



IT Essentials v4.1 LI 11.4.5 Upgrade and configure storage devices and hard drives

CompTIA A+ 220-702 Objective

2.3 Disk management tools

In Windows Vista and Windows 7, use the following path:

Start > Start Search > type diskmgmt.msc > Enter > Continue

IT Essentials v4.1 LI 12.0 Introduction

CompTIA A+ 220-702 Objective

2.0 Operating Systems

Various brands of operating systems are available on the market today, including Microsoft Windows, Apple Mac OS, UNIX, and Linux. A technician must consider the current computer system when selecting an operating system. Additionally, there are several versions of an operating system. Some versions of Microsoft Windows include Windows 2000 Professional, Windows XP Home Edition, Windows XP Professional, Windows Media Center, Windows Vista Home Basic, Windows Vista Business, Windows Vista Premium, Windows 7 Starter, Windows 7 Home Premium, Windows 7 Professional, and Windows 7 Ultimate.

IT Essentials v4.1 LI 12.1.3 Windows OS directory structures

CompTIA A+ 220-702 Objective

2.2 User file locations

2.2 System file locations

2.2 Fonts

2.2 Temporary files

2.2 Program files

2.2 Offline files and folders

Additions to Figure 1

Operating System	User Files	System Files	Fonts	Temporary Files	Program Files	Offline Files and Folders
Windows 7 Starter	C:/Users/Us er_name	C:/Wind ows/Sys tem32	C:/Windo ws/Fonts	C:/Users/U ser_name\ AppData\L ocal\Temp	C:\Program Files	Not supported
Windows 7 Home Premium	C:/Users/U ser_name	C:/Wind ows/Sys tem32	C:/Windo ws/Fonts	C:/Users/U ser_name\ AppData\L ocal\Temp	C:\Program Files for 64-bit C:\Program Files (x86) for 32-bit	Not supported
Windows 7 Professional	C:/Users/U ser_name	C:/Wind ows/Sys tem32	C:/Windo ws/Fonts	C:/Users/U ser_name\ AppData\L ocal\Temp	C:\Program Files for 64-bit C:\Program Files (x86) for 32-bit	C:/Windows\ CSC

Windows 7 Ultimate	C:/Users/U ser_name	C:/Wind ows/Sys tem32	C:/Windo ws/Fonts	C:/Users/U ser_name\ AppData\L ocal\Temp	C:\Program Files for 64-bit C:\Program Files (x86) for 32-bit	C:\Windows\ CSC
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IT Essentials v4.1 LI 12.2.3 Create, view, and manage disks, directories, and files

CompTIA A+ 220-702 Objective

2.3 Disk management tools

2.3 FAT32, NTFS, FAT64 (exFAT)

Within the operating system, disks and directories are locations where data is stored and organized. The file system used by the operating system determines additional factors that affect storage such as partition size, cluster size, and security features.

Disk Structure

A hard disk is divided into specific areas called partitions. Partitions are formatted so that they can store information. The Disk Management utility displays information and performs services such as partitioning and formatting disks in Windows. Figure 1 shows the Disk Management utility used in Windows XP.

There are several types of partitions on a hard drive:

- **Primary partition** – This is usually the first partition. A primary partition cannot be subdivided into smaller sections. There can be up to four partitions per hard drive.
- **Active partition** – This partition is used by the operating system to boot the computer. Only one primary partition can be marked active.
- **Extended partition** – This partition normally uses the remaining free space on a hard drive or takes the place of a primary partition. There can be only one extended partition per hard drive, and it can be subdivided into smaller sections called logical drives.

NOTE: At any given time, you can only designate one partition as the active partition. The operating system uses the active partition to boot up the system. The active partition must be a primary partition.

In most cases, the C: drive is the active partition and contains the boot and system files. Some users create additional partitions to organize files or to be able to dual-boot the computer.

There are several ways to access the Disk Management utility in Windows XP:

- Select **Start > right-click My Computer > Manage**.
- Select **Disk Management**.
- Select **Start > Settings > Control Panel > Administrative Tools > Computer Management**.
- Select **Disk Management**.

