



Figure 20. Recovery Console

✓ The Recovery Console looks like a command prompt (see Figure 20.) and uses many of the commands that worked in DOS as well as some uniquely its own. Following is a list of the most common Recovery Console commands. I've added a description to some you may not have seen. Because some of these commands can destroy or limit access to data on the hard disk drive, the only ones you should try at this time have a ✓ next to them.

- ATTRIB
- ✓ CD
- CHKDSK
- ✓ CLS Clears the screen
- COPY (and XCOPY)
- DEL

√	DIR	
	DISKPART	The Windows 2000 equivalent to FDISK
√	EXIT	Exits the Recovery Console and restarts your computer
	EXPAND	
	FIXBOOT	Writes a new partition table from the backup MST
	FIXMBR	Equivalent to FDISK /MBR
	FORMAT	
√	HELP	Displays a Help screen
	LOGON	Logs on to a Windows 2000 installation
	MD	
	REN	
	RD	
	SYSTEMROOT	Sets the current directory to the root of the system directory, usually C:\

Tech Tip: The files that make up the Recovery Console reside on the system partition, making the Recovery Console useless for system partition crashes. However, the Recovery Console is great when it comes to manually restoring registries (Do you remember where the ERD put the backup copy of the registry?), rebuilding partitions (other than the system partition), or using the EXPAND program to extract copies of corrupted files from a CD-ROM or floppy disk.

E. The Registry Revisited

Just like Windows 2000, Microsoft Windows XP stores hardware and software settings in a central database called the registry hive. The registry for XP system replaces many of the .ini, .sys, and .com files that are used in earlier versions of Windows 9x and Millennium. The registry acts as a backbone to the operating system and provides the information needed to start applications and load components, such as device drivers and network protocols.

Purpose of the Registry

The focus of the registry is to keep track of the hardware installed on the computer. The registry hive identifies components such as the microprocessor, bus type, pointing device or mouse, and keyboard, as well as device drivers, installed applications, and network adapter card settings. The registry contains data the operating system needs to operate. The structure of the registry is a list designed to provide a secure set of records that detail the components installed in the computer. These components read, update, and modify data stored in the registry as changes occur. There are six main components that access the registry and store data.

1. **Device drivers** – The registry sets the configuration settings for the system device drivers. Information is written to the registry when device drivers are updated or referenced.
2. **Setup programs** – When new applications or new hardware is installed in a computer system, a setup program is run that adds new configuration information to the registry. The setup program will also attempt to scan the registry to check if the components have already been installed.
3. **User profiles** – User profiles maintain the settings for all the users that log on to the computer. These settings are first changed in the registry and then made to the user profile. The name of the file that holds the user profile information is NTUSER.DAT.
4. **Windows NT kernel** – The registry plays an important role during boot-up. The Windows NT kernel (NTOSKRNL.EXE) loads the correct device drivers in the proper order.

5. **Ntdetect.com** – The NTDETECT.COM file gathers information about the computer hardware during the boot process. Only Intel-based systems use this file to detect hardware that is installed in a system. The data that is collected during the hardware detection phase is stored in this phase.
6. **Hardware profiles** – Windows NT, 2000, and XP have the capability to have two or more profiles in which the administrator can decide to have pieces of hardware either load or not load. These hardware profile configurations are stored in the registry.

Registry Subtrees

Navigating and editing the registry can be done manually using the Regedt32.exe file. When this command is entered in the Run processor the Registry Editor will pop-up displaying the registry subtrees, keys, and their settings.

You'll need to become familiar with the purpose of the registry subtrees to help you troubleshoot and maintain computers. A key for every process that is running on a system can be found here. The following five subtrees or subtree keys are displayed in **Figure 21**.

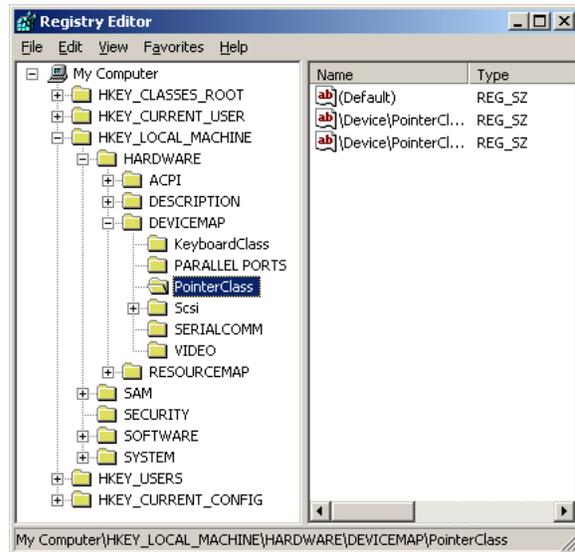


Figure 21. The Registry Editor is used to display and edit the registry subtree. The subtree and subtree keys are shown in the left windows while the right windows lists the values.

