CHAPTER
10 Maintaining Windows

In this chapter, you will learn:

- How to set up and perform scheduled preventive maintenance tasks to keep Windows healthy
- How to prepare for disaster by keeping good backups of user data and Windows system files
- How to use commands to manage files and folders and how to use Disk Management to manage hard drives
- How to configure Windows to use a language other than English

In Chapter 7, you learned how to install Windows. This chapter takes you to the next step in learning how to support a Windows operating system: maintaining the OS after it is installed. Most Windows problems stem from poor maintenance. If you are a PC support technician responsible for the ongoing support of several computers, you can make your work easier and your users happier by setting up and executing a good maintenance plan for each computer you support. A well-maintained computer gives fewer problems and performs better than one that is not maintained. In this chapter, you will learn how to schedule regular maintenance tasks, how to prepare for disaster by setting up backup routines for user data and system files, how to use commands to manage files and folders, how to manage a hard drive, and how to set up Windows to use multiple languages.

In this chapter, we use Windows 7 as our primary OS, but, as you read, know that we'll point out any differences between Windows 7 and Windows Vista/XP so that you can use this chapter to study all three operating systems. As you read, you might consider following the steps in the chapter first using a Windows 7 system, and then going through the chapter again using a Windows Vista or XP system.

Vista Differences For more details about maintaining Windows Vista and Windows XP, see the extra content, "Maintaining Windows Vista and XP," in the online content for this book at *www.cengagebrain.com*. See the Preface for more information.

SCHEDULED PREVENTIVE MAINTENANCE

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Regular preventive maintenance can keep a Windows computer performing well for years. At least once a month, you need to verify critical Windows settings and clean up the hard drive. These skills are covered in this part of the chapter. If you notice the system is slow as you do this maintenance, you need to dig deeper to optimize Windows. How to optimize Windows is covered in Chapter 11.

Notes When you're responsible for a computer, be sure to keep good records of all that you do to maintain, upgrade, or fix the computer. When performing preventive maintenance, take notes and include those in your documentation.

VERIFY CRITICAL WINDOWS SETTINGS

Three Windows settings discussed here are critical for keeping the system protected from malware and hackers. Users sometimes change these settings without realizing their importance. Check the three settings and, if you find settings that are incorrect, take time to explain to the primary user of the computer how important these settings are. Here are the critical Windows settings you need to verify:

- ***Windows Updates.*** Install any important Windows updates or service packs that are waiting to be installed and verify that Windows Updates is configured to automatically allow updating. You learned how to configure Windows Updates in Chapter 7.
- ***Antivirus software.*** To protect a system against malicious attack, you also need to verify that antivirus software is configured to scan the system regularly and that it is up to date. If you discover it is not scanning regularly, take the time to do a thorough scan for viruses.
- ***Network location setting.*** To secure the computer against attack from the network, check that the Windows 7 network location is set correctly. How to verify the network location is covered in Chapter 7. Further details of configuring network security are discussed in Chapter 15.

CLEAN UP THE HARD DRIVE

For best performance, Windows needs about 15 percent free space on the hard drive that it uses for defragmenting the drive, for burning CDs and DVDs, and for a variety of other tasks, so it's important to delete unneeded files occasionally. In addition, you can improve drive performance and free up space by defragmenting the drive, checking the drive for errors, compressing folders, and moving files and folders to other drives. All these tasks are discussed in the following subsections. We begin by learning where Windows puts important folders on the drive.

DIRECTORY STRUCTURES

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Folder or directory locations you need to be aware of include those for user files, program files, and Windows data. In the folder locations given in this discussion, we assume Windows is installed on drive C:.

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User Profile Namespace

When a user first logs onto Windows 7/Vista, a **user profile** is created, which is a collection of user data and settings, and consists of two general items:

- ***A user folder together with its subfolders.*** These items are created under the C:\Users folder, for example, C:\Users\Jean Andrews. This folder contains a group of subfolders collectively called the **user profile namespace**. (In general, a namespace is a container to hold data, for example, a folder.)
- ***Ntuser.data.*** Ntuser.dat is a file stored in the C:\Users*username* folder and contains user settings. Each time the user logs on, the contents of this file are copied to a location in the registry.

Program Files

Here is where Windows stores program files unless you select a different location when a program is installed:

- Program files are stored in C:\Program Files for 32-bit versions of Windows.
- In 64-bit versions of Windows, 64-bit programs are stored in the C:\Program Files folder, and 32-bit programs are stored in the C:\Program Files (x86) folder.

Here are folders that applications and some utilities use to launch programs at startup:

- A program file or shortcut to a program file stored in the C:\Users*username*\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup folder launches at startup for an individual user.
- A program file or shortcut to a program file stored in the C:\ProgramData\Microsoft\Windows\Start Menu\Programs\Startup folder launches at startup for all users.

Folders for Windows Data

An operating system needs a place to keep hardware and software configuration information, user preferences, and application settings. This information is used when the OS is first loaded and when needed by hardware, applications, and users. Windows uses a database called the **registry** for most of this information. In addition, Windows keeps some data in text files called **initialization files**, which often have an .ini or .inf file extension.

Here are some important folder locations used for the registry and other Windows data:

- ***Registry location.*** The Windows registry is stored in the C:\Windows\system32\config folder.
- ***Backup of the registry.*** A backup of the registry is stored in the C:\Windows\system32\config\RegBack folder.
- ***Fonts.*** Fonts are stored in the C:\Windows\Fonts folder.
- ***Temporary files.*** These files, which are used by Windows when it is installing software and performing other maintenance tasks, are stored in the C:\Windows\Temp folder.
- ***Offline files.*** Offline files are stored in the client-side caching (CSC) folder, which is C:\Windows\CSC. This folder is created and managed by the **Offline Files** utility, which allows users to work with files in the folder when the computer is not connected to the corporate network. Later, when a connection happens, Windows syncs up the offline files and folders stored in the C:\Windows\CSC folder with those on the network.

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Differences for Windows XP

For Windows XP, the user profile is stored in the C:\Documents and Settings folder, for example, C:\Documents and Settings\Jean Andrews. The subfolders under the user folder are organized differently under XP than under Windows 7/Vista.