There are several ways to access the Disk Management utility in Windows Vista:

- Select **Start > right-click My Computer > Manage**.
- Select **Disk Management**.
- Select **Start > Settings > Control Panel > Administrative Tools > Computer Management > Continue**.
- Select **Disk Management**.

There are several ways to access the Disk Management utility in Windows 7:

- Select **Start > right-click My Computer > Manage**.
- Select **Disk Management**.
- Select **Start > Control Panel > System and Security > Administrative Tools > Computer Management**.
- Select **Disk Management**.

In Windows, letters are used to name the drives. A Windows computer can have up to 26 physical and logical drives, because there are 26 letters in the English alphabet. Drives A and B are reserved for floppy disk drives, and drive C is reserved for the primary, active partition. Therefore, the maximum number of additional drives is 23. In Windows Vista and Windows 7, you can assign drives A and B to volumes if you do not have floppy drives.

With the NTFS file system, a drive can be mapped to an empty folder on a volume and is referred to as a mounted drive. Mounted drives are assigned drive paths instead of letters and are displayed as a drive icon in Windows Explorer. Use a mounted drive to configure more than 26 drives on your computer or when you need additional storage space on a volume.

To mount a volume in Windows:

- Open **Computer Management** and select **Disk Management**.
- Right-click the partition or volume to be mounted.
- Click **Change Drive Letter and Paths**.
- Click **Add**.
- Click **Mount in the following empty NTFS folder**.
- Create an empty folder, type the path to an empty folder, or browse to an empty folder on an NTFS volume and click **OK**.
- Close **Computer Management**.

Drive Status

The Disk Management utility displays the status of each disk, as shown in Figure 2. The hard drives in the computer will display one of the following conditions:

- **Foreign** – A dynamic disk that has been moved to a computer from another computer running Windows 2000 or Windows XP
- **Healthy** – A volume that is functioning properly
- **Initializing** – A basic disk that is being converted into a dynamic disk
- **Missing** – A dynamic disk that is corrupted, turned off, or disconnected
- **Not Initialized** – A disk that does not contain a valid signature
- **Online** – A basic or dynamic disk that is accessible and shows no problems
- **Online (Errors)** – I/O errors that are detected on a dynamic disk
- **Offline** – A dynamic disk that is corrupted or unavailable
- **Unreadable** – A basic or dynamic disk that has experienced hardware failure, corruption, or I/O errors

Other drive status indicators might be displayed when using drives other than hard drives:

- **Audio CD** – An audio CD that is in the optical drive
- **No Media** – An optical or removable drive that is empty

File System

Partitions are formatted with a file system. The three file systems available in Windows XP are FAT (FAT16), FAT32, and NTFS. NTFS has greater stability and security features. FAT32, NTFS, and exFAT are compared in Figure 3. exFAT, or FAT64, was created to address some of the limitations of using FAT, FAT32, or NTFS when formatting USB flash drives, such as file size and directory size.

For example, Windows does not display the file extension, but this practice can cause security problems. Virus writers are able to distribute executable files disguised as a non-executable file. To avoid this security breach, you should always show file extensions by doing the following:

Select **Start > Control Panel > Folder Options > View**, and uncheck the **Hide extensions for known file types** check box, as shown in Figure 4.

In Windows Vista and Windows 7, click **Start > Control Panel > Appearance and Personalization > Folder Options > View**, and uncheck the **Hide extensions for known file types** check box.

NOTE: Saving files to the root directory of the C: drive can cause organizational problems with data. It is a best practice to store data in folders created on the C: drive.