HKEY_USERS – Contains the system default settings used to control individual user profiles and environments, such as desktop settings, windows environment, and custom software settings.

HKEY_CURRENT_CONFIG – Contains data on the active hardware profile that is selected during the Boot Process. This information is used to configure settings such as the device drivers to load and the display resolution to use.

HKEY_CLASSES_ROOT – This subtree contains software configuration data of all the software that is installed on the computer.

HKEY_CURRENT_USER – Contains data about the current user that is logged into the computer. Retrieves a copy of each user account that is used to log on to the computer and stores it in the registry.

HKEY_LOCAL_MACHINE – Contains all configuration data for the local computer, including hardware and operating system data such as bus type, system memory, device drivers, and startup control data. Applications, device drivers, and the operating system use this data to set the computer configuration. The data in this subtree remains constant regardless of the user.

1. **Registry Backup** – There's real potential to totally disable a computer workstation when you fiddle with the registry hive. Before you start tweaking the registry, it's important to back it up incase you make a catastrophic blunder. If you don't backup, the only way to recover may be reinstalling the operating system and all the software. There are two ways to backup the registry. As a technician, you can choose to export an individual key that you want to edit or you can backup the whole registry. Since there's no telling what you might damage, you're going to backup the keys for the entire registry first.

- ✓ **Back Up the Whole Registry** - To back up the whole registry, use the Windows Backup utility to back up the System State. The System State backup includes the registry, the COM+ Class Registration Database, and the boot files of the workstation.
- ✓ Locate and launch the Windows Backup Utility in Wizard Mode.
Note: You can find the utility in the Programs > Accessories > System Tools folder.

REGISTRY BACKUP PROCEDURE

Prompt	Selection - Entry	Click
Backup or Restore:	Back up files and settings	Next
What to Backup:	Let me choose what to back up	Next
Items to back up:	Open My Computer	
	Check System State	Next
Choose a place to save your backup:	Browse to DESKTOP	
Type a name for this backup:	Registry	Next
Completing the Backup or Restore		Finish
Backup Progress		Report
		Close

2. ✓ **Export Registry Keys** - To back up an individual registry key, use the Registry Editor. Before you edit the registry, it's a good idea to export the keys in the registry that you plan to edit. Follow these steps to export a registry key.

- Click Start, and then click Run.
- In the Open box, type Regedt32, and then click OK.
- Locate and then click the key that contains the value that you plan to edit.
- On the File menu, click Export.
- In the Save in box, select a location in which to save the .reg file. In the File name box, type a file name, and then click Save.

In the following steps, you're going to edit the following registry keys:

HKEY_CURRENT_USER
HKEY_LOCAL_MACHINE

Before you do that however... Don't you think it would be a good idea to backup these two keys?

- ✓ Follow the steps used to export a registry key to export both of these keys to the DESKTOP.
3. ✓ **Editing the Registry** – Let's have some fun. Again... Using Registry Editor incorrectly can cause serious problems that may require that you reinstall your operating system. If it's not clear, you use Registry Editor at your own risk. There is help at the click of a mouse button if you get stuck during this process. For more information about editing the registry, follow these steps in Registry Editor:

- On the Help menu, click Help Topics.
- On the Contents tab, double-click Registry Editor.
- Double-click How To.
- Double-click Change Keys and Values, and then click the topic that you want.

✓ **Speed Up Your Start Menu And Taskbar**

You can reduce the time that the Start menu takes to display its submenus. Go to the HKEY_CURRENT_USER\Control Panel\Desktop subkey and set the MenuShowDelay value to 100.

✓ **Disable CD-ROM AutoRun**

Go to the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Cdrom subkey and set the AutoRun value to 0.

✓ **Add a Pre-Logon Dialog Box**

To alter the welcome dialog box, go to the HKEY_LOCAL_MACHINE \SOFTWARE \Microsoft \Windows NT\CurrentVersion\Winlogon subkey and change the LegalNoticeText value to a string such as, "This is CSS Workstation". To set the dialog box's title bar, change the LegalNoticeCaption value to a string such as Unauthorized Access Prohibited.

✓ Exit Registry Editor and restart the computer. Did you notice the changes you made in the registry?

4. ✓ **Restore the Registry** – Just as there were two ways to backup the registry keys, there are two ways to restore them. If you exported individual keys, you simply double-click on the .reg file as the key will be restored. If you backed up the entire registry, then you have to use the Windows Backup Utility to restore the file.

✓ Restore the registry keys that you exported in the previous steps.

✓ Restart the computer to see if the changes to made to the registry are gone.

✓ Restore the whole registry using the Windows Backup Utility.