Notes Most often, Windows is installed on drive C:, although in a dual boot environment, one OS might be installed on C: and another on a different drive. For example, Windows Vista can be installed on C: and Windows 7 installed on E:. If the drive letter of the Windows volume is not known, it is written in Microsoft documentation as *%SystemDrive%*. For example, the location of the Program Files folder is written as *%SystemDrive%*\Program Files.

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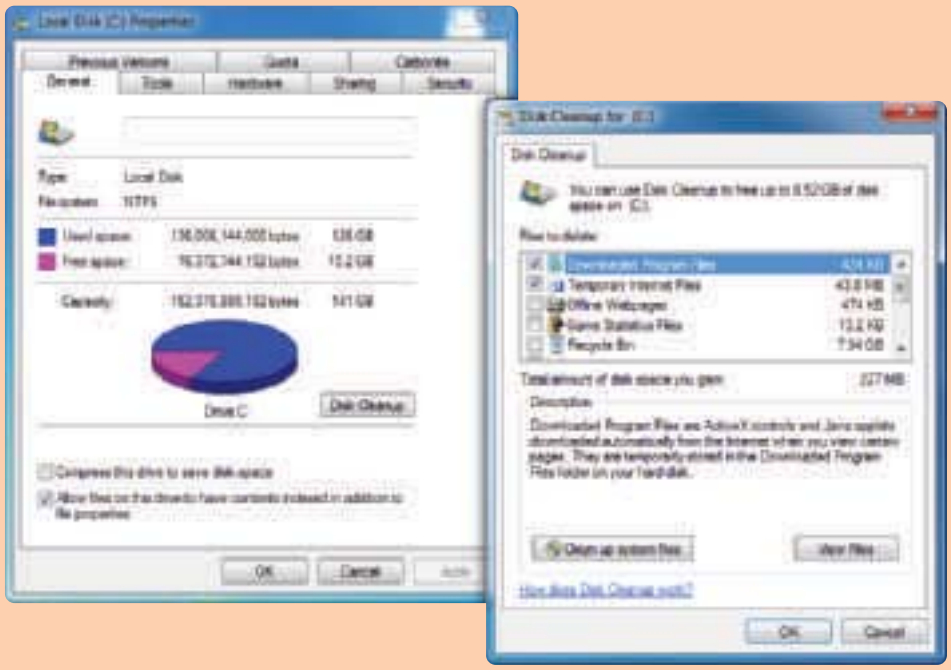
USE THE DISK CLEANUP UTILITY

Begin cleaning up the drive by finding out how much free space the drive has. Then use the Windows **Disk Cleanup** utility to delete temporary files on the drive.

APPLYING CONCEPTS

Follow these steps for Windows 7/Vista to find out how much free space is on the drive, and use Disk Cleanup. The XP Disk Cleanup utility works about the same as Windows 7/Vista.

1. Open Windows Explorer and right-click the volume on which Windows is installed, most likely drive C:. Select **Properties** from the shortcut menu. The drive Properties box appears, as shown on the left side of Figure 10-1. You can see the free space on this drive C: is 15.2 GB, which is about 11 percent of the volume.



Source: Microsoft Windows 7

Figure 10-1 Use Windows Explorer to find out how much free space is on drive C

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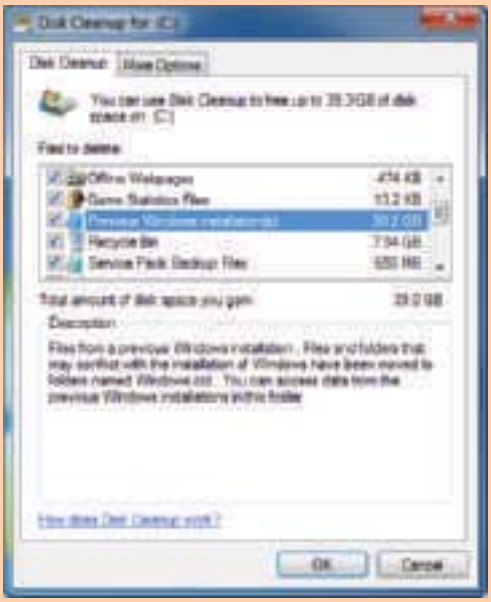
2. On the General tab, click **Disk Cleanup**. (You can also access the utility by clicking **Start** and entering **cleanmgr.exe** in the *Search* box.) Disk Cleanup calculates how much space can be freed and then displays the Disk Cleanup box, shown on the right side of Figure 10-1. Select the files you want to delete.
3. Click **Clean up system files** to see temporary system files that you can also delete. The Disk Cleanup box on the left side of Figure 10-2 shows the result for one computer. Notice in the figure the option to delete files from a Previous Windows installation(s), which can free up 30.2 GB of hard drive space. This space is used by the Windows.old folder, which was created when Windows 7 was installed as an upgrade from Vista. Windows 7 setup stored the old Windows, Program Files, and User folders in the Windows.old folder. If the user assures you that no information, data, or settings are needed from the old Windows installation, it's safe to delete these files to free up the 30.2 GB.



Source: Microsoft Windows 7

Source: Microsoft Windows 7

Figure 10-2 Clean up system files no longer needed in order to free up disk space

4. If you still need more free space, click the **More Options** tab (see the right side of Figure 10-2) in the Disk Cleanup box. In the Programs and Features area, click **Clean up**. You are taken to the Programs and Features window where you can uninstall unneeded software to recover that space. Also on the More Options tab in the Disk Cleanup box, when you click **Clean up** under the System Restore and Shadow Copies area, Windows will delete all but the most recent restore points that are created by System Restore. (You will learn more about System Restore later in this chapter.) In Windows XP, the More Options tab offers a third option to delete installed Windows components that you don't need.

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DEFRAG THE HARD DRIVE

Two types of hard drives are magnetic hard disk drives (HDDs), which contain spinning platters, and solid state drives (SSDs), which contain flash memory. For magnetic hard drives, Windows 7/Vista automatically defragments the drive once a week. To **defragment** is to rearrange fragments or parts of files on the drive so each file is stored on the drive in contiguous clusters.