Additions to Figure 3

	exFAT
Security	exFAT can support access control lists (ACLs) that define permissions for user access
Compatibility	Compatible with Windows XP with SP2 or SP3, Windows Vista with SP1, Windows 7, Windows Server 2003 with SP2, Windows Server 2008, and Linux
File Size	Theoretical maximum of 64 zettabytes (ZBs), 512 TB recommended
Files Per Volume	Maximum of 16 exabytes (EBs)
File Size Efficiency	Cluster size up to 32 MB
Reliability	Can track changes to the file system and recover data if TFAT (Transaction-Safe FAT File System) is enabled. TFAT retains two copies of the file system. If one table is lost or corrupted, the other copy is recoverable

IT Essentials v4.1 LI 12.2.4 Identify procedures and utilities used to optimize the performance of operating systems

CompTIA A+ 220-702 Objective

- 2.3 DEFRAG
- 2.3 Check Disk
- 2.3 System monitor
- 2.3 Resource usage

Several procedures and tools are available to optimize the performance of an operating system. The concepts may be the same across operating systems, but the optimization methods and procedures are different. For example, while virtual memory performs the same function on a Windows 98 and Windows XP operating system, the path to find and set virtual memory settings is different.

System Tools

To maintain and optimize an operating system, you can access various tools within Windows. Some of these tools include disk error checking, which can scan the hard drive for file structure errors, and hard drive defragmentation, which can consolidate files for faster access. Figure 1 shows the hard drive management tools.

Disk Error-Checking Tool

The Windows operating system uses CHKDSK from within the GUI or at the command line to detect and repair disk errors.

To check a drive for errors using the GUI, follow these steps:

1. In Windows XP, double-click **My Computer**. In Windows Vista or Windows 7, click **Computer** in the Start menu.
2. Right-click the drive that you want to check.
3. Click **Properties**.
4. On the Tools tab, under Error-checking, click **Check Now**.
5. Under Check disk options, select the **Scan for and attempt recovery of bad sectors** check box.
6. Click **Start**.

NOTE: The **Scan for and attempt recovery of bad sectors** option will automatically fix file system errors as well as check the disk for bad sectors and recover any data from sectors that are found to be bad. Any data that is recovered is saved to files in the root directory of the disk.

The CLI version of the utility has four options to check a drive for errors:

- **chkdsk** – Displays a status report of the drive
- **chkdsk /f** – Fixes errors on the disk
- **chkdsk /r** – Recovers readable information from bad sectors
- **chkdsk /x** – Dismounts the volume if necessary

CHKDSK makes multiple passes over the disk, checking for specific criteria:

- **Phase 1: Checking Files** – CHKDSK examines each file record in the Master File Table (MFT) for consistency. By the end of this phase, used and available space on the volume have been identified.
- **Phase 2: Checking Indexes** – CHKDSK examines the MFT to ensure that every file and directory is referenced by at least one entry. Finally, CHKDSK checks that the time stamps and file sizes are correct in the directory listings.
- **Phase 3: Checking Security Descriptors** – CHKDSK examines the security descriptors for file or directory ownership information and NTFS permissions.
- **Phases 4 and 5: Checking Sectors** – If the /r option is used, CHKDSK makes two more passes looking for sectors that have physical damage.

Disk Defragmenter

To help optimize the files on the hard drive, Windows operating systems provide a defragmentation utility. As files are accessed and stored on a hard drive, the files change from being contiguous on the disk to being scattered across the disk. This can cause the operating system to slow down. The hard drive has to search several areas on the hard drive platter to find the entire file. For one file, the effect of the process is minimal. When this occurs for thousands of files, however, the process will physically slow down the reading and writing of a file to a hard drive.

To defragment a drive in Windows XP, double-click **My Computer** on the desktop. Right-click the drive that you want to optimize. Choose **Properties**. On the **Tools** tab, click **Defragment Now**.

To defragment a drive in Windows Vista, double-click **Computer** on the desktop. Right-click the drive that you want to optimize. Choose **Properties**. On the **Tools** tab, click **Defragment Now**.

To defragment a drive in Windows 7, click **Computer** in the Start Menu. Right-click the drive that you want to optimize. Choose **Properties**. On the **Tools** tab, click **Defragment Now**.