Operating Systems Guide

Technical Manual

Exercise 4a – Windows 2000 Worksheet

Instructions:

Complete the entire exercise and record the results of your experimentation on this worksheet. Consider using other information sources as well. Periodicals, reference materials, and the Internet are great resources to find the answers to the technical problems you're going to face when servicing computers.

Name:	
Period:	
Date:	

Speaking of resources... Let's save some of our natural resources. Rather than printing out the entire lesson, print out only the worksheet. Study the lesson on-screen and then record your answers on the worksheet. When you're finished, return the worksheet to your supervisor for evaluation. Be sure to complete this assignment before moving onto the next.

Questions:

1. ✓ Research and develop a detailed definition for each of the following terms. Many words have multiple definitions... Some of which may have nothing to do with the field of Computer Service and Support. Make sure your definition falls within the context of this lesson. Refer to the list of Research Resources and Required Materials as well as other materials you feel are appropriate. Write your definitions on the reverse side of this worksheet or a separate piece of paper with each definition being two sentences or more.

- | | | |
|-----------------|-------------|-------------|
| ✓HCL | ✓Properties | ✓Defragment |
| ✓Device Manager | ✓FAT 32 | ✓ScanDisk |
| ✓Counter | ✓NTFS | ✓ERD |

2. ✓ Which two tools or utilities should you use to troubleshoot a Windows NT computer that fails to boot?

- A. A bootable system disk
- B. The emergency repair utility
- C. A System Information Disk
- D. An Emergency Repair Disk

3. ✓ Which of the following cannot be done in the Recovery Console?

- A. Run an XCOPY procedure.
- B. Access the Registry HKeys.
- C. Examine Partition Information
- D. Format a System Disk

4. ✓ The boot mode that starts up Windows 2000 with only essential device drivers and services is called _____ mode.

5. ✓ To display a command line prompt from Windows 2000 system, enter the command _____ in the Start Run Box.

6. ✓ Windows 2000 _____ messages are also known as blue screen messages.

- A. Stop
- B. Error
- C. Dialog
- D. BS

7. √ The command line used to create a set of Windows 2000 startup disks is _____ .
- A. SYSBOOT.EXE
 - B. MAKEBOOT.EXE
 - C. ERD.EXE
 - D. BOOTCFG.EXE
8. √ Which of the following is not a system requirement of Windows 2000?
- A. 133MHZ or higher Pentium processor.
 - B. At least 2GB of free disk space
 - C. At least 256MB of main memory (RAM)
 - D. A CDROM drive
9. √ Which of the following can be used to enter Safe Mode during a Windows 2000 startup?
- A. F5 key during boot process
 - B. F8 key during boot process
 - C. F8 when prompted and select Safe Mode from the Advanced Options menu
 - D. Delete Key during POST
10. √ This utility can be used to download and install product updates, services packs, device drivers, and updates to Windows 2000.
- A. MSINFO32
 - B. Windows Update
 - C. MAKEDISK
 - D. SETUPAPI

Exercise:

This section is used to record the data that's collected during the exercise. Each section number refers to a specific step in the exercise. As you work through each task, record your results here when instructed to do so.

A1. Record your machine's hardware specs.

SYSTEM HARDWARE SPECS	
Value	Specification
MHz	Processor Speed
MB	RAM
GB	Hard Drive Capacity

A2. Access the Hardware Compatibility List on Microsoft's Web site (<http://www.microsoft.com/hcl>) and check for your hardware. Record the Hardware Compatible List specification for your computer trainer.

HARDWARE COMPATIBLE LIST			
Compatible	Manufacturer	Model	Device
YES / NO			Microprocessor
YES / NO			Graphic Interface Card
YES / NO			Sound Card
YES / NO			Network Interface Card
YES / NO			Other

A3. Make a note of any non-HCL components in the computer trainer in the table above.

B1. Record your OS installation information.

OS INSTALLATION INFORMATION	
Parameter	Value
Name:	*
Company:	*
Product Key:	
Computer Name:	*
Computer Description:	*
Workgroup/Domain Name:	*
User Name:	*
User Password:	*
TCP/IP Address:	*

* See your supervisor or system administrator to obtain this information

C1. Click the plus sign (+) to expand Event Viewer. You'll see at least three of the following logs: Application, Directory Service, File Replication Service, Security, and System. Record the description that appears in the right-hand pane for each:

C3. On the General tab, find the manufacturer and location. Record your results in the table below.