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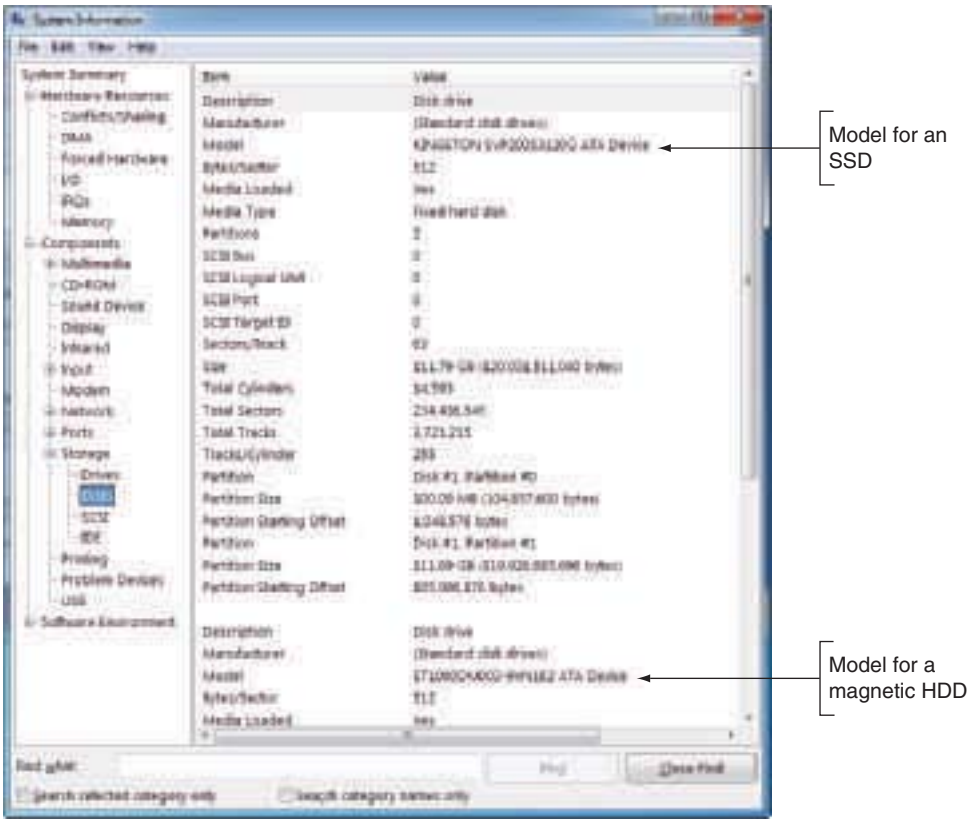
In a file system, a **cluster**, also called a **file allocation unit**, is a group of whole sectors. The number of sectors in a cluster is fixed and is determined when the file system is first installed. A file is stored in whole clusters, and the unused space at the end of the last cluster, called **slack**, is wasted free space. As files are written and deleted from a drive, clusters are used, released, and used again. New files written on the drive can be put in available clusters spread over the drive. Over time, drive performance is affected when the moving read/write arm of a magnetic drive must move over many areas of the drive to collect all the fragments of a file. Defragmenting a drive rewrites files in contiguous clusters and improves drive performance.

Because a solid state drive has no moving parts, defragmenting does not improve read/write time. In fact, defragmenting a solid state drive can reduce the life of the drive and is not recommended. Windows 7/Vista disables defragmenting solid state drives.

Notes To find out what type of hard drive is installed, use Device Manager or the System Information window. For example, Figure 10-3 shows the System Information window where we have drilled down to the Storage Disks area, and you can see the model information for two hard drives installed in the system. A quick search on the web shows the first hard drive is an SSD and the second hard drive is a magnetic HDD.



Source: Microsoft Windows 7

Figure 10-3 Use the System Information window to find the brand and model number for the hard drive

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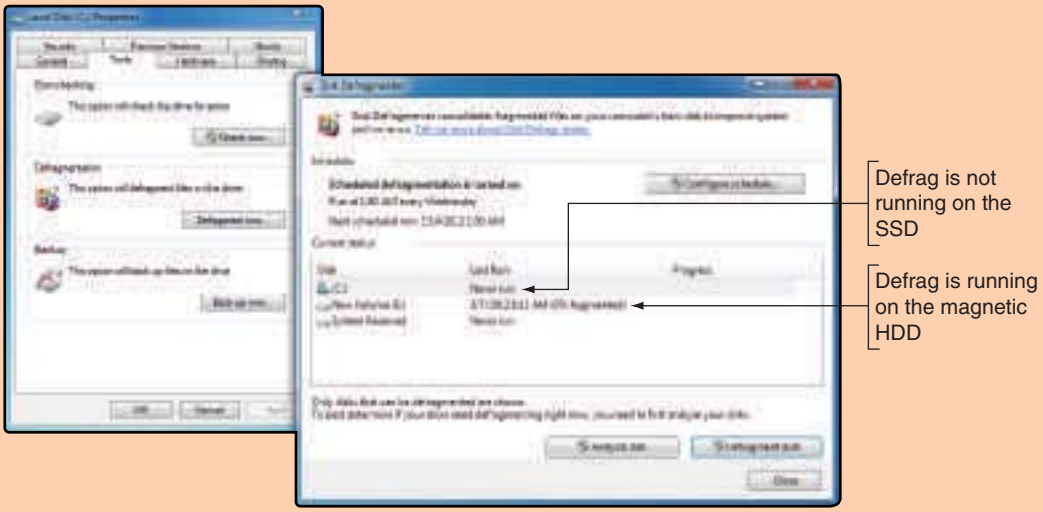
APPLYING CONCEPTS

To verify that Windows 7/Vista is defragmenting a magnetic drive and not defragmenting a solid state drive, do the following:

1. Use Windows Explorer to open the Properties box for a drive and click the **Tools** tab (see the left side of Figure 10-4), and then click **Defragment now**. In the Disk Defragmenter box (see the right side of Figure 10-4), verify the defrag settings. This system has two hard drives installed. Drive C: in this system is an SSD and is not being defragmented. Drive E: is a magnetic HDD and is scheduled for defragging. To have Windows tell you if a drive needs defragmenting, select a drive and click **Analyze disk**.



Source: Microsoft Windows 7

Figure 10-4 Windows is set to automatically defragment a magnetic hard drive once a week

2. If the drive is more than 10 percent fragmented, click **Defragment now** to defrag the drive immediately. The process can take a few minutes to several hours. If errors occur while the drive is defragmenting, check the hard drive for errors and try to defragment again.