System Information

Administrators can use the System Information tool, as shown in Figure 2, to collect and display information about local and remote computers. The System Information tool quickly finds information about software, drivers, hardware configurations, and computer components. The information can be used by support personnel to diagnose and troubleshoot a computer.

To access the System Information tool, use the following path in the Start Menu:

All Programs > Accessories > System Tools > System Information

It may be necessary to send a file containing all of the information about a computer to another technician or help desk. To export a System Information file, click **File > Export**, type the name of the file, choose a location, and click **Save**.

The System Information tool in Windows XP also provides quick access to many other tools:

- **Net Diagnostics** – This tool runs a variety of network tests to troubleshoot network-related problems.
- **System Restore** – This tool creates or loads a restore point for restoring the computer's system files and settings.
- **File Signature Verification Utility** – This tool checks for system files that are not digitally signed.
- **DirectX Diagnostic Tool** – This tool reports detailed information about the DirectX components that are installed on your computer.
- **Dr Watson** – This tool debugs Windows to help diagnose program errors.

To view the information from a remote computer, follow these steps:

- Choose **View > Remote Computer**.
- Choose **Remote Computer on the Network**.
- Type the name of the computer that you want to view and click **OK**.

Remote Desktop Protocol

The Remote Desktop Protocol allows you to use an application such as Remote Desktop or Remote Assistance to connect to another computer. These applications allow you to view the screen and control the computer's mouse and keyboard as though you were local to that computer. The Remote Desktop Protocol is also used to operate computers that are connected to the network but do not have a monitor, mouse, or keyboard.

To access the Remote Desktop program, use the following path:

All Programs > Accessories > Remote Desktop Connection

Remote Assistance uses the Remote Desktop Protocol to allow another user to connect to your computer, see your computer screen, and chat over a network. With your permission, the remote user can control your computer.

To access the Remote Assistance program in Windows XP, use the following path:

Start > Help and Support > Invite a friend to connect to your computer with Remote Assistance > Invite someone to help you

In Windows Vista, use the following path:

Start > Help and Support > Use Windows Remote Assistance to get help from a friend or offer help > Invite someone you trust to help you

In Windows 7, use the following path:

Start > Help and Support > More support options > Windows Remote Assistance > Invite someone you trust to help you

An e-mail invitation must be sent to another user to allow them to connect and control your computer. After the recipient has received the invitation, the recipient can see your desktop and help you.

Virtual Memory

Virtual memory, shown in Figure 3, allows the CPU to address more memory than is installed in the computer. This is done so that every application can address the same amount of memory. Virtual memory is a swap or page file that is constantly read in and out of RAM. Typically, you should let Windows manage the size of the swap file. The only setting that you should change is the location of the swap file. You must be a member of the administrator group to make this change.

To access virtual memory settings in Windows XP, use the following path:

Start > Control Panel > System > Advanced tab > Performance, click the Settings button > Advanced tab

To access virtual memory settings in Windows Vista, use the following path:

Start > Control Panel > System > Advanced system settings > Continue > Advanced tab > Performance, click the Settings button > Advanced tab

To access virtual memory settings in Windows 7, use the following path:

Start > Control Panel > System and Security > System > Advanced system settings > Advanced tab > Performance, click the Settings button > Advanced tab

Administrative Tools

Windows contains many tools that are used to manage permissions and users or configure computer components and services. You must possess administrator rights to access administrative tools. These are some of the most common administrative tools:

1. **Event Viewer** – This tool logs a history of events regarding applications, security, and the system.
2. **Computer Management** – This tool allows you to access administrative areas such as System Tools, Storage, and Services and Applications.
3. **Services** – This tool allows you to manage all of the services on local and remote computers.
4. **Performance Monitor** – This tool displays and logs real-time information about the processors, disks, memory, and network usage for the computer.