Mouse and Other Pointing Device	
Value	Properties
	Manufacturer
	Location



Operating Systems Guide

Technical Manual

Exercise 5 – Windows XP

Introduction:

You should have a pretty good handle on installing and using operating systems by now. Windows XP functions like any other operating system, but it does have some great new features and is definitely more reliable than previous versions of Windows. It's pretty Zippy too. XP also incorporates some of the innovations that made other releases of Windows easy to manage. For that reason, you'll apply all of the skills you've learned in this OS Module thus far. In fact, everything you were able to do with Windows 2000 can also be done with Windows XP. Here's what's new in Windows XP:

Windows XP Home and Professional:

- New user interface
- Improved tools for managing multimedia files
- New system utilities, such as Remote Assistance
- New multimedia programs, including Windows Media Player 8.0 and Windows Movie Maker
- New Internet tools, such as Internet Explorer 6 and Windows Messenger
- Improved multi-user support and Fast User Switching
- Built-in Internet Connection Firewall
- Improved home networking tools like the Network Setup wizard

Windows XP Professional only:

- Multiprocessor support
- Mobile and remote desktop features
- Support for off-line files and folders
- Administrative features, such as group policy administration, roaming user profiles, and remote software installation
- Encrypting file system

System Requirements:

- PC with 300 megahertz or higher processor clock speed recommended; 233 MHz minimum required (single or dual processor system); Intel Pentium/Celeron family, or AMD K6/Athlon/Duron family, or compatible processor recommended
- 128 megabytes (MB) of RAM or higher recommended (64 MB minimum supported; may limit performance and some features)
- 1.5 Gigabytes (GB) of available hard disk space
- Super VGA (800 × 600) or higher-resolution video adapter and monitor
- CD-ROM or DVD drive

Although the OS Technologies portion of the CompTIA A+ exam is currently a Windows 98 exam, that's all about to change. In late 2003, the exam will include the latest release of operating systems including Windows XP.

Exercise Objective:

This lesson is designed to supplement the OS skills you've already gained by completing the previous lessons. Much of what you've learned working with Windows 9x, Windows 2000, and even DOS apply to Windows XP as well. In addition to following lessons, it would be a good idea

to practice the tasks you've learned in previous lessons... Only using Windows XP. ***In this exercise you'll perform tasks covering the following topics:***

A. Getting Started – You'll learn how to upgrade and make a new installation of Windows XP. You'll also learn how to configure a workstation to connect to a network. During this lesson, you will:

- Setup Windows XP Professional.
- Transfer files and settings to your new PC.
- Find and update device drivers.
- Configure a multi-boot workstation.

B. Computer Configuration – You'll learn how to configure your workstation to your own personal specifications. You'll learn about the ClearType Tuner, Accessibility Tools, Dualview, and Fast User Switching. Finally, you'll learn how to setup Windows XP to look and feel like Windows 2000. During this lesson, you will:

- Configure the Desktop properties.
- Adjust the screen font using ClearType.
- Use the Accessibility Wizard to make user adjustments.
- Learn how to use multiple monitors with a workstation.
- Share a computer with Fast User Switching.
- Restore Windows Classic view.

C. Communication and the Internet – You'll learn how to use the latest version of Windows Messenger. During this exercise, you will:

- Use Windows Messenger for a variety of e-meeting functions.

D. Mobile Features - You'll learn how to use Remote Desktop to work with a remote workstation. You'll also learn how to use Offline Files and Offline Viewing of web pages. Finally, you'll learn how to transfer data over a virtual private network. During this exercises, you will:

- Enable and use Remote Desktop.
- Use offline files when you're off the network.
- Make web pages available for offline viewing.
- Setup and use a virtual private network.

E. Multimedia – You'll learn how to use the new multimedia features built into Windows XP. You'll transfer film to computers and edit movies using Movie Maker. You'll also work with Media Player to work with CD media as well as use new features to organize and work with digital photographs. During this lesson, you will:

- Use Windows Movie Maker.
- Use Windows Media Player to work with various types of audio files.
- Organize and Work with Digital Photos.

F. Networking – You'll learn how to setup Windows XP to operate with a small network, Point to Point Protocol, and multiple networks. You'll also learn how to enable and use an Internet Connection Firewall, connection sharing, and infrared devices. During this exercise, you will:

- Create a home or small office network.

- Configure broadband connections using PPPoE.
- Use Automatic Configuration for Multiple Networks.
- Secure a small network with Internet Connection Firewall.
- Set Up and Use Internet Connection Sharing.
- Connect computers and devices with Infrared Data Transfer.

G. Security and Maintenance – You'll learn how to use the Windows Update website to keep your computer's operating system up-to-date. You'll also learn other XP security features such as Access Control Lists and Data Encryption. Finally, you'll learn how to backup files and settings, copy files and folders to CDs, and use hibernate and standby modes to conserve battery power in portable computers. During this lesson, you will:

- Use Windows Update to find the most recent OS updates.
- Use Access Control features to restrict access to a desktop computer.
- Use the Windows Backup and Restore utility to protect data.
- Copy files and folders to a CD Writer.
- Use the Encrypting File System to secure data.
- Use the Hibernate and Standby features to conserve battery power in laptops.