Later in the chapter, you will learn to use the Defrag command to defrag the drive from a command prompt window.

For Windows XP, you must manually defragment the drive, and it's a good idea to do so once a week. For Windows XP, first close all open applications. Using Windows Explorer, open the Properties box for the drive. Click the **Tools** tab and then click **Defragment Now**. In the Disk Defragmenter window, click **Defragment** to start the process. Figure 10-5 shows XP defragmenting a volume. You can also use the Defrag command in XP.

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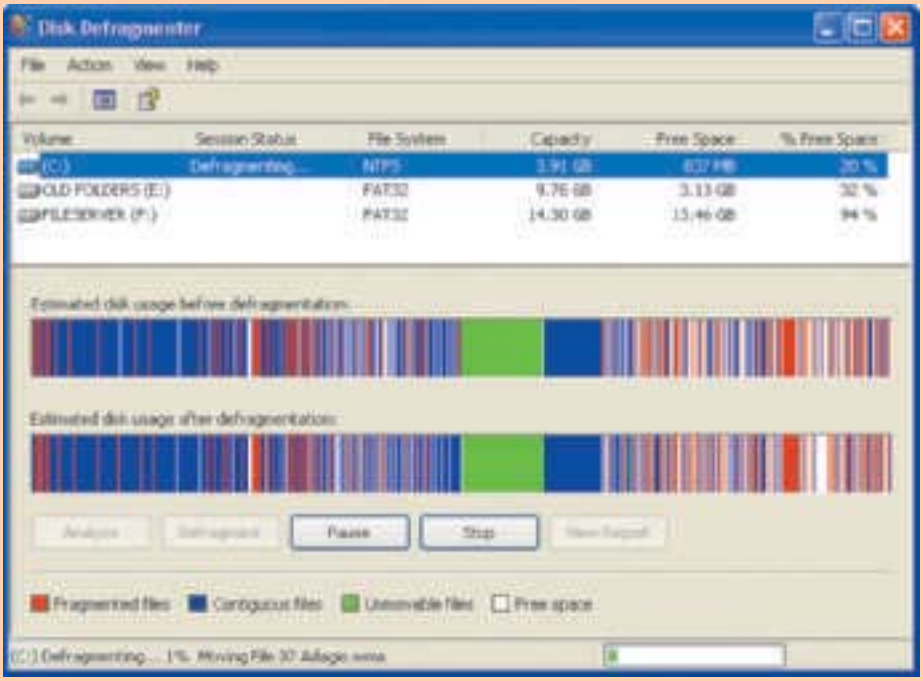

Source: Microsoft Windows XP

Figure 10-5 Windows XP defragmenting a volume

Notes Windows XP Professional offers Task Scheduler that can be used to launch a program to run at scheduled times such as weekly. Using it, you can set XP to automatically defragment the hard drive each week. How to use Task Scheduler is covered in Chapter 11.

CHECK THE HARD DRIVE FOR ERRORS

Next, to make sure the drive is healthy, you need to search for and repair file system errors. The error checking utility searches for bad sectors on a volume and recovers the data from them if possible. It then marks the sector as bad so that it will not be reused.

To use the error checking utility, in Windows Explorer, right-click the drive, and select **Properties** from the shortcut menu. Click the **Tools** tab, as shown in the left side of Figure 10-6, and then click **Check now**. In the Check Disk dialog box, check **Automatically fix file system errors** and **Scan for and attempt recovery of bad sectors**, as shown in the right side of Figure 10-6, and then click **Start**. For the utility to correct errors on the drive, it needs exclusive use of all files on the drive. When Windows has exclusive use, the drive is called a locked drive. Therefore, a dialog box appears telling you about the problem and asking your permission to scan the drive the next time Windows starts. Reboot the system and let her rip.

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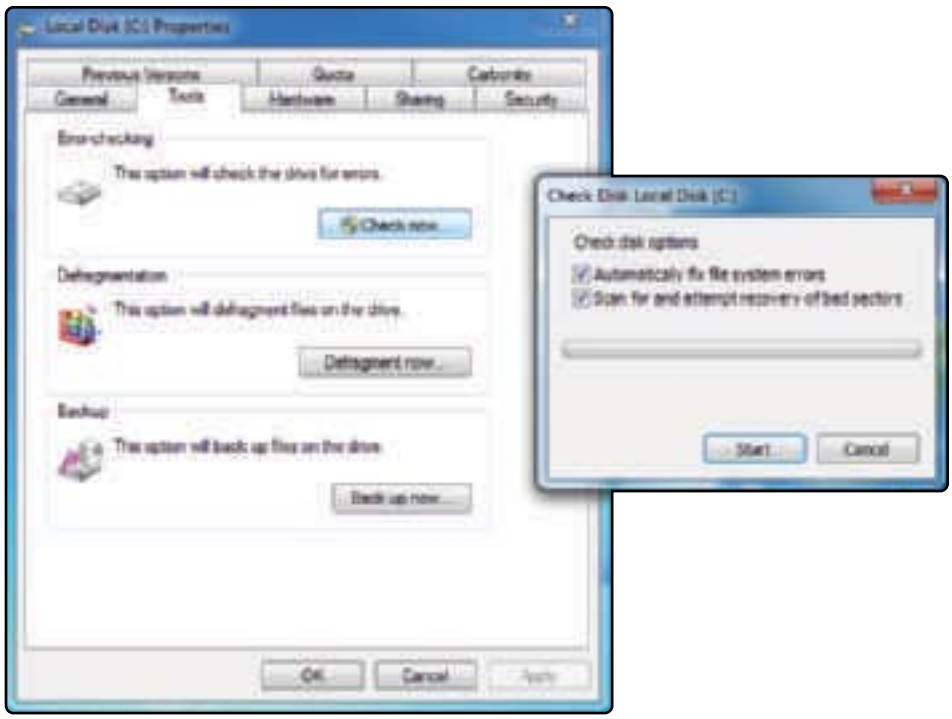

Source: Microsoft Windows 7

Figure 10-6 Windows repairs hard drive errors under the drive's Properties box using Windows Explorer

Later in the chapter, you learn how to use the Chkdsk command from the command prompt window, which also launches the error checking utility.

