STUDY GUIDE

CompTIA

A+ OS Technologies

(220-302)

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About the Author

Robert J. Shimonski (CompTIA HTI+, Security+, Server+, e-Biz+, Inet+, Network+, **A+**, TruSecure TICSA, Cisco CCDP, CCNP, Cisco Firewall Specialist, Nortel NNCSS, Microsoft MCSE, MCP+I, Novell Master CNE, CNE 4/5/6, CIP, CIBS, IWA CWP, Prosoft MCIW, SANS GSEC, GCIH, Symantec SPS and NAI Sniffer SCP) is a Network Manager for a leading manufacturing company. Robert's technical specialties include leading a world class team of Engineers, network infrastructure design with the Cisco and Check Point product lines, Systems Engineering with Microsoft and Novell technologies and troubleshooting with **Sniffer-based** technologies.

Robert has served as a Subject matter Expert (SME) for CompTIA.org, the creators of the A+ exam. Robert has helped not only beta test just about every certification created through CompTIA, but also worked with CompTIA to develop exam content and questions for exams such as HTI+ and eBiz+. He was selected based on his networking expertise and history of developing highly needed top quality material for most of the leading certification software vendors and book publishers worldwide.

Robert is also a best-selling author (www.rsnetworks.net) of many security related articles and published books to include: "Sniffer Network Optimization and Troubleshooting Handbook" from Syngress Media Inc (ISBN: 1931836574), Security+ Study Guide and DVD Training System (ISBN: 1931836728) and the newly upcoming and highly anticipated Network+ study guide based on the 2005 objectives, all from Syngress Media Inc.

Note on Preparation

I have compiled what I believe to be one of the best guides to help you prepare for the A+ exam, but this is not the only resource you should use. This is only meant to augment your study material to distill important topics. Make sure you prepare for the exam properly, as it is expensive, and you do not want to waste your money. Make sure you are working on a PC, and either take a class or use at least one book.

About the Exam

CompTIA A+ Certification is awarded after passing two exams created by CompTIA, one of the world's leaders in certification testing. The CompTIA A+ certification is an international industry credential that validates the knowledge of an entry level PC computer technician and has no prerequisites. The skills and knowledge measured by this examination were derived from an industry-wide job task analysis and validated through an industry-wide survey of many participants. The A + exam is one of the most sought after certifications in CompTIA's arsenal of certification programs, right next to one of the other biggest leaders, Network+. A + has about a decade of existence behind it, and if prepared for properly, is a credential that never expires, that you can hold and build on and be proud of achieving.

There are four major topic areas (domains) that make up 100% of this exam:

- Domain 1.0: OS Fundamentals (28%)
- Domain 2.0: Installation, Configuration and Upgrading (31%)
- Domain 3.0: Diagnosing and Troubleshooting (25%)
- Domain 4.0: Networks (16%)

The Exam Number is 220-302.
The Exam Title is the **A+ OS Technologies**.

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Objectives

Domain 1.0: OS Fundamentals 28%

1.1 Identify the major desktop components and interfaces, and their functions. Differentiate the characteristics of Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

- Contrasts between Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP
- Major Operating System components
  - Registry
  - Virtual Memory
  - File System
- Major Operating System Interfaces
  - Windows Explorer
  - My Computer
  - Control Panel
  - Computer Management Console
  - Accessories/System Tools
  - Command line
  - Network Neighborhood/My Network Places
  - Task Bar/systray
  - Start Menu
  - Device Manager

1.2 Identify the names, locations, purposes, and contents of major system files.

- Windows 9x –specific files
  - IO.SYS
  - MSDOS.SYS
  - AUTOEXEC.BAT
  - COMMAND.COM
  - CONFIG.SYS
  - HIMEM.SYS
  - EMM386.exe
  - WIN.COM
  - SYSTEM.INI
  - WIN.INI
  - SYSTEM.DAT
  - USER.DAT
- Windows NT-based specific files
  - BOOT.INI
  - NTLDR
  - NTDETECT.COM
  - NTBOOTDD.SYS
  - NTUSER.DAT
  - Registry data files

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1.3 Demonstrate the ability to use command-line functions and utilities to manage the operating system, including the proper syntax and switches.

- Command/CMD
- DIR
- ATTRIB
- VER
- MEM
- SCANDISK
- DEFRAG
- EDIT
- XCOPY
- COPY
- FORMAT
- FDISK
- SETVER
- SCANREG
- MD/CD/RD
- Delete/Rename
- DELTREE
- TYPE
- ECHO
- SET
- PING

1.4 Identify basic concepts and procedures for creating, viewing, and managing disks, directories and files. This includes procedures for changing file attributes and the ramifications of those changes (for example, security issues.)

- Disks
  - Partitions
    - Active Partition
    - Primary Partition
    - Extended Partition
    - Logical partition
  - Files Systems
    - FAT16
    - FAT32
    - NTFS4
    - NTFS5.x
- Directory Structures (root directory, subdirectories, etc)
  - Create folders
  - Navigate the directory structure
  - Maximum depth
- Files
  - Creating files
  - File naming conventions (Most common extensions, 8.3, maximum length)
  - File attributes - Read Only, Hidden, System, and Archive attributes
  - File Compression
  - File Encryption

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- File Permissions
- File types (text vs. binary file)

1.5 Identify the major operating system utilities, their purpose, location, and available switches.

- Disk Management Tools
  - DEFRAG.EXE
  - FDISK.EXE
  - Backup/Restore Utility (MSbackup, NTBackup, etc)
  - ScanDisk
  - CHKDSK
  - Disk Cleanup
  - Format
- System Management Tools
  - Device manager
  - System Monitor
  - Computer Manager
  - MSCONFIG.EXE
  - REGEDIT.EXE (View information/Backup registry)
  - REGEDT32.EXE
  - SYSEDIT.EXE
  - SCANREG
  - COMMAND/CMD
  - Event Viewer
  - Task Manager
- File Management Tools
  - ATTRIB.EXE
  - EXTRACT.EXE
  - Edit.com
  - Windows Explorer

Domain 2.0: Configuration and Upgrading 31%

2.1 Identify the procedures for installing Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP, and bringing the operating system to a basic operational level.

- Verify hardware compatibility and minimum requirements
- Determine OS installation options
  - Installation type (typical, custom, other)
  - Network configuration
  - File system type
  - Dual Boot Support
- Disk preparation order (conceptual disk preparation)
  - Start the installation
  - Partition
  - Format drive
- Run appropriate set up utility
  - Setup
  - Winnt
- Installation methods
  - Bootable CD

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    - Boot floppy
    - Network installation
    - Drive Imaging
- Device Driver Configuration
    - Load default drivers
    - Find updated drivers
- Restore user data files (if applicable)
- Identify common symptoms and problems

2.2 Identify steps to perform an operating system upgrade from Windows 9.x/ME, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP. Given an upgrade scenario, choose the appropriate next steps.

- Upgrade paths available
- Determine correct upgrade startup utility (e.g. WINNT32 vs. WINNT)
- Verify hardware compatibility and minimum requirements
- Verify application compatibility
- Apply OS service packs, patches, and updates
- Install additional Windows components

2.3 Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

- Boot Sequence
    - Files required to boot
    - Boot steps (9.x, NT-based)
- Alternative Boot Methods
    - Using a Startup disk
    - Safe/VGA-only mode
    - Last Known Good configuration
    - Command Prompt mode
    - Booting to a system restore point
    - Recovery Console
    - Boot.ini switches
    - Dual Boot
- Creating Emergency Disks with OS Utilities
- Creating emergency repair disk (ERD)

2.4 Identify procedures for installing/adding a device, including loading, adding, and configuring device drivers, and required software.

- Device Driver Installation
    - Plug and Play (PNP) and non-PNP devices
    - Install and configure device drivers
    - Install different device drivers
    - Manually install a device driver
    - Search the Internet for updated device drivers
    - Using unsigned drivers (driver signing)
- Install Additional Windows components
- Determine if permissions are adequate for performing the task

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2.5 Identify procedures necessary to optimize the operating system and major operating system subsystems.

- Virtual Memory Management
- Disk Defragmentation
- Files and Buffers
- Caches
- Temporary file management

Domain 3.0: Diagnosing and Troubleshooting 25%

3.1 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems.

- Common Error Messages and Codes
  - Boot failure and errors
    - Invalid boot disk
    - Inaccessible boot device
    - Missing NTLDR
    - Bad or missing Command interpreter
  - Startup messages
    - Error in CONFIG.SYS line XX
    - Himem.sys not loaded
    - Missing or corrupt Himem.sys
    - Device/Service has failed to start
  - A device referenced in SYSTEM.INI, WIN.INI, Registry is not found
  - Event Viewer – Event log is full
  - Failure to start GUI
  - Windows Protection Error
  - User-modified settings cause improper operation at startup
  - Registry corruption
- Using the correct Utilities
  - Dr. Watson
  - Boot Disk
  - Event Viewer

3.2 Recognize when to use common diagnostic utilities and tools. Given a diagnostic scenario involving one of these utilities or tools, select the appropriate steps needed to resolve the problem.

- Startup disks
  - Required files for a boot disk
  - Boot disk with CD-ROM support
- Startup Modes
  - Safe mode
  - Safe Mode with command prompt
  - Safe mode with networking
  - Step-by-Step/Single step mode
  - Automatic skip driver (ASD.exe)
- Diagnostic tools, utilities and resources
  - User/installation manuals

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    - Internet/web resources
    - Training materials
    - Task Manager
    - Dr. Watson
    - Boot Disk
    - Event Viewer
    - Device Manager
    - WinMSD
    - MSD
    - Recovery CD
    - CONFIGSAFE
- Eliciting problem symptoms from customers
- Having customer reproduce error as part of the diagnostic process
- Identifying recent changes to the computer environment from the user

3.3 Recognize common operational and usability problems and determine how to resolve them.

- Troubleshooting Windows-specific printing problems
    - Print spool is stalled
    - Incorrect/incompatible driver for print
    - Incorrect parameter
- Other Common problems
    - General Protection Faults
    - Blue screen error (BSOD)
    - Illegal operation
    - Invalid working directory
    - System lock up
    - Option (Sound card, modem, input device) or will not function
    - Application will not start or load
    - Cannot log on to network (option – NIC not functioning)
    - Applications do not install
    - Network connection
- Viruses and virus types
    - What they are
    - TSR (Terminate Stay Resident) programs and virus
    - Sources (floppy, emails, etc.)
    - How to determine presence

Domain 4.0: Networks 16%

4.1 Identify the networking capabilities of Windows. Given configuration parameters, configure the operating system to connect to a network.

- Configure protocols
    - TCP/IP
        - Gateway
        - Subnet mask
        - DNS (and domain suffix)
        - WINS
        - Static address assignment
        - Automatic address assignment (APIPA, DHCP)
    - IPX/SPX (NWLink)

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    - AppleTalk
    - NetBEUI/ NetBIOS
    - Configure Client options
    - Microsoft
    - Novell
- Verify the configuration
- Understand the use of the following tools
    - IPCONFIG.EXE
    - WINIPCFG.EXE
    - PING
    - TRACERT.EXE
    - NSLOOKUP.EXE
- Share resources (Understand the capabilities/limitations with each OS version)
- Setting permissions to shared resources
- Network type and network card

4.2 Identify the basic Internet protocols and terminologies. Identify procedures for establishing Internet connectivity. In a given scenario, configure the operating system to connect to and use Internet resources.

- Protocols and terminologies
    - ISP
    - TCP/IP
    - E-mail (POP, SMTP, IMAP)
    - HTML
    - HTTP
    - HTTPS
    - SSL
    - Telnet
    - FTP
    - DNS
- Connectivity technologies
    - Dial-up networking
    - DSL networking
    - ISDN networking
    - Cable
    - Satellite
    - Wireless
    - LAN
- Installing and Configuring browsers
    - Enable/disable script support
    - Configure Proxy Settings
    - Configure security settings
- Firewall protection under Windows XP

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Domain 1.0 – OS Fundamentals

Chapter 1

Quick Jump To:

- Objective 1.1
- Objective 1.2
- Objective 1.3
- Objective 1.4
- Objective 1.5

In this section of the Study Guide we will cover the Domain of OS Fundamentals. In this domain we will look at many of the tools you use to run any typical desktop operating system (especially Windows Based) such as the system Registry, event logs (Event Viewer for Windows) and other management tools and consoles.

Exam Objectives Covered:

1.1 Identify the major desktop components and interfaces, and their functions. Differentiate the characteristics of Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

a. Contrasts between Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP
b. Major Operating System components
   - Registry
   - Virtual Memory
   - File System
c. Major Operating System Interfaces
   - Windows Explorer
   - My Computer
   - Control Panel
   - Computer Management Console
   - Accessories/System Tools
   - Command line
   - Network Neighborhood/My Network Places
   - Task Bar/systray
   - Start Menu
   - Device Manager

1.2 Identify the names, locations, purposes, and contents of major system files.

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   - IO.SYS
   - MSDOS.SYS
   - AUTOEXEC.BAT
   - COMMAND.COM
   - CONFIG.SYS
   - HIMEM.SYS
   - EMM386.exe
   - WIN.COM
   - SYSTEM.INI
   - WIN.INI
   - SYSTEM.DAT
   - USER.DAT
b. Windows NT-based specific files
   - BOOT.INI
   - NTLDR

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- NTDETECT.COM
- NTBOOTDD.SYS
- NTUSER.DAT
- Registry data files

1.3 Demonstrate the ability to use command-line functions and utilities to manage the operating system, including the proper syntax and switches.

a. Command/CMD
b. DIR
c. ATTRIB
d. VER
e. MEM
f. SCANDISK
g. DEFRAG
h. EDIT
i. XCOPY
j. COPY
k. FORMAT
l. FDISK
m. SETVER
n. SCANREG
o. MD/CD/RD
p. Delete/Rename
q. DELTREE
r. TYPE
s. ECHO
t. SET
u. PING

1.4 Identify basic concepts and procedures for creating, viewing, and managing disks, directories and files. This includes procedures for changing file attributes and the ramifications of those changes (for example, security issues.)

a. Disks
    - Partitions
        - Active Partition
        - Primary Partition
        - Extended Partition
        - Logical partition
    - Files Systems
        - FAT16
        - FAT32
        - NTFS4
        - NTFS5.x
b. Directory Structures (root directory, subdirectories, etc)
    - Create folders
    - Navigate the directory structure
    - Maximum depth
c. Files
    - Creating files
    - File naming conventions (Most common extensions, 8.3, maximum length)
    - File attributes - Read Only, Hidden, System, and Archive attributes

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- File Compression
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    - DEFRAG.EXE
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    - Backup/Restore Utility (MSbackup, NTBackup, etc)
    - ScanDisk
    - CHKDSK
    - Disk Cleanup
    - Format

b. System Management Tools
    - Device manager
    - System Monitor
    - Computer Manager
    - MSCONFIG.EXE
    - REGEDIT.EXE (View information/Backup registry)
    - REGEDT32.EXE
    - SYSEDIT.EXE
    - SCANREG
    - COMMAND/CMD
    - Event Viewer
    - Task Manager

c. File Management Tools
    - ATTRIB.EXE
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    - Edit.com
    - Windows Explorer

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1.1 Identify the major desktop components and interfaces, and their functions. Differentiate the characteristics of Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

Contrasts between Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

You will be expected to know the difference between Microsoft's major desktop operating systems which include Windows 9x (the x stands for 95, 98), ME, NT, 2000 and XP.) In the following section, we cover some highlights of each operating system, make sure you visit www.microsoft.com and make sure you look through the URLs listed to gather up all that extra information you may need to cover and review before the exam. Also, you will not be tested on 16 bit OSs like DOS or Windows 3.x (or earlier), the exam starts with 32 bit operating systems – Windows 95. Although Windows 95 has hit the end of its lifecycle, it is still in used frequently enough around the world.

Windows 9.x

Windows 95 and 98 are 32 bit OSs. Windows 95 started the movement to 32 bit architecture. With Windows 98 (and also with the 2nd Edition – Windows 98 SE), you got better support for your file system. With Windows 95, you had FAT16 until the Windows 95 OSR2 surfaced, that is when FAT32 appeared. Windows 98 supports FAT32. Windows 95 and 98 are both mainly used for home based systems, not normally found in companies and businesses where Windows NT, 2000/2003 and XP have shown to be the top players in that arena because of their added functionality.