H. Getting Help and Support – You'll learn how to use the Windows XP Help and Support Center. You'll also learn how to solve device driver problems, undo changes if problems occur, configure Windows XP to run legacy applications, and get help using instant messaging, e-mail, or by sending files. During this exercise you will:

- Use the Windows XP Help and Support Center.
- Restore a previous device driver.
- Remove any system changes that were made since the last time the computer worked.
- Configure Windows XP to run legacy programs.
- Use Remote Assistance to start sessions with instant messaging, e-mail, or FTP.

Discussion of Fundamentals:

This lesson explores the differences between the Windows XP operating systems and the Windows 9x/ME/NT/2000 operating systems. Some considerations include where the operating system will be used, the type of file system, and security issues. Throughout the following activities, you will become familiar with the new features and tools added to the Windows XP OS. You will also identify the requirements for installing or upgrading to the Windows XP operating system.

The Windows XP operating system has some obvious and not so obvious differences from the previous releases of Windows. There are even differences within XP itself (Home or Professional version). Many of the differences are "behind the scenes", but they are very important concepts to understand to fully grasp the different environments that these operating systems are used in. Things to consider are...

- Is the OS going to be used for the office or home?
- Will the computer be part of a network?
- What type of security issues must be taken into account?
- What types of programs are planned to run on the operating system.

All of these factors will determine whether or not to choose the 9x or the Windows NT, 2000, or XP operating system.

Words and Terms You Should Know:

- Files and Settings Transfer
- Multiboot
- Desktop Theme
- ClearType Tuner
- Accessibility
- DualView
- Fast User Switching
- Remote Desktop
- Offline Files
- Virtually Private Network
- Movie Maker
- Media Player
- PPPoP
- Firewall
- Connection Sharing
- Infrared Data Transfer
- Windows Update
- Encryption

Research Resources:

Company	Web Site	Description
Microsoft	http://www.microsoft.com/windowsxp/default.asp	Technical support website for Microsoft Windows XP

Required Materials:

- Computer Trainer
- Windows XP OS (Professional or Home) Distribution Disk
- Networked Computer Trainer with Windows XP Professional or Home Installed

Tech Note: You'll need to use a computer trainer that you can wipe and buildup as you experiment with different installation methods for Windows XP. The remaining experiments can be completed on a Computer Trainer that has an existing installation of Windows XP providing you're running the Professional version and have administrator access to the computer.

Where can I find a legal Windows XP distribution disk? Microsoft supports Windows XP as their premier operating system and you can purchase a copy if you want. However, you can probably locate a legitimate copy of the OS by checking with your system administrator or local Techno Geek. They're bound to have a few legal copies lying around. It's important to know that the OS will only be installed for a short period of time. Once you've completed the following exercise, you'll remove the OS from the system.

Even if you can't find a copy anywhere, you'll still need to become familiar with all aspects of this lesson. Read through the material studying it very carefully. You should really practice working with XP at your earliest opportunity.

Procedure:

Complete each of the following steps in this exercise. When you see a ✓... That's an indication that you need to do something. Some of the lessons will refer to on-line articles from the Windows XP website. You don't need XP to work with the website. Read through the articles and then complete the practical application portion of the lesson on an XP workstation. For your convenience, there is an **Exercise Worksheet** attached to the end of this exercise. To save trees... It would be best to print out this worksheet only. You'll use it to record your answers while performing the following steps.

A. Getting Started

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the **exercise worksheet** at the end of this exercise.

1. [Set Up Windows XP Professional](#)

Find out how to perform a quick upgrade, make a new installation, and join a network. Learn how to configure your computer for connecting to a network, creating accounts, and logging on, along with procedures that allow you to backup and recover. Find answers to common questions about installation and configuration, plus information about troubleshooting, accessibility, and finding support.

[2. Transfer Files and Settings to Your New PC](#)

The Files and Settings Transfer Wizard helps you automatically gather your files and settings from your old computer and transfer them to your new computer.

[3. Finding Driver Information](#)

Making sure you have all the right drivers is a good place to start troubleshooting problems.

[4. Multiboot with Windows XP](#)

Read about multibooting with Windows XP, including how to install Windows XP and Windows 2000; Windows XP and Windows NT Workstation 4.0; or Windows XP and MS-DOS, Windows 95, Windows 98, or Windows Millennium Edition (Windows Me).

B. Computer Configuration

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

[1. Personalize Your Computer Settings](#)

Find out how to change your desktop background, add a screen saver, work with themes, change your screen size, work with sound effects, and customize your mouse and pointer and your Start menu.

[2. Microsoft ClearType Tuner: Customize Your Screen for Your Eyes](#)

Use the ClearType Tuner to increase font readability on your monitor.

[3. Take Advantage of Accessibility Tools](#)

Learn about using the Accessibility Wizard; adjusting accessibility, display, mouse, keyboard, Internet, sounds and audio, taskbar and menu, user accounts, and speech options; and using the Utility Manager, On-Screen Keyboard, Narrator, and Magnifier.