FREE UP SPACE ON THE DRIVE

To free up some space on the hard drive, consider these tips:

- ***Uninstall software you no longer use.*** Doing so will free up some space on the hard drive, and, if the software loads a service or program during Windows startup, Windows startup might see performance improvement.
- ***Move data off the drive.*** Consider moving home videos, movies, photos, and other data to an external hard drive or burning them to DVDs or CDs.
- **Move programs off the drive.** If your Windows volume needs more free space, you can uninstall a program and reinstall it on a second hard drive installed in the system. An installation routine usually gives you the option to point to another location to install the program other than the default C:\Program Files or C:\Program Files (x86) folder.
- ***Use drive or folder compression.*** Windows offers drive and folder compression that can save on hard drive space. However, it is not recommended that you compress the volume on which Windows is stored. To compress a folder or file on an NTFS drive, open the file or folder **Properties** box and click **Advanced** on the General tab. Then click **Compress contents to save disk space** and click **OK**.

Notes Windows 7/Vista installs on an NTFS volume, but if a second volume on the drive is formatted using the FAT32 file system, you can convert the volume to NTFS. For large drives, NTFS is more efficient and converting might improve performance. NTFS also offers better security and file and folder compression. For two Microsoft Knowledge Base articles about converting from FAT to NTFS, go to *support.microsoft.com* and search for articles 156560 and 314097. The first article discusses the amount of free space you'll need to make the conversion, and the second article tells you how to convert.

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MOVE THE VIRTUAL MEMORY PAGING FILE

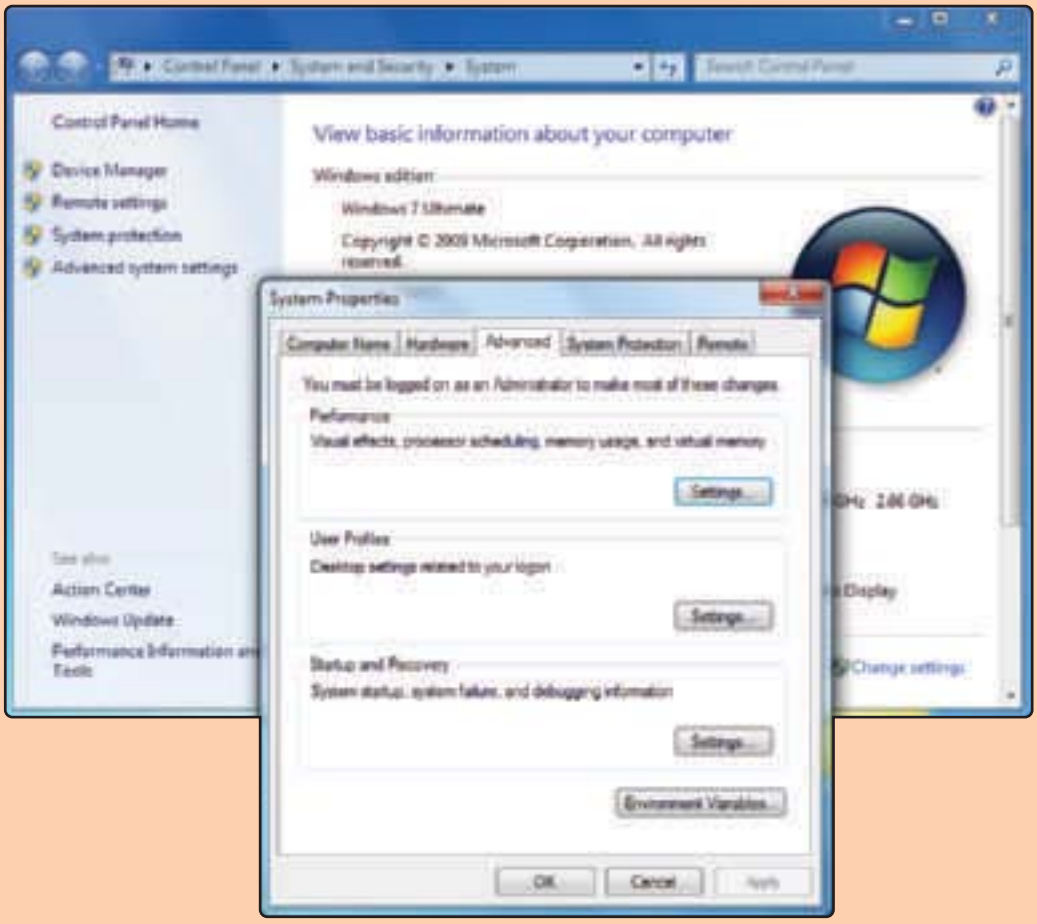
Windows uses a file, Pagefile.sys, in the same way it uses memory. This file is called **virtual memory** and is used to enhance the amount of RAM in a system. Normally, the file, **Pagefile.sys**, is a hidden file stored in the root directory of drive C:. To save space on drive C:, you can move Pagefile.sys to another partition on the same hard drive or to a different hard drive, but don't move it to a different hard drive unless you know the other hard drive is at least as fast as this drive. If the drive is at least as fast as the drive on which Windows is installed, performance should improve. Also, make sure the new volume has plenty of free space to hold the file—at least three times the amount of installed RAM.

A+ Exam Tip The A+ 220-802 exam expects you to know how to configure virtual memory for optimal performance.

APPLYING CONCEPTS

To change the location of Pagefile.sys in Windows 7/Vista, follow these steps:

1. Open the System window and click **Advanced system settings** in the left pane. The System Properties box appears with the Advanced tab selected (see Figure 10-7).