Windows ME

Windows ME (Millennium) came about as the definitive home PC operating system. With a clear distinction between desktop for business and desktop for home – users for Windows 9x normally upgraded to ME to get better driver support, the Windows 2000 GUI and so on. Windows needed for business systems started with NT (3.x and 4.0).

Windows NT

NT 4.0 (or NT Workstation) was the first real business based desktop operating system to rear its head. Being able to secure your desktop, and had tons of other business sensitive features, it did not have (at first) plug an play features and other features to make things easier for the home user. For instance, to install hardware on NT was almost as similar to installing it on Linux5 years ago. Needless to say, it was not easy and you had to know a thing or two about hardware, and the systems architecture to get things up and running, especially SCSI cards. Windows NT used NTFS (New Technology File System) to apply more granular control on security.

Windows 2000

Windows 2000 was based on the NT architecture and provided a great OS that was more stable, secure and significantly more functional. Windows 2000's home edition was ME. Windows 2000 used NTFS as a file system as well but a more enhanced version. Once 2000 was out and growing, XP and 2003 were unleashed.

http://www.microsoft.com/windows/otherversions/default.mspx

Windows XP

Windows XP comes in either Home or Professional and mirrors the same structure we spoke of just before, as in you have a home version, you have a business version. The server based NOS is Windows Server 2003.

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http://www.microsoft.com/windowsxp/default.mspx

NOTE: OS stands for Operating System. NOS stand for Network Operating System. Be familiar with such acronyms for this exam and other CompTIA exams.

Major Operating System components

Registry

The Registry is the central hierarchical database used by Windows for the storage of information needed to configure a system for one or more users, applications, and hardware devices to name some of the things stored – the Registry is quite dense if you peruse it, you will see it keeps configuration information for just about everything on your PC. Applications for instance will write to the Registry upon installation. The Registry (a database) is stored on files on your local PC. Many tools are used to back up your Registry (either third party software) or tools that come with the various Windows operating systems such as System Restore. Older operating systems like Windows 95 required a manual repair process (renaming files) if you wanted to backtrack to an older version of the Registry – but it was still backed up by Windows automatically. It is important to understand how important the Registry is because it is basically the Nervous System of Windows, so to speak. If it is damaged, it is a good bet that something may not work from an application that no longer worked correctly all the way to your system not booting anymore. You need to know the following for the exam.

NOTE: You have 6 keys in the Registry:

- **HKEY_LOCAL_MACHINE:** system hardware profile
- **HKEY_CURRENT_CONFIG:** current hardware profile used
- **HKEY_CLASSES_ROOT:** file type associations (like *.doc)
- **HKEY_USERS:** configuration information for all user profiles
- **HKEY_CURRENT_USER:** configurations for the current user
- **HKEY_DYN_DATA:** hardware device information kept in RAM

Once you expand each key, you will find a hierarchical structure as seen here. You can open the Registry with by doing the following. Go to Start => Run => type REGEDIT and hit enter.

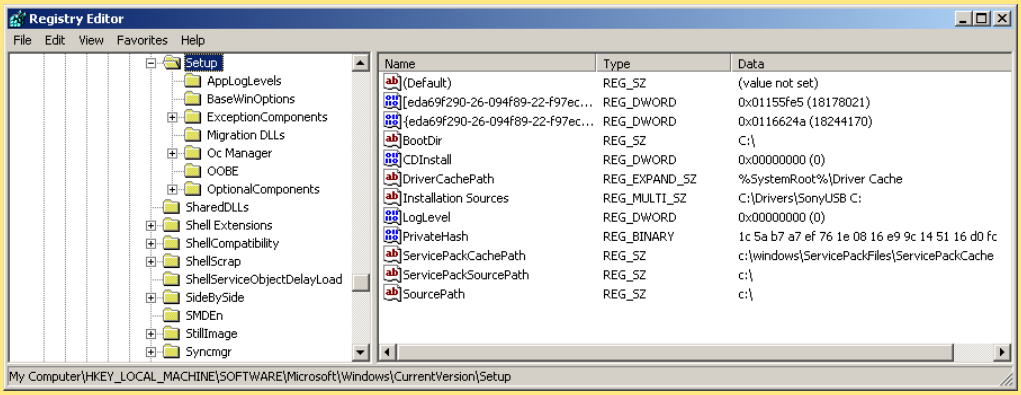

Figure 1: Viewing the Registry

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Virtual Memory

VM is the method of using disk space to provide extra memory by paging unused or leased used data in memory into your hard disk and back. In other words, if you have 32 MB of physical memory (RAM – Random Access Memory) installed on your PC and you open up and application that requires 64, you will obviously not have enough *physical memory* to run the application, so what happens? Through paging *and a page file* you can simulate physical memory by using *swap space* (of a swap file) on your hard disk that allows you to keep a mapping of where the data was in memory and if it is called on again. Then, it is retrieved from the hard disk. Again, VM simulates additional physical RAM. In Windows, the amount of virtual memory available equals the amount of free RAM plus the amount of disk space allocated to the swap file.

NOTE: Pagefile.sys Contains memory data that Windows is unable to fit into physical RAM. During Startup, the virtual memory manager moves data in and out of the paging file to optimize the amount of physical memory available to the operating system and applications

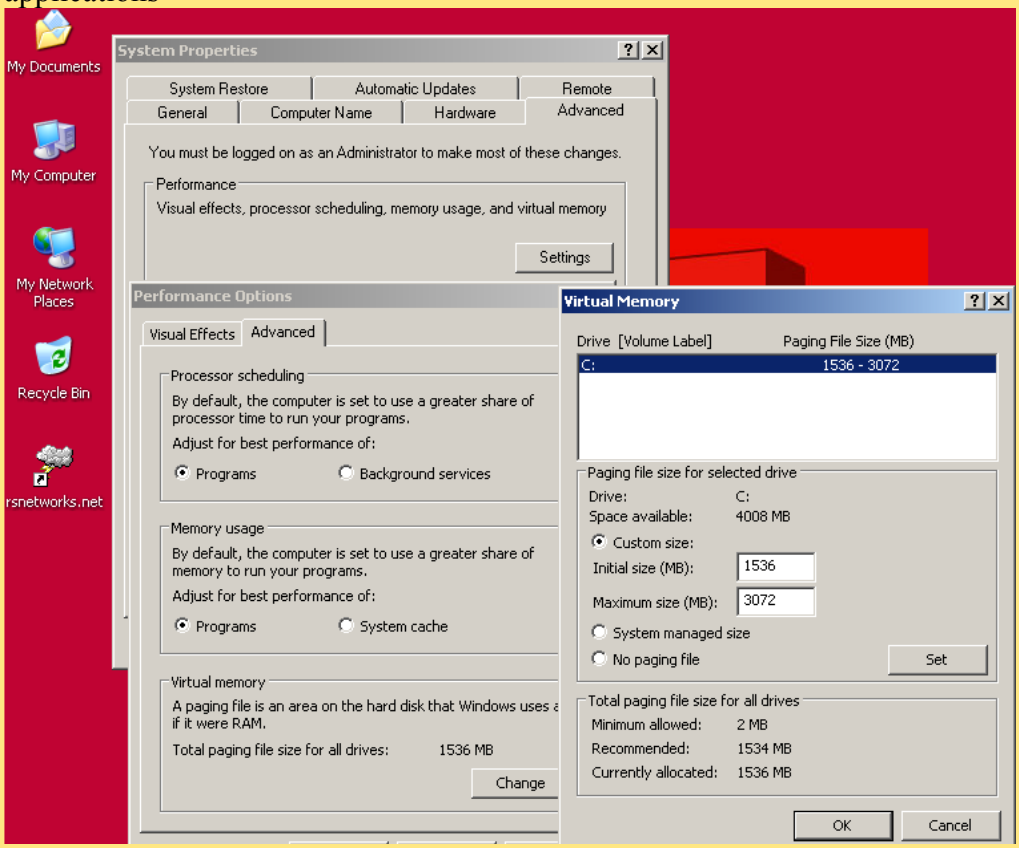

Figure 2: Working with Virtual Memory

The Page File and Virtual Memory Adjustment can be seen on a Windows XP Professional PC by going to the Control Panel (Start => Control Panel) and double clicking on the System Applet. Then go to the Advanced Tab => Virtual Memory, click on Change. This will open the Virtual Memory dialog box (seen in the foreground) where you can adjust the placement of your page file and the size. A few things to mention here are always make sure you do not run out of disk space or run too low if you depend on Virtual Memory. This will impact the system critically.

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Never rely on Virtual Memory. These days, Physical memory is so inexpensive; it is not even recommended that Virtual Memory be used if you can help it. You can run statistics on Virtual Memory with the systems performance/system monitor to see if you need to upgrade your physical memory. Constant disk activity while trying to work on the PC is a good indicator that your system is slow because of paging to and from physical memory. Task Manager is also a great tool to use to visualize your physical and virtual memory usage. Also, if you change the location of the page file on the drive, never put the page file on an extended partition as this will impact performance. Some Server Administrators put the page file on its own separate hard disk to make management of it easier (contain its growth against other system files.) Lastly, the page file can be exploited by hackers because it contains sensitive information.

File System

A file system is a data structure that an operating system uses to keep track of files on a disk or partition; the way the files are organized on the disk. Also used about a partition or disk that is used to store the files or the type of the file system. You can think of the file system as a hierarchical collection of files and directories that make up an organized, structured set of stored information you can retrieve if needed or wanted. File systems can be mounted from a local system or remote system. Major operating system files will be covered next.

1.2 Identify the names, locations, purposes, and contents of major system files.

Windows files (Specific to Windows 9.x based systems)

IO.SYS

In Windows, IO.SYS is a program loaded at startup (normally the 1st file to load) and will tell the operating system how the computer is configured. In Windows 95, IO.SYS and MS-DOS were separate system files and the functionality of both are combined in the new IO.SYS and MSDOS.SYS is now a configuration file. The newer IO.SYS contains all the information needed to start your computer and eliminates the need for the CONFIG.SYS and autoexec.bat files because the values in CONFIG.SYS and AUTOEXEC.BAT are in IO.SYS instead. Both of these files still come with Windows backward compatibility, they still need to be supported.

MSDOS.SYS

In older versions of Windows, MSDOS.SYS worked with IO.SYS to start the boot process, now this file is nothing more than a *configuration* file. It allows you to change settings during boot up. It contains sections in it like:

- [**Paths**] section that lists the locations for other Windows files (such as the registry)
- [**Options**] section that you can use to personalize the boot process.

There are many more, but this is basically what the file will do during the boot process.

AUTOEXEC.BAT

The autoexec.bat is a batch file, meaning it contains basic startup commands, that is referenced during the start up of Windows systems which will help to configure the system. A batch program is nothing more than a file with a set of commands in it used to automate a process. You can make one simply by creating a text file on your desktop and changing the file's associated extension (*.txt) to *.bat.

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COMMAND.COM

A program supplied with MS-DOS that performs the built-in DOS commands such as DIR and TYPE., which are internal commands whereas commands such as FORMAT and COPY are external commands. COMMAND.COM has some simple commands built in - these are known as internal commands, which are contained within COMMAND.COM. The command interrupter, which reads commands typed at the keyboard and attempts to obey them. If you do a DIR at the C:\> prompt of an MSDOS system, you will see that Command.com and FORMAT will be visible. You will not see a DIR.exe in the root.

CONFIG.SYS

This is a text file, which is also the main configuration file for DOS systems, that DOS reads when booting, which instructs the computer about the configuration of the machine, and if this file exists, a DOS computer will execute any commands in it. It contains configuration commands that enable or disable system features, set limits on resources, and extend the operating system functionality by loading device drivers. The most common commands are BUFFERS= and FILES=, which enable you to specify the buffer size and the number of files that can be open simultaneously. You can enter commands that install drivers for devices manually or applications when installed will (may) write lines to the file.

HIMEM.SYS

The Himem.sys file is a device driver that manages memory above conventional memory (the first 640K). In DOS and Windows 3.x it had to be loaded in the CONFIG.SYS file so that you had this functionality. Windows 9x loads it automatically but it has to be present on your hard drive. HIMEM.SYS must be loaded by a DEVICE command in your CONFIG.SYS

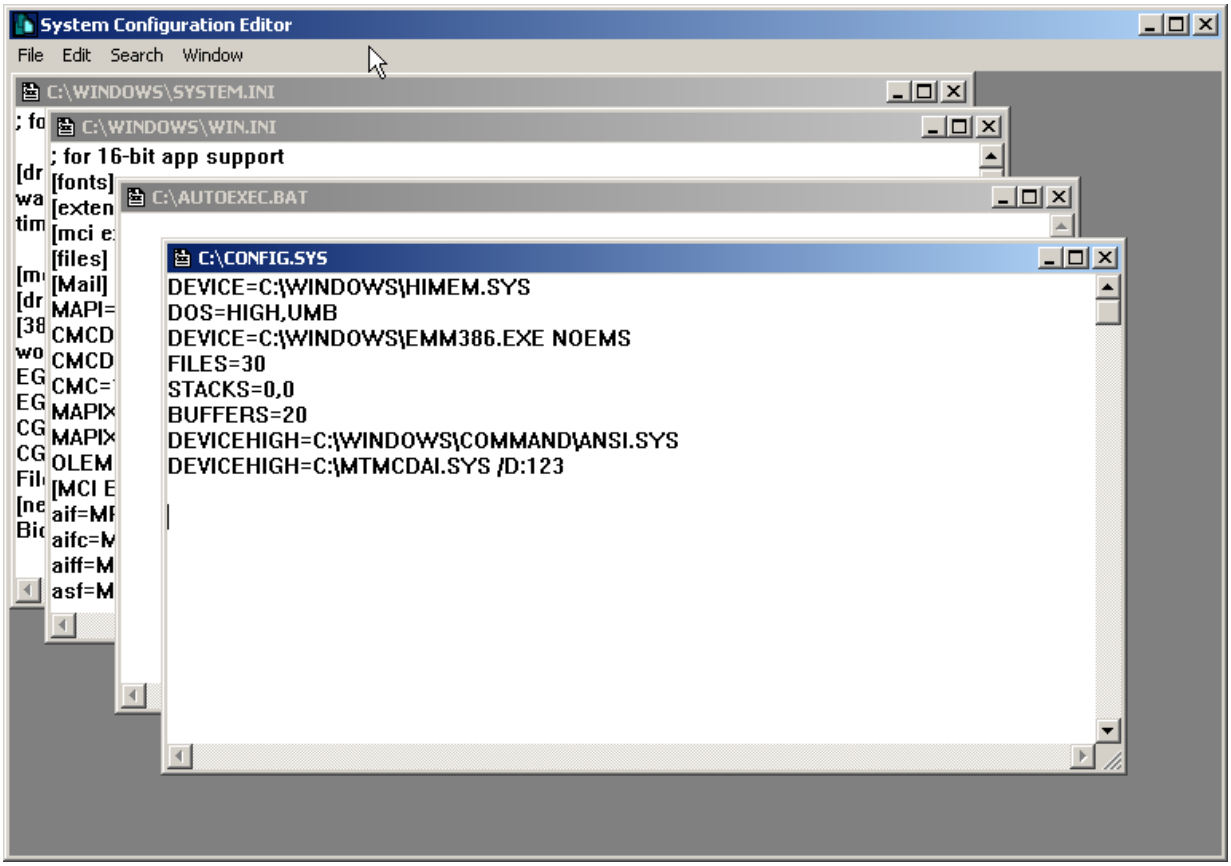

Figure31: Viewing the Config.sys File (within SYSEDIT)

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WIN.COM
Win.com is the executable file responsible for Windows start-up. It runs after the autoexec.bat file is processed, and it accesses the VMM32.vxd file. In a Windows 3.x environment, the win.com file is executed by typing **win** in the DOS prompt. However, in version 9x OSs, win.com runs automatically.

SYSTEM.INI
This is an initialization file used with Microsoft Windows to initialize system settings for the computer such as the fonts, keyboard, language and various other settings. The system.ini file is located in the c:\windows directory and its backup is generally system.

WIN.INI
This is the Microsoft Windows initialization file located in windows directory that is used to load various settings each time Windows boots. Communications drivers, wallpaper, screen savers, languages, and fonts are just some of the items that are loaded each time the win.ini is initialized. If this file becomes corrupt or bad Windows will either not load, or have several errors as it loads.