[4. Expand Your Workspace with Multiple Monitors and Dualview](#)

Find out how to maximize your resources with Multiple Monitors and Dualview.

[5. Share a Computer with Fast User Switching](#)

Fast User Switching lets two or more users share a computer and easily switch in and out of individual accounts without closing applications.

[6. Restore Windows Classic View When You Want It](#)

The new task-based design of Windows XP makes it easier to use a computer regardless of your experience. But if you prefer some things in the classic design you can use the Windows Classic View.

C. Communication and the Internet

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

[Stay in Touch with Windows Messenger 4.5](#)

Learn how to use the latest version of Windows Messenger for instant messaging, online voice communications, video conferencing, sending files and photos, and application and whiteboard sharing, plus find out how to control what others see of your online status.

D. Mobile Features

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

1. Enable Remote Desktop

Here's what you need to know to use Remote Desktop, including how to enable your computer as the host, install client software, and start a Remote Desktop session.

2. Use Offline Files When You're off the Network

Find out how to use Offline Files in Windows XP Professional to help you be more productive.

3. Make Web Pages Available for Offline Viewing

Learn how Internet Explorer 6 in Windows XP can make a Web page available offline so you can view it when your computer is not connected to the Internet.

4. Transfer Internet Data Securely with Virtual Private Networks

Here's how to make your Internet communications secure and extend your private network with a virtual private network (VPN) connection.

E. Multitmedia

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

1. Get Started with Windows Movie Maker

Find out how to get started with Windows Movie Maker, how to transfer film from your camera to your computer, and how to edit movies.

2. Enjoy a World of Music

Get acquainted with Windows Media Player and learn how to copy tracks from a CD onto your computer, find music on the Internet, create play-lists, burn your own CDs, use portable devices, tune in Internet radio, and change the appearance of Windows Media Player.

3. Organize and Work with Your Photos

Start working with photos and find out how to e-mail photos, print photos, order prints online, publish photos to the Web, use photos for your desktop background, organize your photos, and store photos on CD.

F. Networking

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

1. Create a Home or Small Office Network

Get an understanding of small network technologies and find out how to determine your small network layout, put it together, and protect it.

2. Configure Broadband Connections Using PPPoE

Point to Point Protocol over Ethernet (PPPoE) is a protocol used by some ISPs who provide broadband connections. Here's how to make sure it works with Windows XP

[3. Use Automatic Configuration for Multiple Networks](#)

Find out how to use automatic configuration to make it easy to move your mobile computer from your home network to the local area network in your office, without the need to manually reconfigure TCP/IP settings.

[4. Secure Your Small Network with Internet Connection Firewall](#)

Learn how to enable Internet Connection Firewall in Windows XP to restrict what information is communicated between the Internet and your home or small office network.

[5. Set Up and Use Internet Connection Sharing](#)

Find out how you can connect one computer to the Internet, then share the Internet service with several computers on your home or small office network.

[6. Connect Computers and Devices with Infrared Data Transfer](#)

Read about how you can connect your computer to other nearby computers and devices without wires, using infrared light to transfer data, the same way your TV remote control sends signals.

G. Security and Maintenance

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the ***exercise worksheet*** at the end of this exercise.

[1. Keep Your Computer Current with Windows Update](#)

Learn how to use Windows Update, a Web site where you find the most recent updates for your operating system, software programs, and hardware.

[2. Restrict Who Can Use Files with Access Control](#)

Find out how to use the access control features that allow you to restrict access to a specific user, a computer, or a group of users.

[3. Use Backup to Protect Data](#)

Here's how to protect your data from accidental loss if your system hardware or storage media fails.

[4. Copy Files and Folders to CDs](#)

Learn how to use a CD-recordable (CD-R) or CD-rewriteable (CD-RW) drive to copy data to a CD as easily as you can to a floppy disk.

[5. Encrypt Your Data to Keep It Safe](#)

Find out how to take advantage of the advanced Encrypting File System (EFS) security feature in Windows XP.

[6. Conserve Batteries with Hibernate and Standby](#)

Here's how to use the Hibernate and Standby functions in Windows XP Professional to make the batteries in your laptop computer last longer.

[7. Use Security and Privacy Features in Internet Explorer 6](#)

Find out how Internet Explorer 6 in Windows XP helps protect your privacy on the Web by giving you more control over cookies and more information on a Web site's privacy policy.

H. Getting Help and Support

The following items are lesson links to the Windows XP website. Click on the hyperlinks and study the material carefully. When you're finished with this section, complete the appropriate section of the **exercise worksheet** at the end of this exercise.

1. Using the Help and Support Center in Windows XP

Learn how to use the new Windows XP Help and Support Center that consolidates Online Help, support, tools, how-to articles, and other resources in one convenient spot.