Source: Microsoft Windows 7

Figure 10-7 Manage virtual memory using the System Properties box

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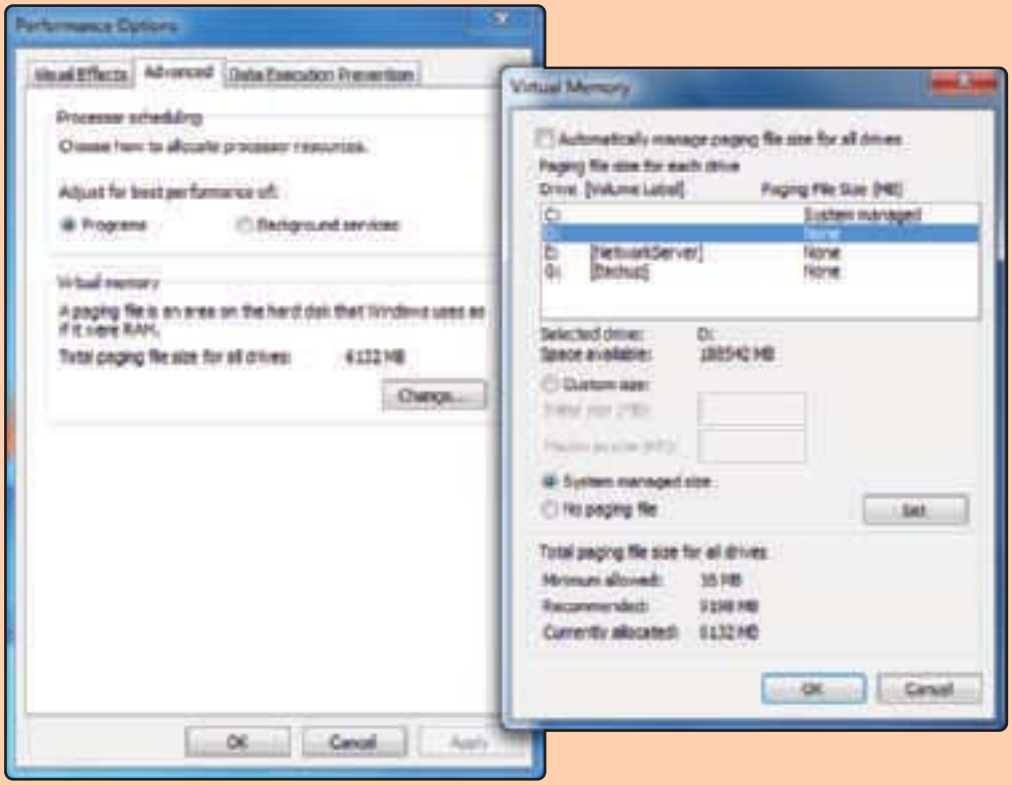
2. In the Performance section, click **Settings**. In the Performance Options box, select the **Advanced** tab and click **Change**. The Virtual Memory dialog box appears.
3. Uncheck **Automatically manage paging file size for all drives** (see Figure 10-8). Select the drive where you want to move the paging file. For best performance, allow Windows to manage the size of the paging file. If necessary, select **System managed size** and click **Set**.



Source: Microsoft Windows 7

Figure 10-8 Move Pagefile.sys to a different drive

4. Click **OK**. Windows informs you that you must restart the system for the change to take effect. Click **OK** to close the warning box.
5. Click **Apply** and close all boxes. Then restart the system.

For Windows XP, click **Start**, right-click **My Computer**, select **Properties**, and then click the **Advanced** tab. In the Performance section, click **Settings**, click the **Advanced** tab, and then click **Change**. The Virtual Memory box that appears looks and works similarly to the Windows 7 Virtual Memory box in Figure 10-8.

If you still don't have enough free space on the Windows volume, consider adding a second hard drive to the system. In fact, if you install a second hard drive that is faster than the Windows hard drive, know that reinstalling Windows on the faster hard drive will improve performance. You can then use the slower and older hard drive for data.

Notes If the Windows system is still slow and sluggish, know that in Chapter 11 you'll learn more about how to optimize Windows so it performs better.

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Hands-on Project 10-1 Performing Routine Maintenance

Log onto Windows 7 using a Standard user account. Step through the process described in the chapter to do the following routine maintenance. As you work, note which chores you cannot perform unless you know the password to an administrator account. Do the following:

1. Verify critical Windows settings in Windows Update, antivirus software, and the Network and Sharing Center.
2. Use the Disk Cleanup utility to clean up the hard drive.
3. Find out the brand and model of the hard drive that holds Windows. What is the brand and model? Is the drive a magnetic or solid state drive? How do you know?
4. Check defrag settings and change them as necessary. Analyze the hard drive and determine if it needs defragmenting. If so, defrag the drive.
5. Check the hard drive for errors.
6. Compress the My Documents folder.

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Now let's look at how to perform on-demand backups and to schedule routine backups.

BACKUP PROCEDURES

A backup is an extra copy of a data or software file that you can use if the original file becomes damaged or destroyed. Losing data due to system failure, a virus, file corruption, or some other problem really makes you appreciate the importance of having backups.

Notes With data and software, here's a good rule of thumb: If you can't get along without it, back it up.

APPLYING CONCEPTS

Dave was well on his way to building a successful career as a PC repair technician. His PC repair shop was doing well, and he was excited about his future. But one bad decision changed everything. He was called to repair a server at a small accounting firm. The call was on the weekend when he was normally off, so he was in a hurry to get the job done. He arrived at the accounting firm and saw that the problem was an easy one to fix, so he decided not to do a backup before working on the system. During his repairs, the hard drive crashed and all data on the drive was lost—four million dollars' worth! The firm sued, Dave's business license was stripped, and he was ordered to pay the money the company lost. A little extra time to back up the system would have saved his whole future. True story!

Because most of us routinely write data to the hard drive, in this section, we focus on backing up from the hard drive to another media. However, when you store important data on any media—such as a flash drive, external hard drive, or CD—always keep a copy of the data on another media. Never trust important data to only one media.

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In this part of the chapter, you will learn how to make a disaster recovery plan and then learn how to use Windows 7 to back up user data, critical Windows system files, and entire volumes.

PLANNING FOR DISASTER RECOVERY

The time to prepare for disaster is before it occurs. If you have not prepared, the damage from a disaster will most likely be greater than if you had made and followed disaster recovery plans. Suppose the hard drive on your PC stopped working and you lost all its data. What would be the impact? Are you prepared for this to happen? Here are decisions you need to make for your backup and recovery plans:

- ***Decide on the backup destination.*** For example, online backup, network drive, CD, DVD, Blu-Ray, SD card, USB flash drive, external hard drive, or other media. Here are points to keep in mind:
  - For individuals or small organizations, an online backup service such as Carbonite (carbonite.com) or Mozy (mozy.com) is the easiest, most reliable, and most expensive solution. You pay a yearly subscription for the service, and they guarantee your backups, which are automatically done when your computer is connected to the Internet. If you decide to use one of these services, be sure to restore files from backup occasionally to make sure your backups are happening as you expect and you can recover a lost file.
  - Even though it's easy to do, don't make the mistake of backing up your data to another partition or folder on your same hard drive. When a hard drive crashes, most likely all partitions go down together and you will have lost your data and your backup. Back up to another media and, for extra safety, store it at an off-site location.
- ***Decide on the backup software.*** Windows offers a backup utility. However, you can purchase third-party backup software that might offer more features. For example, the external hard drive by Western Digital shown in Figure 10-9 comes with backup software that lets you schedule backups and allows you to select the number of generations of backups you keep. However, before you decide to use an all-in-one backup system such as this one, be certain you understand the risks of not keeping backups at an off-site location and keeping all your backups on a single media.