SYSTEM.DAT
This is the Registry file that contains system specific information such as hardware profiles (settings).

USER.DAT
This is the Registry file that contains user specific information such as user profiles (settings)

NOTE: You can view these files in multiple ways, if you run a search on your local hard drive for them or by going to the root of the drive (within the GUI or via DOS) and viewing them. Be aware that some of the files will be hidden from your view so you have to either unhide them in the GUI or use the attrib command to change their attributes. You can also use the System Configuration Editor (SYSEDIT) which can be found by going to Start => Run => type SYSEDIT and hit enter.

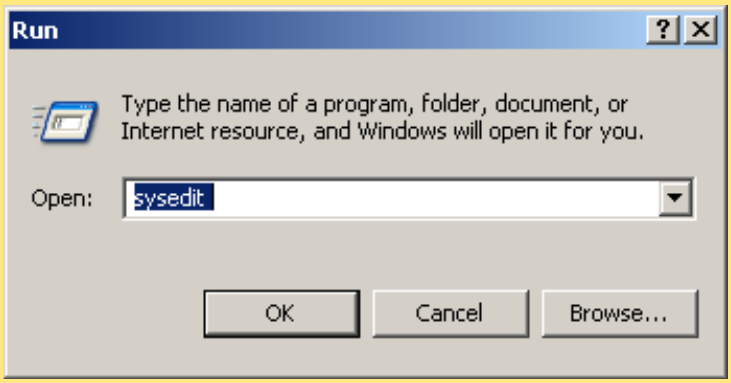

Figure 4: Using the Run Dialog Box to get to SYSEDIT

You will open the editor to view your initial configuration files. By typing REGEDIT in the Run dialog box, you can open the Registry. This will allow you to use the REGEDIT tool to open the System and user.dat files. You can find the *.dat (or any other file by running a search on your local hard disk.

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Windows files (Specific to Windows NT based systems)

BOOT.INI

Boot.ini Contains options for starting the version of Windows that Setup installs and any preexisting Windows installations. *This file will be talked about in more depth later in this guide*.

NTLDR

Ntldr Reads the Boot.ini file, presents the boot menu, and loads Ntoskrnl.exe, Bootvid.dll, Hal.dll, and boot-start device drivers.

NTDETECT.COM

After the boot selection is made; Ntldr loads and executes this 16-bit real-mode program to query the computer for basic device and configuration information. This information includes the time and date information stored in the system's CMOS (nonvolatile memory), the types of buses (ISA, PCI, EISA, and MCA) on the system and identifiers for devices attached to the buses, the number, size, and type of disk drives on the system, the types of mouse input devices connected to the system, and the number and type of parallel ports configured on the system.

NTBOOTDD.SYS

If either the boot or system drives are SCSI-based, Ntldr loads this file and uses it instead of the boot-code functions for disk access

1.3 Demonstrate the ability to use command-line functions and utilities to manage the operating system, including the proper syntax and switches.

Command/CMD

CMD will start a new instance of the command interpreter, Cmd.exe. To get to the Command Prompt, go to Start => Run and type CMD. Hit Enter. For older systems, you can do the same but type the whole word out **command**. CMD.exe is an example of an external command. In newer versions (like Windows XP), you can type Command or CMD

DIR

This internal command displays a list of a directory's files and subdirectories. Used without parameters, dir displays the disk's volume label and serial number, followed by a list of directories and files on the disk, including their names and the date and time each was last modified. For files, dir displays the name extension and the size in bytes. It also displays the total number of files and directories listed, their cumulative size, and the free space (in bytes) remaining on the disk.

ATTRIB

ATTRIB displays, sets, or removes the read-only, archive, system, and hidden attributes assigned to files or directories. Used without parameters, attrib displays attributes of all files in the current directory.

VER

VER displays the Windows XP version number

MEM

This displays used and free memory

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CHKDSK
CHKDSK creates and displays a status report for a disk based on the file system and also lists and corrects errors on the disk. Used without parameters, chkdsk displays the status of the disk in the drive

SCANDISK
This is the Windows 9x/ME version of CHKDSK.

DEFRAG
DEFRAG locates and consolidates fragmented files, and folders on local volumes.

EDIT
This is the DOS text editor.

XCOPY
XCOPY copies files and directories, including subdirectories.

COPY
COPY copies one or more files from one location to another.

FORMAT
This formats the disk in the specified volume to accept Windows files.

FDISK
This displays and allows you to edit partition information for your hard disks.

SETVER
This is used in 9.x/ME for program compatibility and sets and or updates the current version table.

SCANREG
This will check and repair the Registry upon initial boot sequence.

MD/CD/RD
These commands will move, create and remove directories.

- Mkdir (md)
  - Creates a directory or subdirectory
- Chdir (cd)
  - Displays the name of the current directory or changes the current folder. Used with only a drive letter (for example, Chdir C:), Chdir displays the names of the current drive and folder. Used without parameters, Chdir displays the current drive and directory
- Rmdir (rd)
  - Removes (deletes) a **directory**

Delete
Del (erase): Deletes specified **files**

Rename
Rename (ren): Changes the name of a file or a set of files

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DELTREE
Will allow you to delete an entire folder and all subfolders

TYPE
Displays the contents of a text file without modifying it

ECHO
Turns the command-echoing feature on or off, or displays a message. Used without parameters, echo displays the current echo setting

SET
Displays, sets, or removes environment variables. Used without parameters, set displays the current environment settings

PING
PING is used to test and perform diagnostics with. This is a tool that will allow you to test connectivity of a device using the ICMP (part of the TCP/IP protocol suite). PING will also allow you to send an ICMP packet to another host, if you get a reply that is favorable, and then connectivity at that level has been verified.

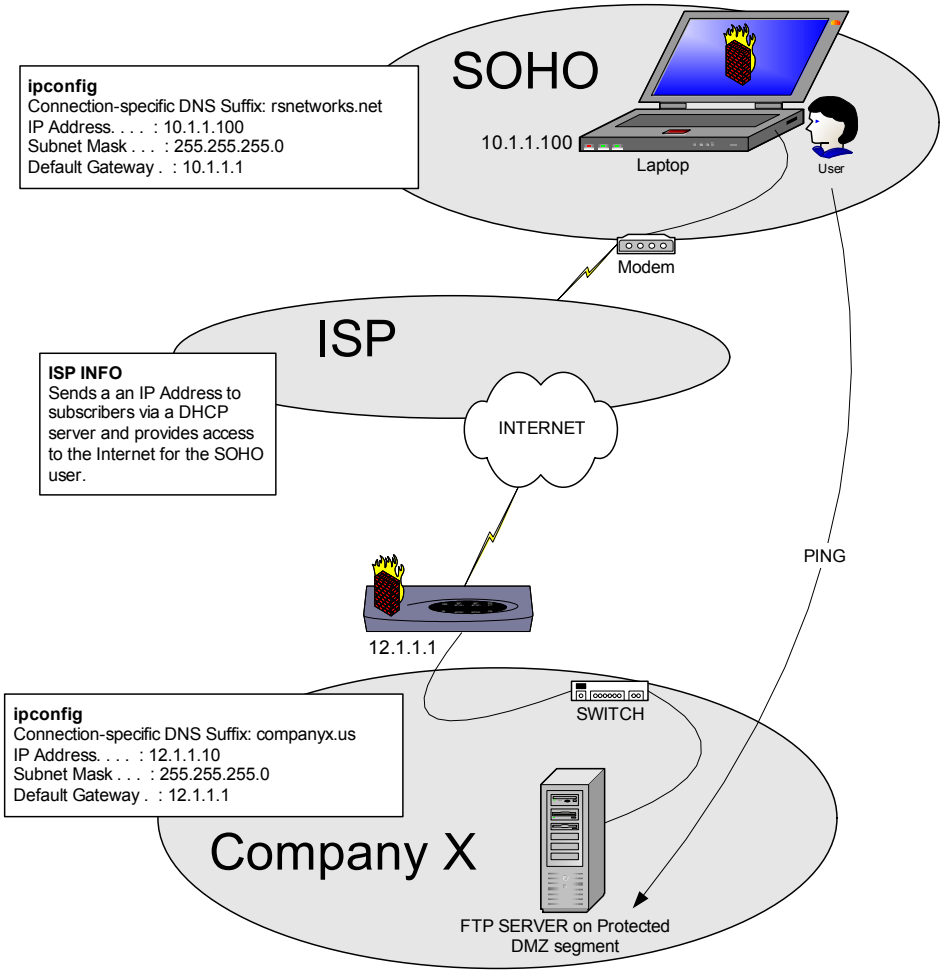

Figure 5: Checking Connectivity (with topology map)

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NOTE: Using Ping is something common to not only technicians in the IT field, but also to consumers of products such as PCs for the home that need to connect to the Internet. Many times, when dealing with your ISP (Internet Service Provider) you may be asked to *or need to* ping an IP Address that they provide to test your systems connectivity to them. As you can see from the previous illustration, it is imperative that you understand how to use this tool to test that the connection from you to another host is valid. If you receive replies back from the host, that means that you have verified connectivity. Ping uses the ICMP protocol. If the firewalls shown in the graphic are blocking ICMP then the ping will not pass and you will receive a *false positive* result. This last fact is not on the exam, but helpful nonetheless. The most important items to take away here is that as an A+ technician you are commonly going to be working on Internet connected systems (or network connected systems) and you need to know how to verify that the connection is valid, if it is not, then take the next step to verify that the connection is good by using Ping. To use the Ping tool, go to Start => Run => CMD. Type Ping and hit enter. This will show you all the available switches and options available with this tool. You will not need to know this in depth, but definitely will need to know how to use this tool on the most fundamental levels.

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\WINDOWS\SYSTEM32>ping yahoo.com

Pinging yahoo.com [216.109.112.135] with 32 bytes of data:

Reply from 216.109.112.135: bytes=32 time=15ms TTL=55
Reply from 216.109.112.135: bytes=32 time=23ms TTL=54
Reply from 216.109.112.135: bytes=32 time=22ms TTL=54
Reply from 216.109.112.135: bytes=32 time=32ms TTL=54

Ping statistics for 216.109.112.135:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 15ms, Maximum = 32ms, Average = 23ms

C:\WINDOWS\SYSTEM32>
```

Figure 6: Viewing PING statistics

Swap Yahoo.com with company X from the previous example and instead of FTP, you simply want to view the webpage. You cannot, so you ping the site. It works, which means that this problem you are experiencing is NOT a problem with connectivity to it. This shows you that you are connected to their main website, as well, how fast the connection appears to be and since you sent a ping to the Domain Name instead of the IP and it worked. This means that you just verified that your DNS (Domain Name System) resolution work.

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1.4 Identify basic concepts and procedures for creating, viewing, and managing disks, directories and files. This includes procedures for changing file attributes and the ramifications of those changes (for example, security issues.)

Disks

Partitions

Active Partition

This is the *current* partition in use by the OS.

Primary Partition

This is the partition that contains the OS itself.

Extended Partition

This is a partition that can be created *optionally*, as it is not needed, but can be created to be used if needed. Must contain one logical drive to be functional.

Logical Partition

This is a drive letter assigned to extended partitions, so you can have one physical drive in your system and have one or more extra partitions made up. Since you will have the appearance of more hard drives to the system that only have 1 physical disk installed, the extra drives seen are *logical*.

NOTE: You need to know how to manipulate FDISK and the Windows Computer Management Console (Disk Management) tool. Make sure you are comfortable with knowing what all partitions are and how to configure them either via the GUI or within FDISK. You can see that the C Drive is the *primary* partition from the graphic below.

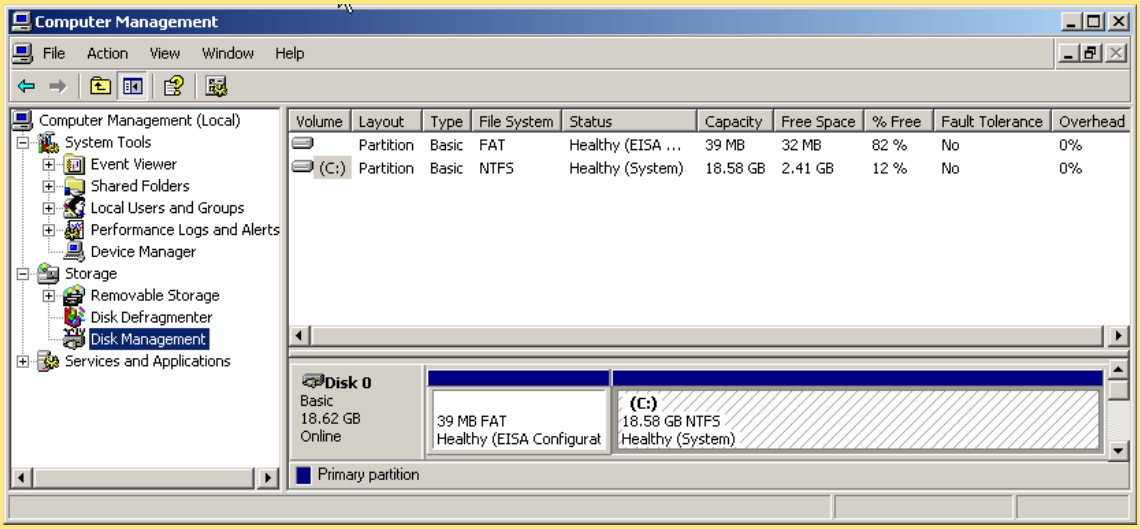

Figure 7: Using the Computer Management Console

To get to the Computer Management Console, Go to Start => Control Panel => Administrative Tools => Computer Management

Go to www.fdisk.com which is a great site to learn from for more information on Partitions

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File Systems

FAT16

This is a 16-bit DOS and Windows file system (see FAT) that varies cluster sizes based on hard drive size. Cluster sizes range from:

- 4K (for drives up to 127MB)
- 8K (511MB drives)
- 16K (1GB drives)
- 32K (for drives up to 2GB).
- The ultimate capacity of a FAT16 partition is 2GB

FAT32

This is a 32-bit version of the File Allocation Table which first shipped with Windows95 SR2. FAT32 uses 32 bits to address each cluster and can support drives as big as two Terabytes. The older FAT used 16-bits to address each cluster and was limited to drive sizes of 512 Mb. Each cluster in a FAT32 system is only 4 Kb which also helps to save space on your hard drive.

NTFS (4)

NTFS is the Windows NT file system. Unlike FAT, NTFS does not use an allocation table but stores information about any file directly with the file. Other operating systems, including Windows 95, and many applications, such as ScanDisk, cannot read NTFS partitions. However, NTFS files or folders that are shared on a network can be accessed by other operating systems. Advantages of NTFS over FAT include faster access to files, more efficient information storage (for example, through a smaller cluster size), better data recovery, integrated file compression, larger disk partitions, and better file security. NTFS is preferred for Windows NT Server because of its better security and fault tolerance features. NTFS partitions also remain relatively unfragmented for long periods of time. NTFS 5.0 (NTFS5) is the version of NTFS included with Win2K

NOTE: For detailed information on NTFS5, please read this article on Microsoft's TechNet.

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnw2kmag00/html/NTFSPart1.asp

Directory Structures

Root and Subdirectories

A root directory is the main directory for the entire drive. If you install a drive, you need a root directory to start with, so you can create subdirectories under them to populate. A hierarchical directory structure is used to organize the files that exist on any hard disk volume. This *logical tree* is used on almost every file system, because of the intuitive way it arranges files, and the power it gives the user to create meaningful organization schemes for files.

Much as a real tree has all its branches and roots come together in one spot, so too does a file system directory structure. The directory at the base of the logical tree is called, appropriately enough, the root directory. The root directory is special because it follows rules that do not apply to the other, regular directories on the hard disk.

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There can only be one root directory for any disk volume; obviously, having more than one would result in confusion, and there is not any need to have more than one anyway. In the conventional FAT file system, the root directory is fixed in place at the start of the DOS volume; it anchors the directory tree. It is located on the disk volume directly after the two copies of the FAT, which are themselves directly below the other key disk structures. This contrasts with regular directories, which can be located anywhere on the disk.

In addition to being fixed in location, the root directory is also fixed in size (under FAT12/FAT16/VFAT). Regular directories can have an arbitrary size; they use space on the disk much the way files do, and when more space is needed to hold more entries, the directory can be expanded the same way a file can. The number of entries that the root directory can hold depends on the type of volume in use. The most commonly set cap is the root for a hard disk and that is set at 512.

One of the improvements introduced in the newer FAT32 version of the FAT file system was to remove these restrictions on the root directory. Under FAT32, the root directory is treated much more like a regular directory, and can be relocated and expanded in size like any other. The root cannot be deleted. The root directory has no parent directory

Create Folders

You should create folders when you want to organize your data into groups and to store data hierarchically on the hard disk. If you wanted to store pictures, you may want to create a folder on your hard disk called PICTURES and store all of them in there. You may want to go further and create subdirectories to store groupings within pictures like one folder for FAMILY and maybe on folder for FRIENDS.

You need to determine *where* you want to create it. If you wanted to create it on your desktop, the root of your hard disk or in some other subdirectory, you will need to select the location first and go there.

To make a folder, you have options. To create a folder, you have to first decide how you are going to create it – either via the command line with DOS commands, or within the GUI. The GUI is the Graphical User Interface that basically symbolizes what Windows is, which is an easy way to manipulate an operating system with pictures instead of with command line text.

GUI

To make a folder in the GUI, depending on what Operating System you are using will determine on how you can make one and where. With Windows XP, the most common way to make a folder is to either use the File and Folder Tasks as seen below in the illustration. 2 is to right click and 3 is to use the file menu.

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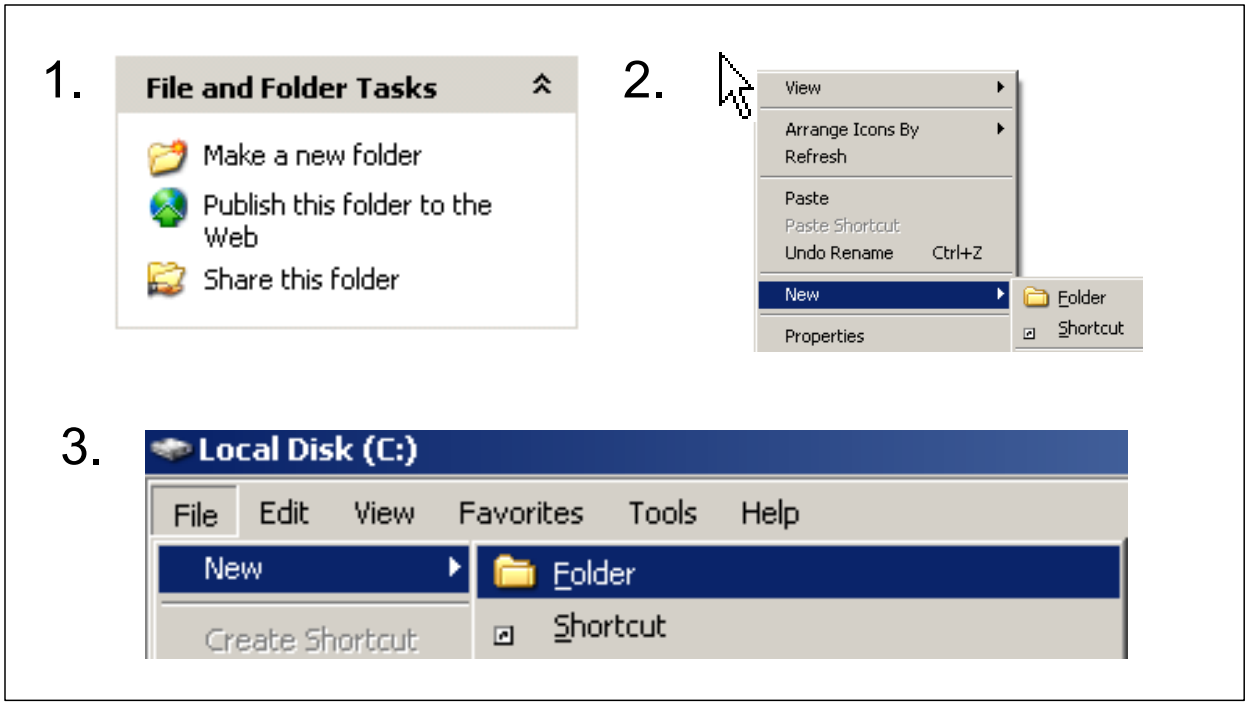

Figure 8: 3 ways to create a folder in the GUI

DOS (Command Line/Prompt)

You can use the command line to make a folder. Please note that the commands were covered earlier in the study guide. One possible option is that you can use the MD command. You could also make a directory on C by making sure you are first at the C:\> prompt and then typing md c:**new,** where "new" is the directory that you want to make.

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```
C:\>md /?
Creates a directory.

MKDIR [drive:]path
MD [drive:]path

If Command Extensions are enabled MKDIR changes as follows:

MKDIR creates any intermediate directories in the path, if needed.
For example, assume \a does not exist then:

    mkdir \a\b\c\d

is the same as:

    mkdir \a
    chdir \a
    mkdir b
    chdir b
    mkdir c
    chdir c
    mkdir d

which is what you would have to type if extensions were disabled.

C:\>
```