2. Roll Back a Device Driver

If a new driver does not work properly, Windows XP lets you restore the previous driver. Here's how.

3. Use System Restore to Undo Changes if Problems Occur

Find out how to use System Restore to remove any system changes that were made since the last time you remember your computer working correctly.

4. Take Advantage of Program Compatibility Mode

Learn how Windows XP lets you run older games and other programs that were written specifically for an earlier version of Windows.

5. Get Help Anywhere with Remote Assistance

With Remote Assistance in Windows XP, you can get the help you need when you run into problems with your computer, even if the person helping you is on the other side of town. Find out how to start sessions with instant messaging, e-mail, or by sending files.



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Exercise 5a – Windows XP Worksheet

Instructions:

Complete the entire exercise and record the results of your experimentation on this worksheet. Consider using other information sources as well. Periodicals, reference materials, and the Internet are great resources to find the answers to the technical problems you're going to face when servicing computers.

Name:	
Period:	
Date:	

Speaking of resources... Let's save some of our natural resources. Rather than printing out the entire lesson, print out only the worksheet. Study the lesson on-screen and then record your answers on the worksheet. When you're finished, return the worksheet to your supervisor for evaluation. Be sure to complete this assignment before moving onto the next.

Questions:

1. ✓ Research and develop a detailed definition for each of the following terms. Many words have multiple definitions... Some of which may have nothing to do with the field of Computer Service and Support. Make sure your definition falls within the context of this lesson. Refer to the list of Research Resources and Required Materials as well as other materials you feel are appropriate. Write your definitions on the reverse side of this worksheet or a separate piece of paper with each definition being two sentences or more.

- | | | |
|-------------------|-----------------------------|----------------------|
| ✓ Multiboot | ✓ DualView | ✓ PPPoP |
| ✓ Desktop Theme | ✓ Remote Desktop | ✓ Firewall |
| ✓ ClearType Tuner | ✓ Virtually Private Network | ✓ Connection Sharing |

2. ✓ What tool is used move files and settings from another computer over to one with Windows XP?

- A. File Transfer Protocol (FTP)
- B. Files and Settings Transfer Wizard
- C. Settings Transfer Program
- D. File Properties Wizard

3. ✓ How do you check to see if software and hardware is compatible with Windows XP?

- A. Click **Start, Help and Support** and **Find** compatible hardware/software for Windows XP
- B. Click **Start, Help and Support** and type "Program Compatibility Wizard" in Search box.
- C. Click **Start, Run** and **Find** compatible hardware and software for Windows XP
- D. Click **Start, Run** and type "Program Compatibility Wizard" in the Search box.

4. ✓ You would like to install multiboot capability on a computer workstation so you can run both Windows XP and Windows 98 on the same machine. What's the minimum number of partitions you need to install on your hard disk drive?
- A. 3
 - B. 1
 - C. 2
 - D. Windows XP doesn't require partitions for multiboot operations
5. ✓ In Display Settings... What tab is used to change the screen resolution?
- A. Settings
 - B. Theme
 - C. Screen Saver
 - D. Appearance
6. ✓ How do you get to the screen where you can customize the mouse and pointer in Windows XP?
- A. Start, Control Panel, Mouse Pointers
 - B. Start, Control Panel, Desktop Properties, Mouse Pointers
 - C. Start, Control Panel, Appearance and Themes, See Also, Mouse Pointers
 - D. Start, Control Panel, Mouse
7. ✓ What is the maximum number of monitors that you can use when taking advantage of the Windows XP DualView feature?
- A. 2
 - B. 10
 - C. 128
 - D. 4
8. ✓ Which of following is not necessary to turn-on the Fast User Switching feature?
- A. Have a computer administrator account
 - B. Be a member of a workgroup
 - C. Be using a stand-alone computer
 - D. Be using Windows XP Home version
9. ✓ Which Windows Messenger feature operates well without a broadband connection?
- A. Video Conferencing
 - B. Whiteboard Sharing
 - C. Online Voice Communications
 - D. Instant Messenger
10. ✓ Which Windows XP Professional utility is used to remotely control another computer?
- A. Remote Desktop
 - B. Remote Control
 - C. Remote Administrator
 - D. RConsole