Figure 10-9 The Western Digital My Passport Essential 750 GB external drive uses USB 3.0 and comes with backup software

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- ***Decide how simple or complex your backup strategy needs to be.*** A backup and recovery plan for individuals or small organizations might be very simple. But large organizations might require backups be documented each day, scheduled at certain times of the day or night, and recovery plans tested on a regular basis. Know the requirements of your organization when creating a backup and recovery plan. As a general rule of thumb, back up data for about every 4 to 6 hours of data entry. This might mean a backup needs to occur twice a day, daily, weekly, or monthly. Find out the data entry habits of workers before making your backup schedule and deciding on the folders or volumes to back up.

After you have a backup plan working, test the recovery plan. In addition, you need to occasionally test the recovery plan to make sure all is still working as you expect. Do the following:

- ***Test the recovery process.*** Erase a file on the hard drive, and use the recovery procedures to verify that you can re-create the file from the backup. This verifies that the backup medium works, that the recovery software is effective, and that you know how to use it. After you are convinced that the recovery works, document how to perform it.
- ***Keep backups in a safe place and routinely test them.*** Don't leave a backup disc lying around for someone to steal. Backups of important and sensitive data should be kept under lock and key. In case of fire, keep enough backups off-site so that you can recover data even if the entire building is destroyed. Routinely verify that your backups are good by performing a test recovery of a backed-up file or folder. Backups are useless if the data on the backup is corrupted.

Now let's see how to back up user data, important Windows system files, and entire volumes using Windows 7/Vista/XP tools.

A+ Exam Tip The A+ 220-802 exam expects you to know how to create and use backups and best practices when scheduling backups.

CREATE AND USE BACKUPS IN WINDOWS 7

Using Windows 7 Backup and Restore, you can back up user data and/or the volume on which Windows is installed. When you set up a backup schedule, you select the folders to back up and you can also choose to back up the Windows volume.

BACK UP THE WINDOWS VOLUME

The backup of the Windows 7 volume is called the **system image**. Here are points to keep in mind when creating a system image and using it to recover a failed Windows volume:

- ***A system image includes the entire drive C: or other drive on which Windows is installed.*** When you restore a hard drive using the system image, everything on the volume is deleted and replaced with the system image.
- ***A system image must always be created on an internal or external hard drive.*** When using Backup and Restore to back up your data folders, you can include the system

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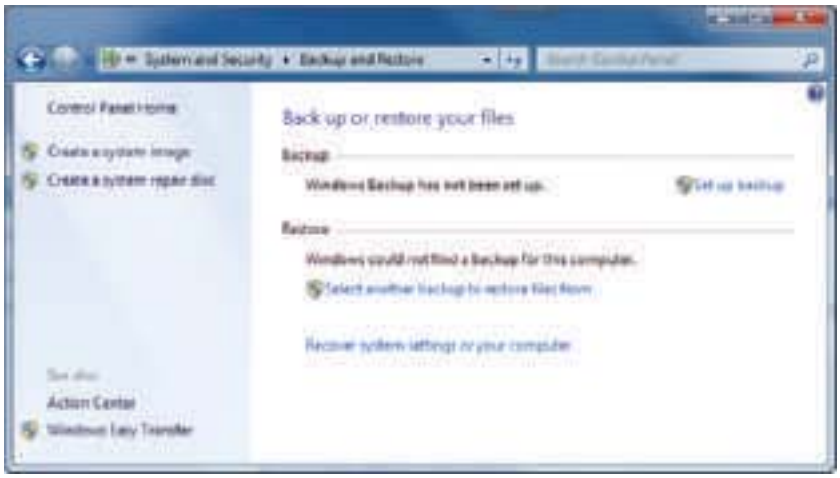
image in the backup procedure. Even if the files and folders are being copied to a USB drive, CD, or DVD, the system image will always be copied to a hard drive.

- ***Don't depend just on the system image as your backup.*** You should also back up individual folders that contain user data. If individual data files or folders need to be recovered, you cannot rely on the system image because recovering data using the system image would totally replace the entire Windows volume with the system image.
- ***You can create a system image any time after Windows is installed, and then you can use this image to recover from a failed hard drive.*** To create the image, click **Start**, **All Programs**, **Maintenance**, and **Backup and Restore**. The Backup and Restore window opens (see Figure 10-10). Click **Create a system image** and follow the directions on-screen. Using the system image to recover a failed hard drive is called reimaging the drive. The details of how to reimage the drive are covered in Chapter 14.

Caution Before creating a system image on a laptop, plug the laptop into an AC outlet so that a failed battery will not interrupt the process.



Source: Microsoft Windows 7

Figure 10-10 Use the Backup and Restore window to create a system image

Notes The system image you create using Backup and Restore can be installed only on the computer that was used to create it. The method used to create a hardware-independent system image, called a standard image, is discussed in Chapter 7 and Appendix D.

BACK UP USER DATA

Because data on a hard drive is likely to change often, it's important to back it up on a regular schedule. Using Backup and Restore, you can create a backup schedule that can include any folder on the hard drive and the system image. The folders and volume are first backed up entirely (called a full backup). Then on the schedule you set, any file or folder is backed up that has changed or been created since the last backup (called an incremental backup). Occasionally, Windows does another full backup.