Figure 9: making a directory with the command line

Navigate the Directory Structure

You need to know how to navigate the directory structure for the A+ exam. To navigate it, you can do it either via the GUI and/or DOS. In the illustrations that follow, you will see the most common ways to navigate data (the directory structure) available to you.

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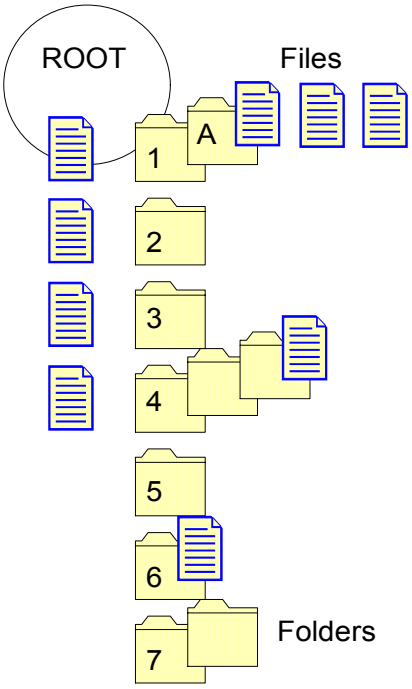

Figure 10: Viewing the physical folder and file structure

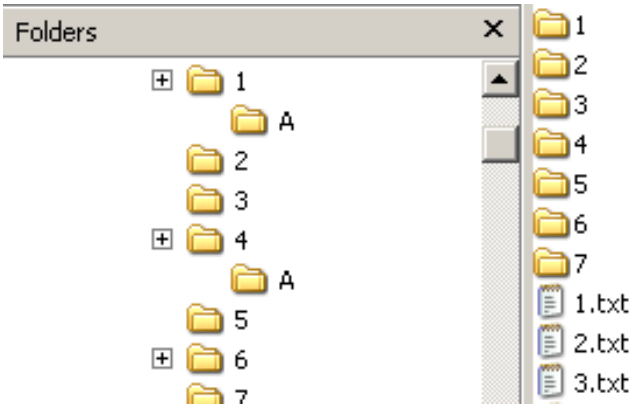

Figure 11: Using Windows Explorer to view the Root

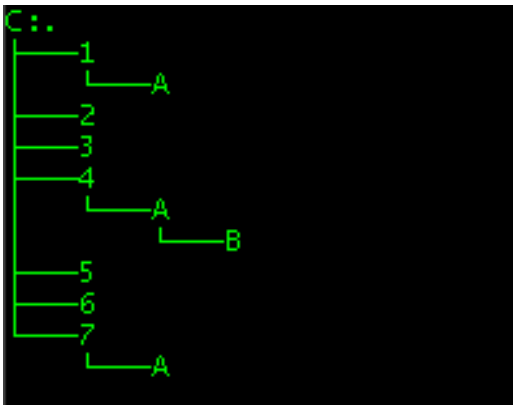

Figure 12: Using the Tree command to view the Root

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NOTE: A Directory is also a Folder. A Folder is a Directory. The terms are used interchangeably.

Files

Creating files

To create a file, follow the same examples for folders, but select files. Files are contained within folders and can be made and stored on the Root although not recommended.

File naming conventions (Most common extensions, 8.3, maximum length)

Some of the most common extensions are:

***.exe**	Executable	***.com**	Command
***.sys**	System	***.dll**	Library
***.txt**	Text	***.bat**	Batch

NOTE: The * is a wildcard used to represent whatever the file name is. This is where we can drive home 8.3. 3 is the extension limit - 8 = the file name limit which would mean that your file name had to be something that ended in 8 characters like: yourfile.txt was 8.3 characters long. The extension (maintained in the HKEY_CLASSES_ROOT key of the Registry) maps the data to an associated program that is normally used to open it.

There really is no way to cover every extension out there in a study guide, so if you really want to brush up on them, I recommend that you peruse the Registry Key and check out what is associated with what.

File Attributes

Read Only, Hidden, System, and Archive attributes:

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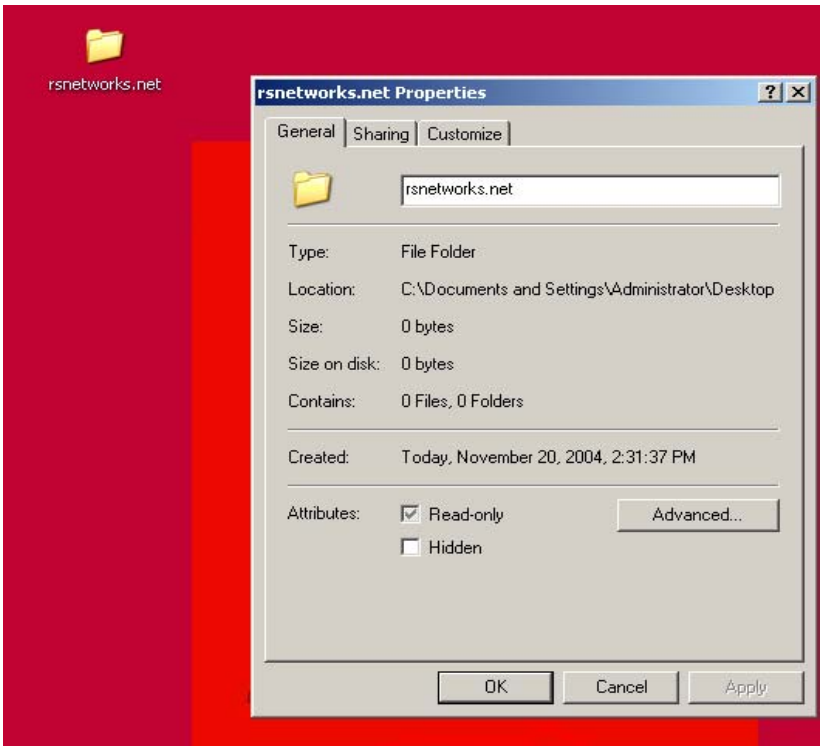

Figure 13: Viewing the Attributes of a Folder

File Compression and Encryption

This is changed easily via the Advanced Tab from the Folder we were last in. Now, we can click on the Compress/Encrypt options as seen in the next illustration.

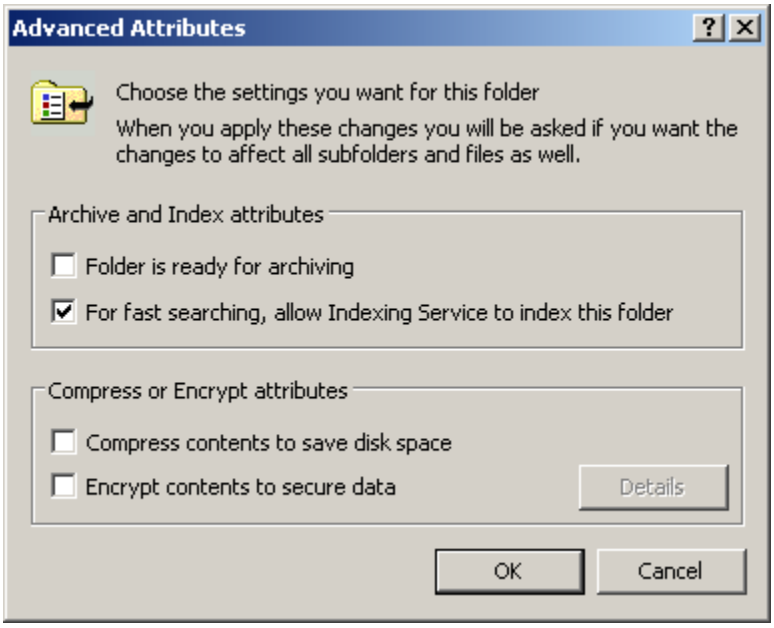

Figure 14: Viewing Advanced Attributes such as Encryption

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1.5 Identify the major operating system utilities, their purpose, location, and available switches

Disk Management Tools

DEFRAG.EXE

This performs the same function as the command line tool discussed earlier in the study guide, except this is the graphical utility. For Disk Management purposes, DEFRAG keeps the disk *optimized* because it puts data in contiguous chunks that can be retrieved from the hard disk quickly, so the brains of the drive do not have to spend too much time searching the drive for your file that may be spread out across it. DEFRAG puts these files very close together for speed.

Disk Defragmenter consolidates fragmented files and folders on your computer's hard disk, so that each occupies a single, contiguous space on the volume. As a result, your system can gain access to your files and folders and save new ones more efficiently. By consolidating your files and folders, Disk Defragmenter also consolidates the volume's free space, making it less likely that new files will be fragmented.

FDISK.EXE

This was also discussed earlier in the study guide. www.Fdisk.com For Disk Management purposes, FDISK (or the Disk Management Utility in newer systems) really helps you manage the disks where you keep your data. Where DEFRAG optimizes it, FDISK will help you manage it, make new partitions, delete others, change drive letters and so on. These utilities are used for *Management*.

Backup/Restore Utility (MSBackup, NTBackup, etc)

For Disk Management purposes, the backup and restore utility (and other disaster recovery utilities) help you to keep your data safe. If you have a disk failure, if you accidentally delete data, the backup and restore utility can help you to get back on track.

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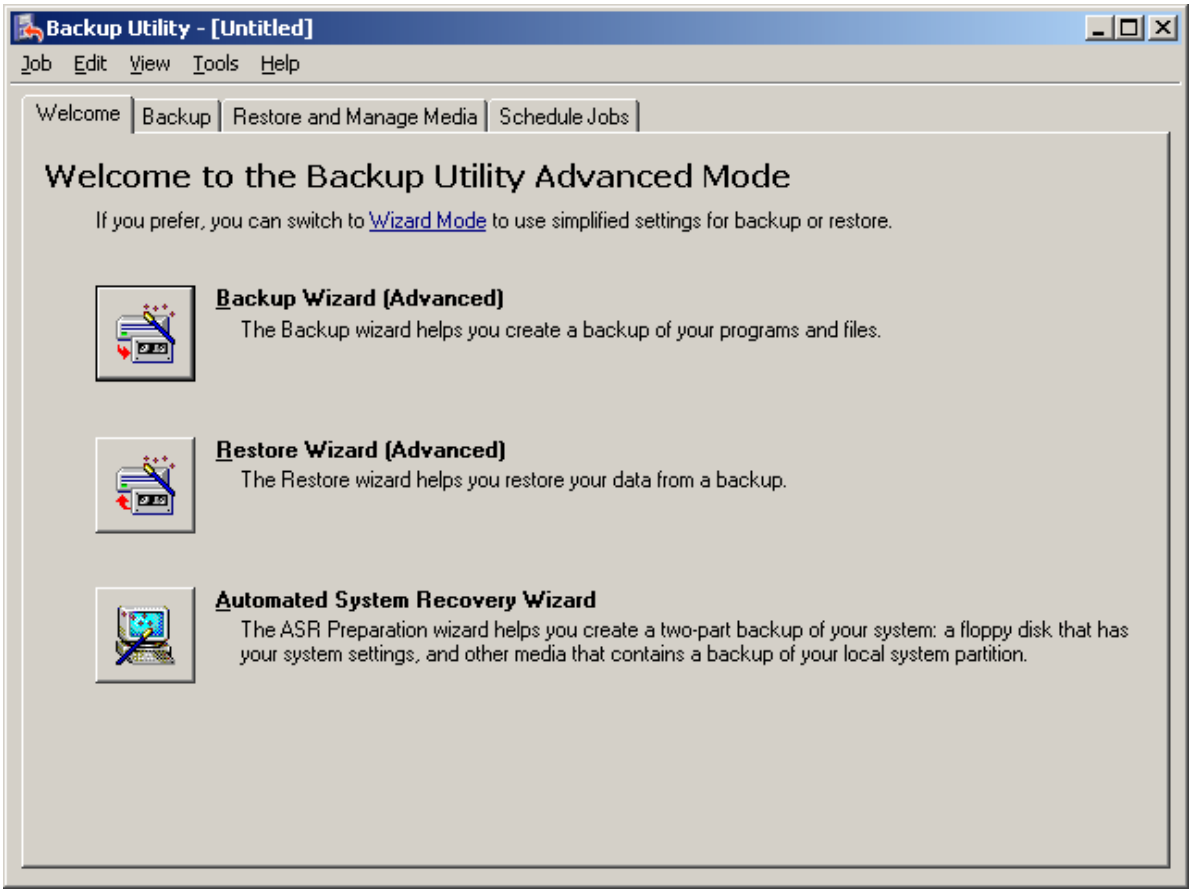

Figure 15: Working with the Backup Utility

So how do you use it? By going to Start => Run and typing NTBACKUP in your Windows XP system, you will pull up the Backup Utility. You may have to take it out of Wizard mode, just uncheck the box and cancel the Wizard and then open NTBackup again.