11. ✓ Where are the Offline Files settings located in Windows XP?
- A. Folder Options
 - B. File Type
 - C. File Options
 - D. Control Panel
12. ✓ VPN uses a technique known as _____ to transfer data securely on the Internet to a remote access server on a workplace network.
13. ✓ Where does Windows XP store the files that are transferred from a digital camera?
- A. My Documents
 - B. My Photos
 - C. My Pictures
 - D. My Graphics
14. ✓ You have a broadband connection to the Internet. The software you use to connect to your ISP doesn't work with Windows XP. Instead of downloading an update, you can connect directly to your ISP by configuring the broadband connection using:
- A. Dial-Up Services
 - B. IPX
 - C. NETBUI
 - D. Point-to-Point Protocol on Internet
15. ✓ Where do you find the Internet Connection Firewall settings for Windows XP?
- A. Under the ICF tab of the Network Tasks Tab
 - B. Under the Advanced Tab of Local Area Connection Properties
 - C. In the Network Connections Utility under the Advanced Tab
 - D. In the Network Security Utility
16. ✓ With _____ in Windows XP, you can connect one computer to the Internet, then share the Internet service with several computers on a home or small office network.
17. ✓ You can restrict who has access to data on your computer, or on the network, using access control lists in Windows XP on a drive formatted to use _____.
- A. FAT16
 - B. NTFS
 - C. FAT32
 - D. HPFS
18. ✓ The sequence of commands or the procedure below is used to _____ a file?
- Step 1. Select a file
 - Step 2. Edit its properties
 - Step 3. On the general tab, click advanced
 - Step 4. Encrypt contents to secure data

19. ✓ _____ reduces the power consumption of your computer by cutting power to hardware components you are not using.
- A. Energy Star
 - B. Advanced Configuration and Power Interface (ACPI)
 - C. Hibernate
 - D. Standby
20. ✓ After you upgrade to Windows XP, you're favorite game doesn't work anymore. A "Requires Windows 95" error message pops up each time you try to run it. What's the name of the wizard that will allow you to run the game in Windows 95 mode?
- A. Win9x Mode
 - B. Compatibility Mode
 - C. FAT32 Mode
 - D. Configuration Mode

Exercise:

This section is used to record the data that's collected during the exercise. Each section number refers to a specific step in the exercise. As you work through each task, record your results here when instructed to do so.

A1. Setup Windows XP

- ✓ Record your machine's hardware specs.

SYSTEM HARDWARE SPECS	
Value	Specification
MHz	Processor Speed
MB	RAM
GB	Hard Drive Capacity

- ✓ Access the Hardware Compatibility List on Microsoft's Web site (<http://www.microsoft.com/hcl>) and check for your hardware. Record the Hardware Compatible List specification for your computer trainer.

HARDWARE COMPATIBLE LIST			
Compatible	Manufacturer	Model	Device
YES / NO			Microprocessor
YES / NO			Graphic Interface Card
YES / NO			Sound Card
YES / NO			Network Interface Card
YES / NO			Other

- ✓ Make a note of any non-HCL components found in the computer trainer in the table above.

- ✓ Record your OS installation information.

OS INSTALLATION INFORMATION	
Parameter	Value
Name:	*
Company:	*
Product Key:	
Computer Name:	*
Computer Description:	*
Workgroup/Domain Name:	*
User Name:	*
User Password:	*
TCP/IP Address:	*

* See your supervisor or system administrator to obtain this information.

- ✓ Following the Windows XP installation instructions provided in the Setup Windows XP Professional web article to perform a New Installation of Windows XP. **Have your supervisor check your work.**

A3. Finding Device Drivers

- ✓ Use Windows Update to check for the latest updates, service packs, and device drivers. Install all critical updates and device drivers. Do not install the recommended updates.
- ✓ Turn on the Windows Update Catalog and search the catalog for your computer's NIC and Video Card. Did you find them? **Have your supervisor check your work.**

B3. Take Advantage of Accessibility Tools

- ✓ Demonstrate how to use the Narrator Accessibility Tool. **Have your supervisor check your work.**

B5. Share a Computer with Fast User Switching

- ✓ Demonstrate how to use the Fast User Switching feature. **Have your supervisor check your work.**

B7. Restore Windows Classic View When You Want It

- ✓ Demonstrate how to switch between Windows 2000 and Windows Classic Views. **Have your supervisor check your work.**

D3. Mobile Features

- ✓ Demonstrate how to make a web page available off-line. **Have your supervisor check your work.**

E1. Multimedia

- ✓ Demonstrate how to use Windows Movie Maker.
- ✓ Demonstrate how to use the new features in Windows Media Player.

F1. Networking

- ✓ Network two Windows XP computers using a hub. ***Have your supervisor check your work.***

G2. Restrict Who Can Use Files with Access Control

- ✓ Create a folder and copy some files into it. Using Access Control, configure the files so only you have access to them. ***Have your supervisor check your work.***

G5. Encrypt Your Data to Keep it Safe

- ✓ Use the Encryption File Security file system to encrypt one of the files in your folder. ***Have your supervisor check your work.***

H3. Use System Restore to Undo Changes if Problems Occur

- ✓ Demonstrate how to use the System Restore utility. ***Have your supervisor check your work.***

H4. Take Advantage of Program Compatibility Mode

- ✓ Demonstrate how to make Windows XP compatible with legacy software. ***Have your supervisor check your work.***