Services

Services are a type of application that runs in the background to achieve a specific goal or wait for a request. Only necessary services should be started to reduce unnecessary security risks. See Figure 4 for some of the services available on a computer. Four settings, or states, can be used to control the services:

- Automatic
- Manual
- Disabled
- Stopped

If a service, such as DHCP or Automatic Updates, is set to automatic, it will start up when the PC starts. Manual services, such as the support of an UPS, need to be manually configured to work. Some services may be stopped or disabled for troubleshooting purposes, such as turning off the print spooler when there are printer problems.

Device Manager

The Device Manager, shown in Figure 5, allows you to view all of the settings for devices in a computer such as the IRQ, I/O address, and the DMA settings. It can also be used to diagnose and resolve device conflicts. From the Device Manager, you can view details about the installed driver version. You can also perform the following functions:

- Update a driver
- Roll back a driver
- Uninstall a driver
- Disable a device

The Device Manager uses special icons to indicate a problem with a specific device:

- A red X appears on the icon of devices that have been disabled.
- An exclamation point inside a yellow triangle appears on the icon of devices that do not have properly installed drivers or do not respond.

Task Manager

The Task Manager, shown in Figure 6, allows you to view information about applications that are currently running. From the Task Manager, you can perform many functions:

- Close any applications that have stopped responding.
- Start a new task.
- Monitor the performance of the CPU.
- Monitor the performance of the virtual memory.
- View all processes that are currently running.
- View information about network connections.

There are five tabs within the Task Manager:

- **Applications** – This tab shows all of the applications that are running. From this tab, you can create, switch to, or end tasks using the buttons at the bottom of this tab.
- **Processes** – This tab shows all of the processes that are running. A process is any set of instructions running on the computer that were started by a user, a program, or the operating system. From this tab, you can end processes or set process priorities.
- **Performance** – This tab shows the CPU and page file usage of the computer.
- **Networking** – This tab shows the usage of all network adapters in the computer.
- **Users** – This tab shows all users that are logged on the computer. From this tab, you can disconnect remote users or log off local users.

Windows 7 has an additional tab called Services, which displays all the installed services and their status, and from which you can start and stop services.

Be careful when ending processes. Ending a process will cause the program to end immediately without saving any information. Ending a process that Windows has initiated may prevent the system from running correctly. Be careful when changing the priority of processes. If you change the priority of a process, the change might adversely affect the performance of the computer.

System Monitor

The System Monitor in Windows XP, shown in Figure 7, is part of the Performance Console and displays real-time information about the processors, disks, memory, and network usage of the computer. You can easily summarize these activities through histograms, graphs, and reports. In Windows Vista and Windows 7, Performance Monitor is used to collect real-time information.

You must have administrative privileges to access the Performance Monitor console. To view the Performance Monitor console in Windows XP, use the following path:

Start > Control Panel > Administrative Tools > Performance

To view the Performance Monitor console in Windows Vista, use the following path:

Start > Control Panel > Administrative Tools > Reliability and Performance Monitor > Continue

To view the Performance Monitor console in Windows 7, use the following path:

Start > Control Panel > System and Security > Administrative Tools > Performance Monitor > Performance Monitor

The data that the System Monitor displays is used to help you understand how the workload of the computer affects system resources such as the CPU, memory, and network. Use the System Monitor to display detailed data about the resources that you are using when performing specific tasks or multiple tasks. The data that you collect helps you to determine when an upgrade might be necessary. The System Monitor shows how configuration changes or system tuning affects the computer. For example, use the System Monitor to determine whether a newly installed program needs more RAM in the computer.

Regional and Language Options

You can change many of the standards and formats for numbers, currencies, dates, and time by using the Regional and Language Options settings. These settings also allow you to change the primary language or install an additional language. To access the Regional and Language Options settings in Windows XP, use the following path:

Start > Control Panel > Regional and Language Options

In Windows Vista and Windows 7, access the Regional and Language Options settings, using the following path:

Start > Control Panel > Clock, Language, and Region > Region and Language

Temporary Files

Almost every program uses temporary files, which are usually automatically deleted when the application or the operating system is finished using them. However, some of the temporary files must be deleted manually. Since temporary files take up hard drive space that could be used for other files, it is a good idea to check and delete as necessary every two or three months. Temporary files are usually located in the following locations in Windows XP:

- C:\Temp
- C:\Tmp
- C:\Windows\Temp
- C:\Windows\Tmp
- C:\Documents and Settings\%USERPROFILE%\Local Settings\Temp

Temporary files are usually located in the following locations in Windows Vista and Windows 7:

- C:\Windows\Temp
- C:\Users\%USERPROFILE%\AppData\Local\Temp

NOTE: In the paths above, %USERPROFILE% is an environment variable set by the operating system with the name of the user that is currently logged on to the computer. Environment variables are used by the operating system, applications, and software installation programs. To see the environment variables that are configured on your Windows XP computer, use the following path:

Start > Control Panel > System > Advanced > Environment Variables

To see the environment variables that are configured on your Windows Vista, use the following path:

Start > Control Panel > System > Advance system settings > Advanced tab > Environmental Variables

To see the environment variables that are configured on your Windows 7 computer, use the following path:

Start > Control Panel > System and Security > System > Advanced System Settings > Advanced tab > Environment Variables

IT Essentials v4.1 LI 12.2.5 Identify procedures and utilities used to optimize the performance of browsers

CompTIA A+ 220-702 Objective

3.2 Install and configure a small office home office (SOHO) network

To access the cache settings in Windows Vista or Windows 7, open an IE browser window and choose **Tools > Internet Options**. In the **Browsing History** area, click **Settings**.

IT Essentials v4.1 LI 12.2.9 Windows CLI commands

CompTIA A+ 220-702 Objective

2.1 SFC

NOTE: To run the SFC program in Windows Vista and Windows 7, you must first open a console with administrator privileges using the following path:

Start > All Programs > Accessories > right-click Command Prompt > Run as administrator > Yes

IT Essentials v4.1 LI 12.3 Describe how to upgrade operating systems

CompTIA A+ 220-702 Objective

2.0 Operating Systems

- Only Windows Vista can be upgraded to Windows 7.

IT Essentials v4.1 LI 12.4.1 Schedule automatic tasks and updates

CompTIA A+ 220-702 Objective

2.3 Task Scheduler

To open the Scheduled Tasks wizard in Windows Vista or Windows 7, select **Start > All Programs > Accessories > System Tools > Task Scheduler**. Select **Create Basic Task** or **Create Task**, as shown in Figure 2.

IT Essentials v4.1 LI 12.5.2 Identify common problems and solutions

CompTIA A+ 220-702 Objective

2.4 Devices drivers failure (input / output devices)

2.4 Application install, start or load failure

2.4 Device / service failed to start

2.4 Device / program in registry not found

2.4 System Performance and Optimization, Aero settings, UAC

The auto restart function can be disabled in the Advanced Startup Options menu. Figures 1, 2, and 3 are charts of common operating system problems and solutions.

New Figure 3

Common Windows 7 Problems and Solutions

Older programs are not compatible with Windows 7.	The programs were installed before upgrading to Windows 7.	Reinstall the programs in Compatibility Mode.
A device is not detected, installed, or working properly.	A driver is not compatible with Windows 7.	Update the driver to a Windows 7 driver.
The DVD drive is not found after upgrading to Windows 7.	A registry error prevents Windows 7 from recognizing the DVD drive.	Open the Windows registry and navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Class\{4D36E965-E325-11CE-BFC1-08002BE10318}. Delete the UpperFilters and LowerFilters registry keys. Restart the computer.
The Aero theme does not work.	The graphics card does not support Aero. The graphics card driver is not up to date.	Replace the graphics card with one that meets the minimum hardware requirements for Windows 7. Update the driver for the graphics card.
Windows 7 runs slowly.	Unnecessary visual effects are slowing down the GUI.	In the Performance Information and Tools control panel, select Adjust for best performance in the Performance Options dialog box.
Windows 7 UAC appears too often.	The UAC setting is too high for basic computing.	Lower the UAC setting in the Change User Account Control settings dialog box of the User Accounts control.