The Backup utility in Windows XP Professional helps you protect your data in the event your hard disk fails or files are accidentally erased due to hardware or storage media failure. By using Backup you can create a duplicate copy of all of the data on your hard disk and then archive it on another storage device, such as a hard disk or a tape.

If the original data on your hard disk is accidentally erased or overwritten, or becomes inaccessible because of a hard–disk malfunction, you can easily restore it from the disk or archived copy by using the Restore or Automated System Recovery Wizards.

To start Backup or to access Restore and Automated System Recovery Click Start => All Programs => click Accessories => click System Tools => click Backup

ScanDisk

This used to check and repair the disk structure, like the allocation table.

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CHKDSK
Used to check and repair the disk, chkdsk is commonly found on Windows NT based systems, not Windows 9x based systems that use ScanDisk

Disk Cleanup
The Disk Cleanup Wizard is used to check a specified volume and estimates the amount of disk space it might be able to recover and let you use once completed. The wizard can identify space savings in several areas, including:

- program files that you have downloaded and installed
- temporary Internet files
- temporary files
- temporary offline files (Win2K only)
- offline files (Win2K only)
- Recycle Bin content
- offline Web pages (Windows XP only)
- setup log files (XP only)
- compressed files that you have not accessed recently
- catalog files for the content indexer that the OS used during a previous indexing operation
- To run the Disk Cleanup Wizard, perform the following steps:
  - Start Disk Cleanup (go to Start, Programs, Accessories, System Tools, and click Disk Cleanup).

Format
Format is used to format a drive. Never format a drive unless you are positive that you can lose all the information located on it. You can use the format command found by right clicking a drive you want to format in the Windows Explorer. You can also format a drive by the command prompt with the format.exe command.

Figure 16: Formatting a Drive via the GUI

NOTE: Go to a command prompt and enter the format command:
C:\ > format /?
The /? Will show you all the options available with the format command.

Formatting (or Initializing) a disk means that you are preparing a disk for use by your hardware and operating system while destroying any information already there.

System Management Tools
Device Manager
Device Manager is used to examine and change software-configurable devices. To start Device Manager:

- Click Start => Control Panel.
- Double-click the System applet, and then click the Device Manager tab.
- You can also get to it via the Computer Management Console.

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NOTE: Commonly seen Device Manager is problems represented by icons. You may see a Red **X** through your Network Interface Card (NIC) and at the same time, have no network connectivity. Coincidence? Check out exactly what those icons mean:

A black exclamation point (**!**) on a yellow field indicates the device is in a problem state and can be functioning or non functional.

A red **X** indicates a disabled device. A disabled device is a device that is physically present in the computer and is consuming resources, but does not have a protected-mode driver loaded.

A blue **i** on a white field on a device resource in Computer properties indicates that the Use Automatic Settings feature is not selected for the device and that the resource was manually selected. Note that this does not indicate a problem or disabled state.

A green question mark **?** in Device Manager means that a compatible driver for this device is installed, indicating the possibility that all of the functionality may not be available. Note that this applies only to Windows Millennium Edition (Me).

System Monitor

You can use System Monitor to measure the performance of your own computer or other computers on a network. Specifically, you can use System Monitor to do the following:

- Collect and view real-time performance data on a local computer or from several remote computers.
- View data collected either currently or previously in a counter log.
- Present data in a printable graph, histogram, or report view.
- Incorporate System Monitor functionality into applications that support ActiveX controls, such as Web pages, and Microsoft Word and other applications in the Microsoft Office suite.
- Create HTML pages from performance views.
- Create reusable monitoring configurations that can be installed on other computers using Microsoft Management Console.

Computer Manager

The Computer Manager (although CompTIA has it listed in its objectives as this, it is commonly called the Computer Management Console) is where all your computer management tools reside within a convenient MMC. The MMC is a Microsoft Management Console. The Computer Management MMC is nothing more than a preconfigured MMC with specific tools in it that are commonly used in configuring your system like setting alarms, performance monitoring, checking logs, user and group administration, and so on. You can even add more to it and as your systems change (if you add new components or services); your MMCs will change with them. Make sure that you know this console well and its contents.

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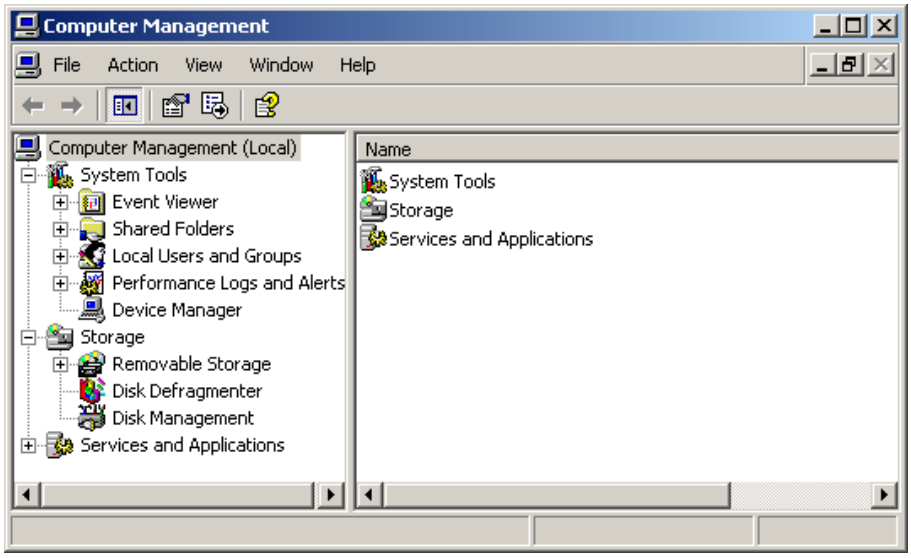

Figure 17: The Computer Management Console

NOTE: The Microsoft Management Console (MMC) is a tool used to create, save, and open collections of administrative tools, called consoles. Consoles contain items such as snap-ins, extension snap-ins, monitor controls, tasks, wizards, and documentation required to manage many of the hardware, software, and networking components of your Windows system. You can add items to an existing MMC console, or you can create new consoles and configure them to administer a specific system component.
Start => Run => MMC /a => hit enter.
You can also use the tool to connect to and control remote PCs

MSCONFIG.EXE

Built into Windows 98, 98SE, ME, and XP is a special tool called the *Microsoft System Configuration Utility* or simply *MSCONFIG*. Designed to help you troubleshoot problems with your computer. You can see it in use here, editing the BOOT.INI

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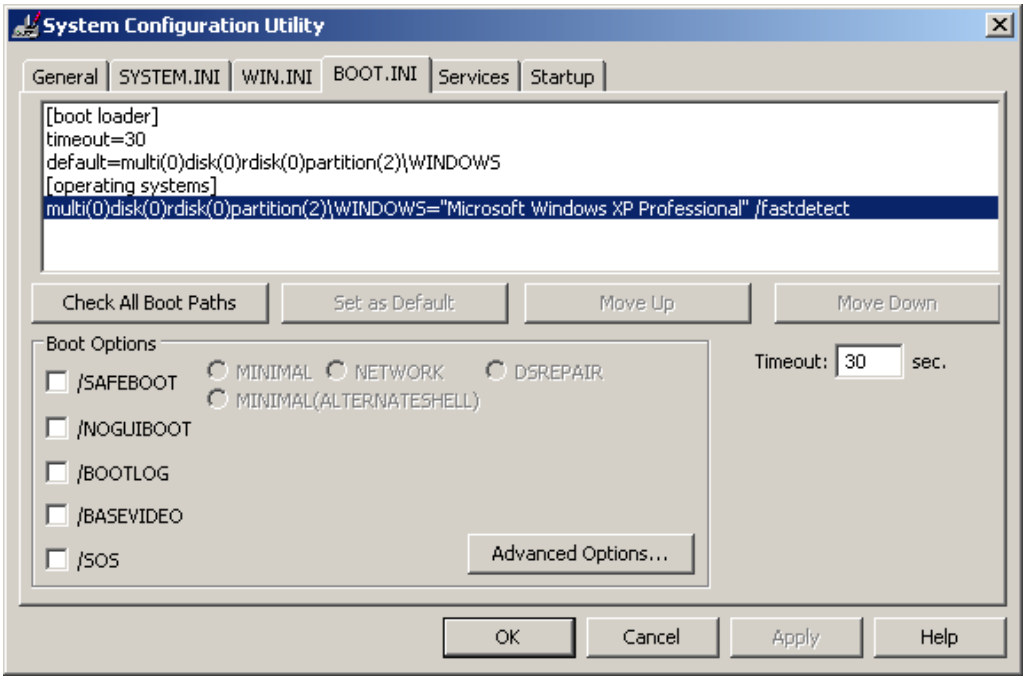

Figure 18: Using MSCONFIG

REGEDIT.EXE (View information/Backup registry)

To view the Registry, go to Start => Run = Regedit hit enter and this will open the Registry files mentioned earlier – User and System.dat. Once you have it open, you can manipulate the contents of the files with this utility. Should be used with caution. Any changes made to the Registry will take affect upon next reboot. You should backup the Registry before attempting to edit it. You can do this many ways. There are so many ways to do it, visiting the Microsoft KB site will show you them all. (http://support.microsoft.com/kb/322756)

REGEDT32.EXE

There are many differences between Regedit and Regedt32 based on what operating system you are running. To get a good explanation on the differences based on OS visit the Microsoft.com site (http://support.microsoft.com/default.aspx?kbid=141377)

SYSEDIT.EXE

Explained earlier in this study guide, SYSEDIT is used to edit system files such as config.sys and autoexec.bat

SCANREG

Used to scan the Registry for errors and issues, it will prompt if issues found.

COMMAND/CMD

This used to run tools (internal and external) that help manage the system.

Event Viewer

Event Viewer maintains logs about program, security, and system events on your computer. You can use Event Viewer to view and manage the event logs, gather information about hardware and software problems, and monitor Windows security events.

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- To open Event Viewer, click Start => Settings => Control Panel => Double-click Administrative Tools applet => double-click Event Viewer
- There are three main logs: Application, Security and System.
- There are other logs that can be added later such as when you install DNS to a Server, a DNS log is created.
- You can adjust the log sizes and much more within the properties of each log.

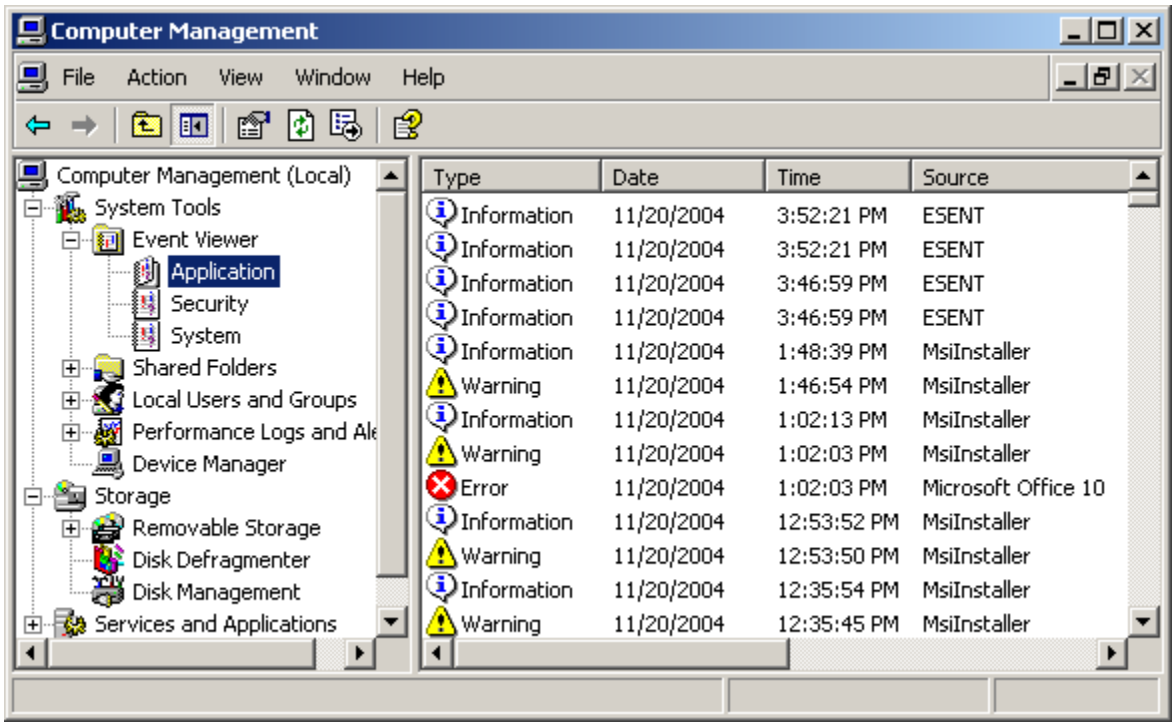

Figure 19: The Event Viewer Logs

NOTE: Make sure you are comfortable with the Computer Management Console for the A+ exam. Knowing this console and the tools within it are important to remember and come in very handy when you need them to help manage your system. Things break and this console can help you figure it out. Device Manager, Event Viewer, they can all give clues to problems.

Task Manager

Task Manager is a utility that will allow you to view information about computer performance as well as details about programs and processes running on your computer. To open Windows Task Manager right-click an empty space on the taskbar and then click Task Manager. Much like the older system where if you did a CTRL+ALT+DEL you would open up a dialog box with the running processes in memory, in case you had to end one of them that may have become unstable and unresponsive. Task Manager is a much larger, much more detailed version of that same tool.

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File Management Tools

ATTRIB.EXE

Attrib is used to view or alter file permissions

- **A:** Archive (the Archive bits for backup programs!)
- **R:** Read Only
- **S:** System
- **H:** Hidden

```
C:\>attrib
A           C:\AUTOEXEC.BAT
A  SHR      C:\BOOT.INI
A  SH       C:\BOOTSECT.DOS
A           C:\COMLOG.txt
A           C:\CONFIG.SYS
A   HR      C:\DELL.SDR
A  SH       C:\hiberfil.sys
A   H       C:\IO.SYS
A   H       C:\MSDOS.SYS
A  SHR      C:\NTDETECT.COM
A  SHR      C:\NTLDR
A  SH       C:\pagefile.sys
A           C:\robocopy.exe
A           C:\test.txt
A           C:\WFCNAME.INI
A   H       C:\_NavCClt.Log

C:\>
```

Figure 20: using ATTRIB

EXTRACT.EXE

Microsoft product files are compressed and stored in cabinet (.cab) files. To use a file in a .cab file, you must first extract that file from the cabinet. This executable can be used to extract files such as cabinet files.

Edit.com

Start => Run => CMD => EDIT enter. This should open you up to the old DOS file editor. This can be thought of as the equivalent of Notepad in the Windows GUI.

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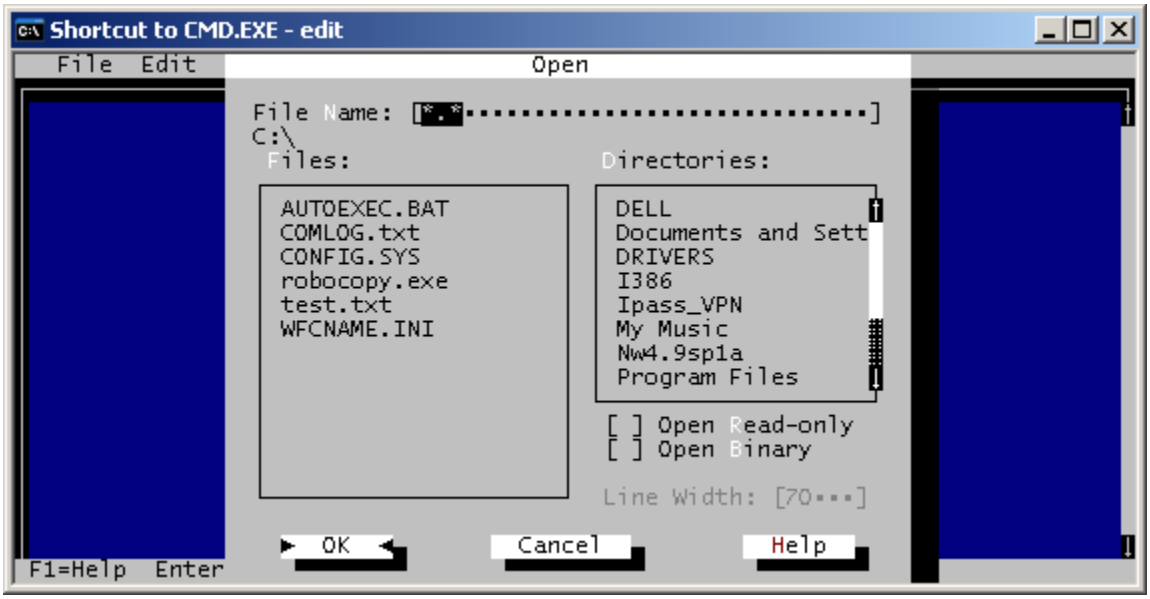

Figure 21: Using EDIT

Windows Explorer

Windows Explorer (not Internet Explorer although part of it, and commonly called **Explorer** for short) is the Windows Shell interface to the desktop and filing system. Explorer is split into two panes with a collapsible hierarchy showing the directory structure on the left side, and a sub window displaying the current folder's contents at the right.

NOTE: You should know Windows Explorer inside and out for the A+ exam. You need to know how to navigate your system properly and quickly; this is the tool you want to get accustomed to using and mastering.

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Domain 2.0 - Installation, Configuration and Upgrading

Chapter 2

Quick Jump To:

- Objective 2.1
- Objective 2.2
- Objective 2.3
- Objective 2.4
- Objective 2.5

In this section of the study guide we will talk about installation, configuration and upgrading of systems. You are expected as an A+ to know how to bring a system to a basic operational level.

Exam Objectives Covered:

2.1 Identify the procedures for installing Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP, and bringing the operating system to a basic operational level.

a. Verify hardware compatibility and minimum requirements
b. Determine OS installation options
   - Installation type (typical, custom, other)
   - Network configuration
   - File system type
   - Dual Boot Support
c. Disk preparation order (conceptual disk preparation)
   - Start the installation
   - Partition
   - Format drive
d. Run appropriate set up utility
   - Setup
   - Winnt
e. Installation methods
   - Bootable CD
   - Boot floppy
   - Network installation
   - Drive Imaging
f. Device Driver Configuration
   - Load default drivers
   - Find updated drivers
g. Restore user data files (if applicable)
h. Identify common symptoms and problems

2.2 Identify steps to perform an operating system upgrade from Windows 9.x/ME, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP. Given an upgrade scenario, choose the appropriate next steps.

a. Upgrade paths available
b. Determine correct upgrade startup utility (e.g. WINNT32 vs. WINNT)
c. Verify hardware compatibility and minimum requirements
d. Verify application compatibility
e. Apply OS service packs, patches, and updates
f. Install additional Windows components

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2.3 Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

a. Boot Sequence
    - Files required to boot
    - Boot steps (9.x, NT-based)
b. Alternative Boot Methods
    - Using a Startup disk
    - Safe/VGA-only mode
    - Last Known Good configuration
    - Command Prompt mode
    - Booting to a system restore point
    - Recovery Console
    - Boot.ini switches
    - Dual Boot
c. Creating Emergency Disks with OS Utilities
d. Creating emergency repair disk (ERD)

2.4 Identify procedures for installing/adding a device, including loading, adding, and configuring device drivers, and required software.

a. Device Driver Installation
    - Plug and Play (PNP) and non-PNP devices
    - Install and configure device drivers
    - Install different device drivers
    - Manually install a device driver
    - Search the Internet for updated device drivers
    - Using unsigned drivers (driver signing)
b. Install Additional Windows components
c. Determine if permissions are adequate for performing the task

2.5 Identify procedures necessary to optimize the operating system and major operating system subsystems.

a. Virtual Memory Management
b. Disk Defragmentation
c. Files and Buffers
d. Caches
e. Temporary file management

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2.1 Identify the procedures for installing Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP, and bringing the operating system to a basic operational level:

Verify hardware compatibility and minimum requirements

Hardware Compatibility List: http://www.microsoft.com/hcl/
Windows 95: http://support.microsoft.com/kb/138349
Windows 98: http://support.microsoft.com/kb/182751
ME: http://support.microsoft.com/kb/253695
NT: http://www.microsoft.com/ntserver/ProductInfo/Systemreqs/sysreqs.asp
2000: http://www.microsoft.com/windows2000/server/evaluation/sysreqs/default.asp
XP: http://support.microsoft.com/kb/314865
2003: http://www.microsoft.com/windowsserver2003/evaluation/sysreqs/default.mspx http://support.microsoft.com/kb/814617

Determine OS installation options

Installation type (typical, custom, and other)

When installing an operating system, it is imperative that you know how you are going to perform it – either a typical installation or a custom install. (http://support.microsoft.com/?kbid=316941) This link will show you nearly everything that you need to know to install XP. Apply the same concepts to older operating systems as well. Once you want to install, you should consider these items *before* the installation so you can perform the installation properly.

Network configuration

You will need to know if you are going to install this system on a network, if you do, then you would need to know from a network engineer what the protocol you need to install on the Operating System is. Though it is most likely *TCP/IP,* this will not always be the case. You will need to know IP address, the subnet mask, and the default gateway if you want to communicate with hosts on different networks than the one you are directly connected to.

File system type

You will need to know what file system type you want to select, most likely NTFS, you can still select FAT32, etc.

Dual Boot Support

Will this system be the only one on this PC will you want to install Linux and Windows XP on the same PC and have *dual boot* support which means you will be able to (once configured properly) select which system you want to boot to when you initially start the PC.

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Disk preparation order (conceptual disk preparation)

You need to know how you will layout the system on your hard disks. You can put sections on separate drives, you may have to install this operating system on a system that already runs so you will need to know what your requirements are and make sure you are able to meet them.

Start the installation

You need to know how to start the installation. You can run Winnt. Are you installing the system from a reboot? Are you installing it from within a running copy of Windows?

- Bootable CD
- Boot floppy
- Network installation
- Drive Imaging

Partition

You need to have a valid partition set up with FDISK if needed.

Format drive

The drive you create then needs to be formatted if it is not already. This is normally seen when installing an operating system on a disk that is brand new. You would partition the disk, make the partition active and then format the drive you create. Once formatted, then you can install the operating system.

Identify common symptoms and problems

"An Unexpected Error (768) Occurred at Line 5118@ind:Xp\Client\Boot\Setup\Setup.c" Error Message During Windows XP Setup Microsoft Knowledge Base Article: 311562
"An Unexpected Error Has Occurred (536821760)" Error Message When You Try to Install Windows XP Microsoft Knowledge Base Article: 316400
Error Message: Error = 3E6H. Setup Cannot Continue. Please Contact Microsoft Technical Support Microsoft Knowledge Base Article: 311442
"STOP 0x0000001E" Error Message During Windows Setup Microsoft Knowledge Base Article: 314451
"STOP 0x000000ED UNMOUNTABLE_BOOT_VOLUME" Error Message During Windows XP Upgrade Microsoft Knowledge Base Article: 297185
Error Message: Setup Cannot Set the Required Windows XP Configuration Information Microsoft Knowledge Base Article: Q316425

NOTE: It would be impossible to list out all the problems that could come up with an installation. I have listed out some common Microsoft Knowledge base articles that should connect you to your best resource – the Microsoft TechNet and KB databases. As you have problems, make sure you look them up on the Microsoft website.

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2.2 Identify steps to perform an operating system upgrade from Windows 9.x/ME, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP. Given an upgrade scenario, choose the appropriate next steps

Scenario: Install Windows XP Professional:

First, make sure you have read the HCL and your PC conforms. The hardware must be compatible or you may have problems with installation. Next, make sure you have a hard disk prepared. You should have a hard disk that well exceeds the minimum requirements needed to install this operating system. Then, create a partition and format the drive.

Install the drivers that are needed. If you need to run the installation program from CD, then you need to make sure the CD works and that it can run the installation. You may need to use boot disks. If you cannot configure your system to boot from a CD drive, you must download the boot floppy setup disks from Microsoft:

http://support.microsoft.com/default.aspx?scid=KB;en-us;q310994

The **Welcome to Setup** screen appears with the option of Continuing Setup, Repair a previous installation, or Quitting. You can Press ENTER to Continue Setup, you may also choose R to Repair, or you may also choose F3 to Quit and reboot the system. You then have to read and accept (F8) the licensing agreement. Afterward, you can adjust your partitions if needed. Options include L to Delete the partition. You can hit ESC to cancel. After you are done with the partition, you can format. You can also choose to keep what you already have in place. After you format, Setup copies the system files to the drive and then you will have to restart. When you restart you will have to continue with the installation but this portion of the installation will be based on configuring the system you just installed.

NOTE: When you install Windows, you are prompted to make boot disks. You should make any setup or boot disks you are asked to make to learn how to do it for the exam, and also to have a set of disks that you will either need for your studies and for the upkeep of the system itself.

2.3 Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x/Me, Windows NT 4.0 Workstation, Windows 2000 Professional, and Windows XP.

Boot Sequence for Windows NT Based Systems:

The first thing that happens when you power on your PC is you have a POST. The POST stands for Power on Self Test. Memory is tested as well as all other hardware on the system being verified. Once POST completes, the PC will attempt to locate a bootable device. Once the bootable device is found, the MBR (Master Boot Record) is loaded into memory. The MBR locates the active partition and into memory loads the boot sector.

The operating system is selected by NTLDR. NTLR will use the Ntdetect.com, boot.ini, and bootsect.dos files to get the proper OS selected and loaded. When NTLDR runs 32-bit mode starts as opposed to the real mode (16 bit) load before it. Once NTLDR switches into 32-bit mode, the file system is loaded (NTFS, FAT32, etc) so that the boot.ini can be read and then checked. Once the boot.ini is

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checked, you select the OS you would like to load. Windows will now pass control over to Ntdetect.com so it can start to gather information about your systems hardware.

- Computer ID
- Bus/adapter type
- SCSI adapters
- video adapters
- keyboard
- Com ports
- Parallel ports
- Floppy disks
- Pointing devices

Once Ntdetect.com collects the needed information, NTLDR loads Ntoskrnl and passes control to it. Ntoskrnl.exe and hal.dll are loaded. Next, the Registry is loaded and a hardware profile is selected. If you have multiple hardware profiles created, you may be asked to select from one to load. After you have selected the proper hardware profile (or if the default one just loads), then you will next be greeted by the login prompt.

Alternative Boot Methods

Using a Startup disk

You can use a startup disk which contains enough files to get you up to a command prompt so that you may be able to run some tools to get things fixed or to boot to another system.

Safe/VGA-only mode

Safe (or VGA) mode is nothing more than a smaller footprint of the OS loaded so that you can repair any damage that may have taken place. A good example is installing a new Video Driver that the hardware cannot support. You will not be able to load the system to repair it, so you can load the system in Safe Mode which does not load most device drivers. Your video card is now accessible and you can remove the setting or whatever caused the system to fail.

Last Known Good configuration

The last known good configuration is a revert back to the old Registry files last loaded on the system. If you make a change to your system (like install an application) and it crashes your system, the last known good configuration can be loaded instead.

Command Prompt mode

When selected, this is loaded much the same way you would use a startup disk. The Command Prompt mode allows you to run commands from within the prompt to help fix the system if it is in need of repair.

Booting to a system restore point

System Restore is a feature of Windows that allows the administrator of the PC to rollback to another instance of the system from an earlier time. It will restore your computer to a previous state, if a problem occurs, without losing data files, history, drawing, favorites, and e-mail.

System Restore monitors changes to the system and some application files, and it automatically creates easily identified restore points unless you disable it from doing so. Stopping restore points from being created it is not recommended, but if you do, you can save a lot of disk space, considering that the saved restore points can eat up hard disk space. These restore points allow you to revert the system to a previous time. They are created daily and at the time of significant system events (such as when an

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application or driver is installed). You can also create and name your own restore points at any time. Make a restore point by going to Start => Programs => Accessories => System Tools => System Restore

Recovery Console

The Recovery Console is a tool that will allow you to solve issues in the boot process or to help avert disaster – it should be used after tools like Safe Mode are attempted. Using the Recovery Console, you can enable and disable services, format drives, read and write data on a local drive (including drives formatted to use NTFS), and perform many other administrative tasks. The Recovery Console is particularly useful if you need to repair your system by copying a file from a floppy disk or CD-ROM to your hard drive, or if you need to reconfigure a service that is preventing your computer from starting properly.

There are two ways to start the Recovery Console. If you are unable to start your computer, you can run the Recovery Console from your Setup CD. As an alternative, you can install the Recovery Console on your computer to make it available in case you are unable to restart Windows. You can then select the Recovery Console option from the list of available options on startup. After you start the Recovery Console you will have to choose which installation you want to log on to (if you have a dual-boot or multiple-boot system) and you will have to log on with your administrator password.

The console provides commands you can use to do simple operations such as changing to a different directory or viewing a directory, and more powerful operations such as fixing the boot sector. You can access Help for the commands in the Recovery Console by typing **help** at the Recovery Console command prompt.

To install the Recovery Console as a startup option, you have two options. You can either insert the Setup CD into your CD-ROM drive with Windows running, or you can click Start => Run => D:\i386\winnt32.exe /cmdcons. To run the Recovery Console, restart your computer and select the Recovery Console option from the list of available options. You must be logged on as an administrator or a member of the Administrators group in order to complete this procedure.

Boot.ini switches

The Boot.ini file was covered earlier in this study guide.

Creating emergency repair disk (ERD)

An ERD is a disk, created by the Backup utility that contains copies of three of the files stored in the %SystemRoot%/Repair folder including Setup.log that contains a list of system files installed on the computer. This disk can be used during the Emergency Repair Process to repair your computer if it will not start or if your system files are damaged or erased

Creating the ERD is a simple process.

- Obtain a blank, formatted, virus-free floppy diskette
- Make a backup copy of the Winnt\repair directory on to the disk.
- Click Start => Programs => Accessories => System Tools => Backup.
- On the Welcome tab => click the button next to Emergency Repair Disk.
- In the Emergency Repair Diskette window that appears => click the box next to "Also backup the Registry to the repair directory..." Insert the floppy in the drive, and click OK.
- Once you receive the success message, click OK
- Save the disk somewhere safe, it contains sensitive information

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2.4 Identify procedures for installing/adding a device, including loading, adding, and configuring device drivers, and required software.

Device Driver Installation

Installing Device Drivers

Device Drivers (drivers for short) help your hardware and software communicate, as well, to keep the hardware you use, independent to the operating system you have installed. If you want to make a printer, it is easier to make a printer with drivers for all the operating systems you want the printer to be used with. Then to make printers specific for each one. Drivers are an integral part of the system in which you are going to be working on and with when installing new devices on your system.

Plug and Play

Plug and Play (PNP) and non-PNP devices can be installed on your system by simply connecting them and then rebooting the system. If your BIOS is plug and play, you will boot up and the hardware will be found, and you will be prompted with options to configure it or Windows will do it for you.

Using unsigned drivers (driver signing)

When Windows 2000 or XP install a new device, they check to see if the driver has been digitally signed. With the advent of Windows 2000, Microsoft introduced digital signatures attached to device drivers to help remove stability issues when installing 3rd party software from other vendors. Driver signing basically gives you an option of taking a chance on using it or not, many times the drivers work either way, but this is a safe way to ensure that something that has been signed has been tested and is safe for use. If no signature is present, Windows will warn you and it is your option to install. You can see in the Hardware Properties dialog box (next illustration) what options you have when working with drivers such as rolling it back or updating it. To get to it, you can open the Computer Management MMC => Device Manager => Select the properties of a device installed on your system. Select the Driver tab and you will have many options such as updating it, rolling it back to a previous state and more.

NOTE: To Update Drivers online, you can go to the Windows Update site and you can install device drivers from there as well.

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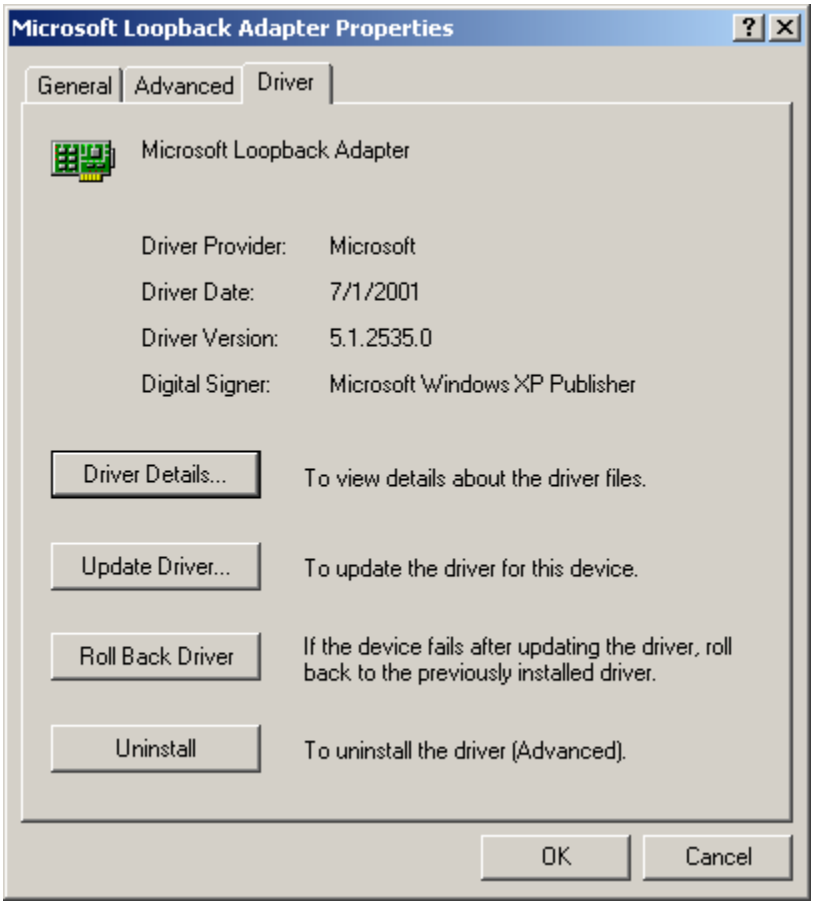

Figure 22: Device Driver Options

Make sure when you finish any install you go through the process of *customizing* the default install with additional security steps, as well as to tweak memory, and so on. Areas to focus on for the exam would be in the memory management area. This was covered earlier in the study guide.

- Virtual Memory Management
- Disk Defragmentation
- Files and Buffers
- Caches
- Temporary file management

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Domain 3.0 - Diagnosing and Troubleshooting

Chapter 3

Quick Jump To:

- Objective 3.1
- Objective 3.2
- Objective 3.3

In this section of the study guide we will cover diagnosing and troubleshooting of systems. For the A+ exam and when working in the IT field, especially as a support technician, it is imperative that you know how to isolate problems, expose them and fix them. In this section we will look at some of the most common issues you will have and some ways to resolve them.

Exam Objectives Covered:

3.1 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems.

a. Common Error Messages and Codes
   - Boot failure and errors
     - Invalid boot disk
     - Inaccessible boot device
     - Missing NTLDR
     - Bad or missing Command interpreter
   - Startup messages
     - Error in CONFIG.SYS line XX
     - Himem.sys not loaded
     - Missing or corrupt Himem.sys
     - Device/Service has failed to start
   - A device referenced in SYSTEM.INI, WIN.INI, Registry is not found
   - Event Viewer – Event log is full
   - Failure to start GUI
   - Windows Protection Error
   - User-modified settings cause improper operation at startup
   - Registry corruption

b. Using the correct Utilities
   - Dr. Watson
   - Boot Disk
   - Event Viewer

3.2 Recognize when to use common diagnostic utilities and tools. Given a diagnostic scenario involving one of these utilities or tools, select the appropriate steps needed to resolve the problem.

a. Startup disks
   - Required files for a boot disk
   - Boot disk with CD-ROM support

b. Startup Modes
   - Safe mode
   - Safe Mode with command prompt

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- Safe mode with networking
- Step-by-Step/Single step mode
- Automatic skip driver (ASD.exe)

c. Diagnostic tools, utilities and resources
- User/installation manuals
- Internet/web resources
- Training materials
- Task Manager
- Dr. Watson
- Boot Disk
- Event Viewer
- Device Manager
- WinMSD
- MSD
- Recovery CD
- CONFIGSAFE

d. Eliciting problem symptoms from customers
e. Having customer reproduce error as part of the diagnostic process
f. Identifying recent changes to the computer environment from the user

3.3 Recognize common operational and usability problems and determine how to resolve them.

a. Troubleshooting Windows-specific printing problems
- Print spool is stalled
- Incorrect/incompatible driver for print
- Incorrect parameter

b. Other Common problems
- General Protection Faults
- Blue screen error (BSOD)
- Illegal operation
- Invalid working directory
- System lock up
- Option (Sound card, modem, input device) or will not function
- Application will not start or load
- Cannot log on to network (option – NIC not functioning)
- Applications do not install
- Network connection

c. Viruses and virus types
- What they are
- TSR (Terminate Stay Resident) programs and virus
- Sources (floppy, emails, etc.)
- How to determine presence

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3.1 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems

Common Error Messages and Codes

Boot Failure

Booting failures and errors such as Invalid boot disk, Inaccessible boot device, Missing NTLDR, Bad or missing Command interpreter appear from time to time and you will need to know how to determine what the problem is from an error message and from the message, know the next steps to fix them system, or at a minimum, determine what the problem is.

Missing Operating System

This error occurs when the boot record signature of the master boot record does not match a certain value at a certain location. In this case, the boot sector is invalid and the computer cannot boot. This error can also occur if there is no active partition defined in the partition table.

Non-System Disk or Disk Error

This error is generated by the computer's BIOS when the boot sector or master boot record of the boot drive is damaged or missing. It can also occur if the boot device has been improperly configured in the BIOS. In this case, data in the partition may be valid and undamaged, but there is no bootable partition. This message also occurs when a non-bootable disk is left in drive A during startup. If you receive this error, make sure that there is no disk in drive A and restart your computer.

Boot Error Press F1 to Retry

This error is generated by the computer's BIOS when the hard disk is missing a master boot record or boot sector, or when there is a problem accessing the boot drive.

NO ROM BASIC

If there is no active partition defined, the master boot record returns an error to the BIOS. In some cases, the master boot code attempts to go to ROM Basic when no bootable disk is found. Since some computers do not have ROM Basic, they display a NO ROM BASIC or other error message. The message displayed is dependent upon the computer's BIOS.

Invalid Media Type

This error message is displayed when the boot sector of a defined partition is damaged. The error message is normally received using a new partition that has not been formatted. However, if the boot sector is damaged, the partition may appear unformatted to the operating system, and this error message is generated.

Hard Disk Controller Failure

This error message indicates either the hard disk controller has failed, the hard disk controller is not set up properly in the BIOS, or the controller cannot communicate with the attached drive(s). In this case, do not perform the troubleshooting steps below. Instead, consult the documentation included with your computer or contact the computer's manufacturer for more information.

Startup messages

Startup messages will show you errors that occur during the startup process.

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Bad or Missing COMMAND.COM
This means that the OS is unable to locate the file COMMAND.COM. To fix this problem use the make sure that the necessary boot files are located on the hard drive. If not, boot with the startup disk and enter the command SYS C:\ which will copy the system files to the hard drive (Windows 9x only).

HIMEM.SYS not loaded
Check the CONFIG.SYS file and make sure that the line Device=C:\HIMEM.SYS exists and that the path specified to the file is where the file actually is.

Error in CONFIG.SYS line XX
This error is usually caused by a syntax error in the CONFIG.SYS or AUTOEXEC.BAT file where XX will be the line number that the error occurred.

NOTE: Dr. Watson for Windows is a program error debugger that gathers information about your computer when an error (or user-mode fault) occurs with a program. Technical support groups can use the information that Dr. Watson obtains and logs to diagnose a program error. When an error is detected, Dr. Watson creates a text file (Drwtsn32.log) that can be delivered to support personnel by the method they prefer. You also have the option of creating a crash dump file, which is a binary file that a programmer can load into a debugger

http://support.microsoft.com/default.aspx?scid=kb;EN-US;308538

3.2 Recognize when to use common diagnostic utilities and tools. Given a diagnostic scenario involving one of these utilities or tools, select the appropriate steps needed to resolve the problem

Startup Modes

Startup Modes are used to help troubleshoot the system that may be having problems. If you are not able to boot up, or start the PC, then you may have to use the startup modes menu options to help you get into the system. If you need to get into the system

Safe mode
Loads the system to the desktop with a minimal set of drivers and services for troubleshooting purposes

Safe Mode with command prompt
System load in safe mode and you work within the command prompt only.

Safe mode with networking
System load in safe mode, but allows the networking drivers to load

Step-by-Step/Single step mode
Allows you to start the PC step by step and verify or see each action taken at each step of the boot

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Automatic skip driver (ASD.exe)
Automatic Skip Driver Agent identifies devices that can cause Windows to stop responding (hang) when you start your computer, and then disables them so that they are bypassed when you next restart your computer.

Diagnostic tools, utilities and resources
There are many tools and resources you can use to troubleshoot your system.

User/installation manuals
Any reference material that comes with a system can be used to help troubleshoot the system. If the manual does not come with the system and you have an Internet connection, then you can use that as an online resource.

Internet/web resources
These are online resources you can use to help solve problems. Major search engines, vendor websites and user forums are the best resources you can use.

Training materials
Any form of training class you take should come with a manual or some form of book related work. These can be used to help you troubleshoot and diagnose issues.

Task Manager
Covered earlier in this guide, task Manager can be used to help troubleshoot system problems like if your system hangs, you can start and stop process that may be causing the issue, and you can view memory and processor statistics as well as many other things.

Boot Disk
A boot disk can help you bypass corrupted files that may have previously kept you from booting it up normally and getting into that system.

Event Viewer:
The Event Viewer is used to view system logs that can show problems in the system from startup through normal operation and during showdown.

Device Manager
Device Manager (covered earlier in the study guide) is a tool that can help you see what hardware in your PC may not be configured or operating properly.

WinMSD
WinMSD reports information on the following:

- Memory use
- Services
- Devices
- IRQs
- Ports
- Environment variables
- Network information
- Hardware information

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MSD
This is the older version of WinMSD

Eliciting problem symptoms from customers, having customer reproduce error as part of the diagnostic process and Identifying recent changes to the computer environment from the user.
As an A+ technician, it is very important to know how to resolve problems in an organization or place of work, or at home. You need to know how to help someone who has a problem by first defining what the problem is (or getting that information from someone you are trying to help), all the way to isolating and resolving the issue.

Having customer reproduce error as part of the diagnostic process.
Make sure that you can get the customer to clearly define the problem. Make sure that the error is what it is; you can try to reproduce the error to prove that. By being able to reproduce the error, then you know what the problem is. Always try to get the problem defined.

Identifying recent changes to the computer environment from the user.
Always try to see what the last thing that was done was, or what was the last change made to the system. Try to let the customer know that even though it might be petty to them (like putting a floppy in the A: drive), whatever the last things that they did while the computer was operational is important to know. For instance, that floppy could have had a virus on it, etc. Also, find out if anything happened in the area like a power outage, etc.

3.3 Recognize common operational and usability problems and determine how to resolve them

Viruses and virus types
A virus is software used to infect a computer. Virus code is usually buried within the code of another program. Once the program is executed the virus is activated and attaches copies of itself to other programs in the system. Infected programs copy the virus to other programs. The effects of a virus can range from harmless messages that appear on screen to destruction of data, either right away or on a set date. File attachments in e-mail messages are a common source of virus. More information about Virus activity can be found at www.sarc.com.

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Domain 4.0 - Networks

Chapter 4

Quick Jump To:

- Objective 4.1
- Objective 4.2

In this section of the study guide we will cover networking and TCP/IP. You will not need to know too much about networking for the A+ exam, but you will be required to have the very fundamentals down at minimum.

Exam Objectives Covered:

4.1 Identify the networking capabilities of Windows. Given configuration parameters, configure the operating system to connect to a network.

a. Configure protocols
   - TCP/IP
     - Gateway
     - Subnet mask
     - DNS (and domain suffix)
     - WINS
     - Static address assignment
     - Automatic address assignment (APIPA, DHCP)
   - IPX/SPX (NWLink)
   - AppleTalk
   - NetBEUI/ NetBIOS
   - Configure Client options
   - Microsoft
   - Novell

b. Verify the configuration

c. Understand the use of the following tools
   - IPCONFIG.EXE
   - WINIPCFG.EXE
   - PING
   - TRACERT.EXE
   - NSLOOKUP.EXE

d. Share resources (Understand the capabilities/limitations with each OS version)

e. Setting permissions to shared resources

f. Network type and network card

4.2 Identify the basic Internet protocols and terminologies. Identify procedures for establishing Internet connectivity. In a given scenario, configure the operating system to connect to and use Internet resources.

a. Protocols and terminologies
   - ISP
   - TCP/IP
   - E-mail (POP, SMTP, IMAP)
   - HTML
   - HTTP
   - HTTPS
   - SSL

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- Telnet
- FTP
- DNS

b. Connectivity technologies
    - Dial-up networking
    - DSL networking
    - ISDN networking
    - Cable
    - Satellite
    - Wireless
    - LAN

c. Installing and Configuring browsers
    - Enable/disable script support
    - Configure Proxy Settings
    - Configure security settings

d. Firewall protection under Windows XP

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4.1 Identify the networking capabilities of Windows. Given configuration parameters, configure the operating system to connect to a network

Configure protocols

TCP/IP

Transmission Control Protocol/Internet Protocol, the suite of communications protocols used to connect hosts on the Internet TCP/IP is actually two separate protocols, TCP and IP. IP addressing is the logical addressing used to identify a unique host on a network. *Normally seen as 10.0.0.1*

Gateway

When configuring IP addresses, you may need to configure a gateway address which is basically nothing more than a device (normally a router) that will know what to do with your request, it will know where to send it if it is configured properly.

Subnet mask

A mask helps to identify the host and the network portions of an IP address

```
Ethernet adapter LOOPBACK:

        Connection-specific DNS Suffix  . :
        Autoconfiguration IP Address. . . : 169.254.25.129
        Subnet Mask . . . . . . . . . . . : 255.255.0.0
        Default Gateway . . . . . . . . . :
```

Figure 23: Viewing the IP address, Subnet Mask and Gateway for a host (APIPA)

DNS (and domain suffix)

Domain Name System is a system that allows you to remember easy to remember words, instead of having to memorize IP addresses. A Domain Name System will use a system of records in a database that will make the connection between the IP address and the Domain Name to the requesting client. If you wanted to get to a website, the DNS name you use would resolve to your Internet DNS server if you were trying to access the website while connected via your ISP

WINS

WINS is the Windows Internet Naming Service. It resolves IP addresses to NetBIOS names, like your computer name.

Static address assignment

You can statically assign an IP address to your PC.

- Start => Control Panel => Network Connections.
- Right click the connection you would like to configure and select Properties.

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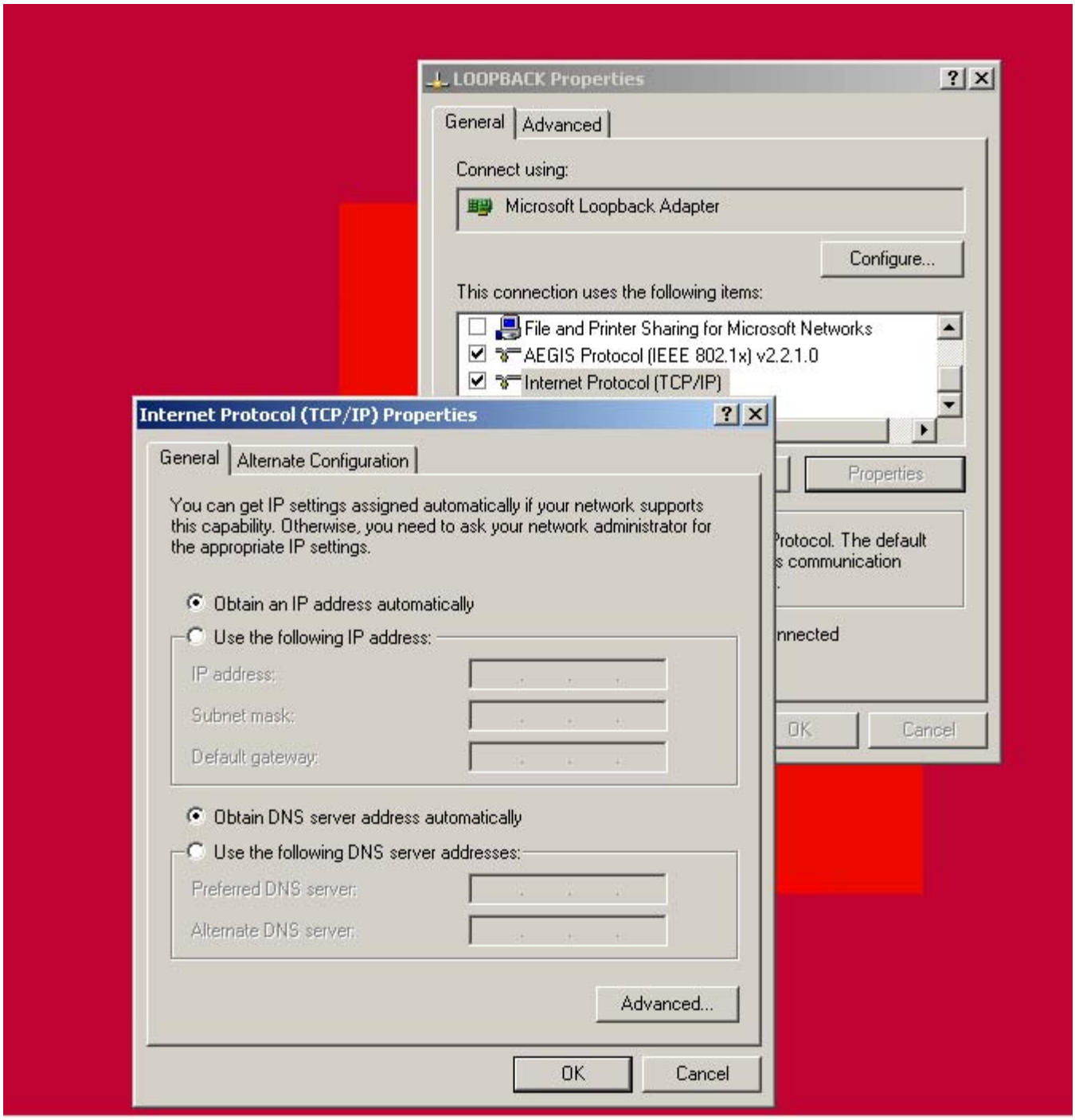

Figure 24: Configuring IP Addressing

Automatic address assignment (APIPA, DHCP)

You can use automatic IP addressing features as well. To keep a static database of IP addresses can be cumbersome. Using a DHCP server can help in the keeping of the IP addressing database, *and* give out the IP addresses to the client for you. DHCP short for Dynamic Host Configuration Protocol is a protocol used for assigning dynamic IP addresses to devices on a network or LAN.

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Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means that a new computer can be added to a network without the hassle of manually assigning it a unique IP address

APIPA
Automatic Private IP Addressing is a feature of later Windows operating systems. With APIPA, DHCP clients can automatically self-configure an IP address and subnet mask when a DHCP server is not available. The IP address range is 169.254.0.1 through 169.254.255.254 (default class B subnet mask of 255.255.0.0). A client uses the self-configured IP address until a DHCP server becomes available

IPX/SPX (NWLink)
This is Internetwork Packet Exchange /Sequenced Packet Exchange. On Novell NetWare systems, IPX is a network layer protocol used in the file server operating system. SPX is a transport layer protocol built on top of IPX and used in client/server applications

AppleTalk
This is the proprietary local area network developed by Apple Computer to link Macintosh computers and peripherals, especially LaserWriter printers.

NetBEUI/NetBIOS
Network Basic Input Output System is a network protocol created by IBM for their PC-Net network. It is used by IBM (OS/2 Networking), Artisoft (Lantastic), Microsoft (Microsoft Networking) Samba, and others. NetBEUI (NetBIOS Enhanced User Interface.) NetBIOS is not routable and must be encapsulated in TCP/IP to go through routers (NetBIOS over TCP/IP or TCPBEUI.)

4.2 Identify the basic Internet protocols and terminologies. Identify procedures for establishing Internet connectivity. In a given scenario, configure the operating system to connect to and use Internet resources

Protocols and terminologies

ISP
Short for Internet Service Provider, a company that provides access to the Internet. For a monthly fee, the service provider gives you a software package, username, password and access phone number. Equipped with a modem, you can then log on to the Internet and browse the World Wide Web and USENET, and send and receive e-mail. In addition to serving individuals, ISPs also serve large companies, providing a direct connection from the company's networks to the Internet. ISPs themselves are connected to one another through Network Access Points (NAPs.)

E-mail (POP, SMTP, IMAP)
IMAP4
Short for Internet Message Access Protocol (version 4), IMAP4 is a protocol for retrieving e-mail messages. The latest version of IMAP is similar to POP3 but supports some additional features. For example, with IMAP4, you can search through your e-mail messages for keywords while the messages are still on mail server. You can then choose which messages to download to your machine.

POP3
Short for Post Office Protocol (version 3), POP3 is a protocol used to retrieve e-mail from a mail server. Most e-mail applications (sometimes called an e-mail client) use the POP protocol, although some can use the newer IMAP (Internet Message Access Protocol). There are two versions of POP. The first,

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called POP2, became a standard in the mid-80s and requires SMTP to send messages. The newer version, POP3, can be used with or without SMTP.

SMTP

Short for Simple Mail Transfer Protocol, SMTP is a protocol for sending e-mail messages between servers. Most e-mail systems that send mail over the Internet use SMTP to send messages from one server to another; the messages can then be retrieved with an e-mail client using either POP or IMAP. In addition, SMTP is generally used to send messages from a mail client to a mail server. This is why you need to specify both the POP or IMAP server and the SMTP server when you configure your e-mail application.

HTML

HyperText Markup Language is the coding language used to create Hypertext documents for use on the World Wide Web. HTML looks a lot like old-fashioned typesetting code, where you surround a block of text with codes that indicate how it should appear. In HTML you can specify that a block of text, or a word, is linked to another file on the Internet. HTML files are meant to be viewed using a World Wide Web Client Program, such as Netscape or Mosaic

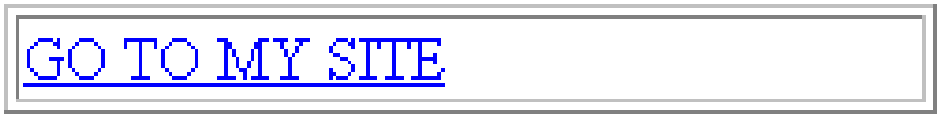

Figure 25: Viewing a table with a hyperlink

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">

<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=windows-1252">
<meta http-equiv="Content-Language" content="en-us">
<title>shows up in the title bar</title>
</head>
<body>
<table border="1" width="20%">
<tr>
<td width="100%">
<a href="http://www.rsnetworks.net">GO TO MY SITE</a>
</td>
</tr>
</table>
</body>
</html>
```

Figure 26: Viewing the Document in HTML

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<html></html>	Creates an HTML document
<head></head>	Sets off the title and other information that is not displayed on the Web page itself
<body></body>	Sets off the visible portion of the document
<title></title>	Puts the name of the document in the title bar
<table></table>	Used to create Tables in the document
****	Used to Create a Hyperlink

HTTP
HyperText Transport Protocol is the protocol for moving hypertext files across the Internet. It requires a HTTP client program on one end, and an HTTP server program on the other end. HTTP is the most important protocol used in the World Wide Web (WWW)

HTTPS
The Secure and Encrypted form of HTTP. HTTP sends data in cleartext so HTTPS helps to secure it.

SSL
Secure Sockets Layer is a protocol designed by Netscape Communications to enable encrypted, authenticated communications across the Internet. SSL used mostly in communications between web browsers and web servers. URLs that begin with **https** indicate that an SSL connection will be used. SSL provides 3 important things: privacy, authentication, and message integrity.

Telnet
Telnet is a protocol for remote computing on the Internet. It allows a computer to act as a remote terminal on another machine, anywhere on the Internet. This means that when you telnet to a particular host and port, the remote computer (which must have a telnet server) accepts input directly from your computer (which must have a telnet client) and output for your session is directed to your screen

FTP
File Transfer Protocol is very common method of moving files between two Internet sites. FTP is a special way to login to another Internet site for the purposes of retrieving and/or sending files. There are many Internet sites that have established publicly accessible repositories of material that can be obtained using FTP, by logging in using the account name anonymous, thus these sites are called anonymous ftp servers

DNS
The Domain Name System is a system of mapping names to IP addresses. Because domain names are alphabetic, they are easier for humans to remember. The Internet, however, is really based on IP addresses. Every time you use a domain name, DNS translates the name into the corresponding IP address. It is similar to a phonebook for the Internet

Connectivity technologies
Dial-up networking
Dial up networking is when you want to connect to a network via dial up lines, like older analog POTS lines or the PSTN. Slow.

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DSL networking

DSL Short for Digital Subscriber Line. Much faster than dial up. This is technology that uses ordinary copper telephone lines to provide Internet speeds ranging from 1.5 to 9 Mbps. These speeds are 30 to 50 times faster than a regular 56-kbps dial-up modem. DSL also allows users to receive voice and data simultaneously. The signal is carried on a higher frequency than normal telephone traffic. xDSL refers to all types of Digital Subscriber Lines, including:

- **ADSL**
  - Asymmetric Digital Subscriber Lines
- **SDSL**
  - Single-line Digital Subscriber Lines
- **HDSL**
  - High-data-rate Digital Subscriber Lines
- **VDSL**
  - Very-high-data-rate Digital Subscriber Lines

ISDN networking

Integrated Services Digital Network and is a system of digital phone connections which allows voice and data to be transmitted simultaneously across the world using end-to-end digital connectivity. There are two basic types of ISDN service. The first is Basic Rate Interface. BRI is a basic service that is intended to meet the needs of most individual users 2 B channels and a D channel. The second type is Primary Rate Interface. PRI is intended for users with greater capacity requirements – Full T1, 23 B channels, all signaling for control consolidated to 1 D channel.

Cable

Cable is normally referenced from cable TV as the normally the providers of Cable TV will give a portion of the bandwidth that the television programming comes on to Data transferring.

Satellite

Internet gateways can be accessed via geostationary satellites also known as GEOs. These systems are not optimized for TCP/IP and Internet use and can be quite expensive. The delay may prove problematic for Voice over Satellite as well

Wireless (802.11)

The IEEE formed a committee to create 802.11. The IEEE 802.11 standard is based around wireless technologies, and in 2001, the IEEE standardized 802.11 wireless technologies. Coming out at a whopping megabit per second, wireless was more about awe than a great technology.

Not having to use wires astonished everyone as wireless technology seemed to open a million new doors in the IT industry, and it did. Problem was it was slow, unsecure and totally unreliable. Now wireless is getting better with speeds up to 54 Mbps reachable in just about any home and company who can purchase the equipment. There have also been many enhancements to make it more reliable and secure. Another great aspect is that over time it is become cheaper to go wireless. When first released, wireless was a bit costly.

Soon after IEEE released 802.11, 802.11b was released to the public as a standard that would bring more benefits to the 802.11 standard. First, a bigger speed increase. 802.11b will operate at 11 Mbps. Today, we have 802.11g hardware accessible to the general public and their homes, we have coffee shops and

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airports where you can get a wireless link from an Access Point (AP) and get internet access and check your email at higher speeds, up to 54 Mbps.
There are multiple standards you should memorize for the A+ exam.

- 802.11= 1 Mbps
- 802.11b = 11 Mbps (ISM band)
- 802.11a = 54 Mbps UNNI band
- 802.11g = 54 Mbps ISM band
- 802.11, 802.11b and 802.11g are compatible
- 802.11a requires different antennas (and hardware) as it operates in a different radio band

The farther away you get from an access point directly affects the coverage you have, as well as the speed of your connection.

NOTE: You need to know that 802.11 will also consist of 802.11, 802.11a, 802.11b, and 802.11g. The most common standard in use today for wireless networks, the 802.11b standard defines DSSS networks that use the 2.4GHz ISM band and communicate at speeds of 1, 2, 5.5 and 11 Mbps. Understanding wireless for the exam is important, but at the A+ level, you do not need to be a Wireless Network Engineer to pass the exam, but with current industry trends and how mobile the workforce is getting, it would be to your best interests read the information here in this study guide and start to learn more about it from other sources as well. This link has many wireless resources in it.

http://www.windowsecurity.com/Robert_J_Shimonski/

There are short articles and primers online that will reinforce all that you need to fundamentally know to understand how wireless networking takes place.
This knowledge will help you to pass the A+ exam and feel confident while sitting the exam that you have covered most everything that you will need to know on the exam about wireless technologies.

Networking Tools

From the Start menu, choose **Run** and type **cmd** to open a command window, and then type in the name of the utility to run.

Tracert / traceroute	Tracert is a test tool that uses ICMP and will allow you to track the path from one end of the network to another. It will display the name or IP address of each intermediate router or other network gateway device the message passes through to reach its destination. Tracert is especially useful when diagnosing connectivity problems on the Internet because if you have high latency issues, you can see how many *hops* your data is taking and how long it takes to get through each hop. Hops are normally known as router hops, or each router data has to traverse from point A to point B. Traceroute is the Unix version, Tracert is the Windows version
ping	Ping is the single most powerful troubleshooting tool for networked computers. The ping tool can help verify that TCP/IP is installed correctly on a computer and that a computer is reachable from one point of the network to another. The ping tool's main offering is that it helps test connectivity via ICMP

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ipconfig	The ipconfig tool shows a computer's TCP/IP configuration. It displays the IP address, the network (subnet) mask and the Internet/network gateway address (if one is set for that network). You can use this tool to verify that a TCP/IP configuration has been set up correctly. Ipconfig /all shows the entire configuration. Make sure you are aware of other command line switches you can use by typing ipconfig /? Found with NT, 2000, 2003, XP
ifconfig	Linux version of ipconfig
winipcfg	The winipcfg tool shows a computer's TCP/IP configuration. It displays the IP address, the network (subnet) mask and the Internet/network gateway address (if one is set for that network). You can use this tool to verify that a TCP/IP configuration has been set up correctly. It is found with older Windows 9x systems primarily.

Note: Ping was also covered earlier in this study guide.

NOTE: The following links can pretty much give you all you need to know about solving connectivity issues on a network and all the syntax you need to know for the A+ exam.

http://support.microsoft.com/kb/314067

http://support.microsoft.com/?kbid=323388

Firewalls

A firewall is used to protect one network from another and is an Infrastructure device or service that normally protects a perimeter such as your personal connection to the Internet where you could be the victim of attack. It is used to separate and control network segments and the traffic that traverses them.

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