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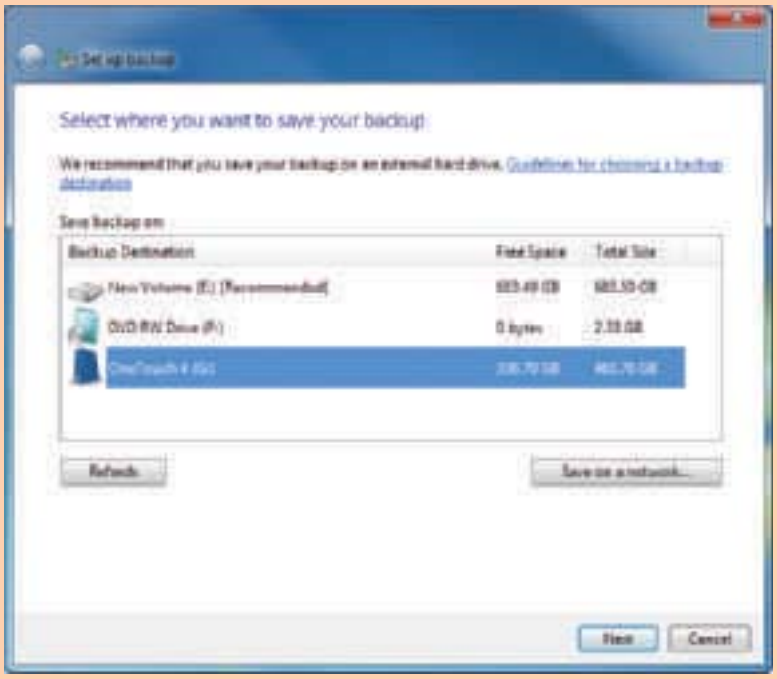
APPLYING CONCEPTS SET UP A BACKUP SCHEDULE

Follow these steps to learn how to set up a backup schedule using Windows 7 Backup and Restore:

1. Open the Backup and Restore window. If no backup has ever been scheduled on the system, the window will look like the one in Figure 10-10. Click **Set up backup**.

Notes You can open Backup and Restore using the Start, All Programs menu, using the Control Panel (in Control Panel, click **Back up your computer**), or by typing **Backup and Restore** in the *Search* box.

2. In the next dialog box (see Figure 10-11), select the media to hold the backup. In Figure 10-11, choices are volume E: (a second internal hard drive), the DVD drive, and OneTouch (an external hard drive). Make your selection and click **Next**.



Source: Microsoft Windows 7

Figure 10-11 Select the destination media to hold the backup

Notes Windows 7 Professional, Ultimate, and Enterprise editions allow you to save the backup to a network location. To use a shared folder on the network for the backup destination, click **Save on a network** (see Figure 10-11). In the resulting box (see Figure 10-12), click **Browse** and point to the folder. Also enter the username and password on the remote computer that the backup utility will use to authenticate to that computer when it makes the backup. You cannot save to a network location when using Windows 7 Home editions. For these editions, the button *Save on a network* is missing in the window where you select the backup destination.

3. In the next box, you can allow Windows to decide what to back up or decide to choose for yourself. Select **Let me choose** so that you can select the folders to back up. Click **Next**.

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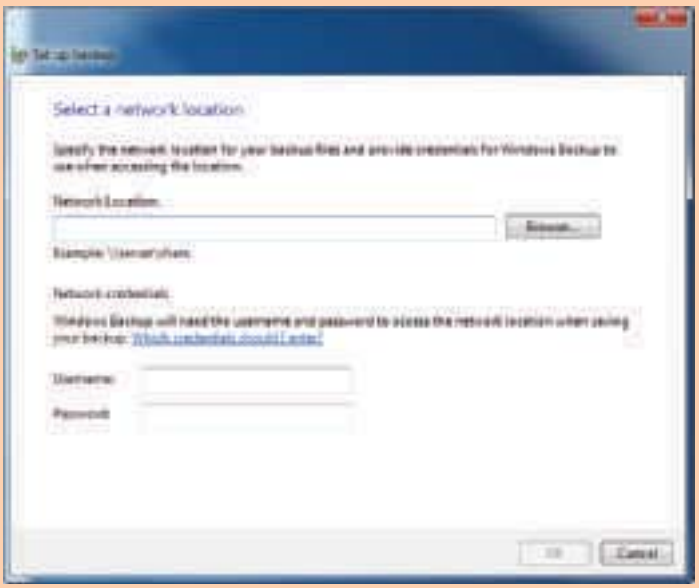
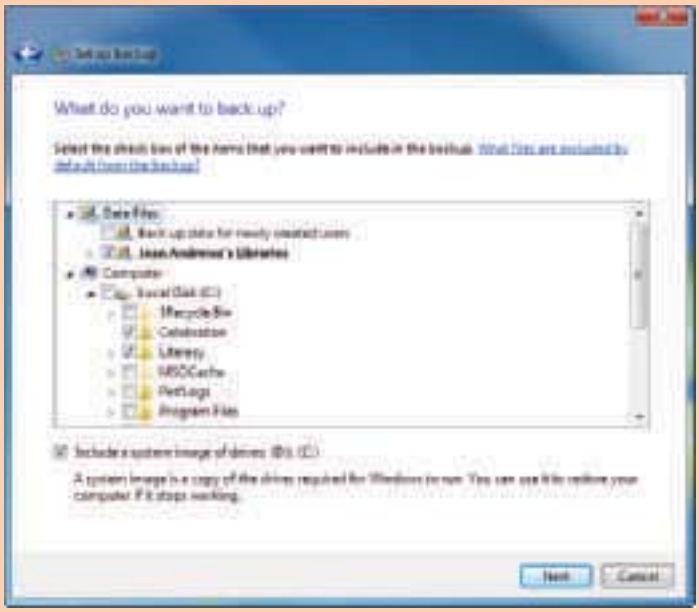


Source: Microsoft Windows 7

Figure 10-12 Select the folder on the network to hold the backup and enter the username and password for the remote computer

4. In the next box (see Figure 10-13), select the libraries and folders you want to back up. You can click the white triangle beside Local Disk (C:) to drill down to any folder on the hard drive for backup. Check folders or libraries to back up. If the backup media can hold the system image, the option to include the image is selected by default. If you don't want to include the image, uncheck it. Click **Next** to continue. Here are folders that might contain important user data:

   - Application data is usually found in C:\Users*username*\AppData.
   - Internet Explorer favorites are in C:\Users*username*\Favorites.
   - Better still, back up the entire user profile at C:\Users*username*.
   - Even better, back up all user profiles at C:\Users.

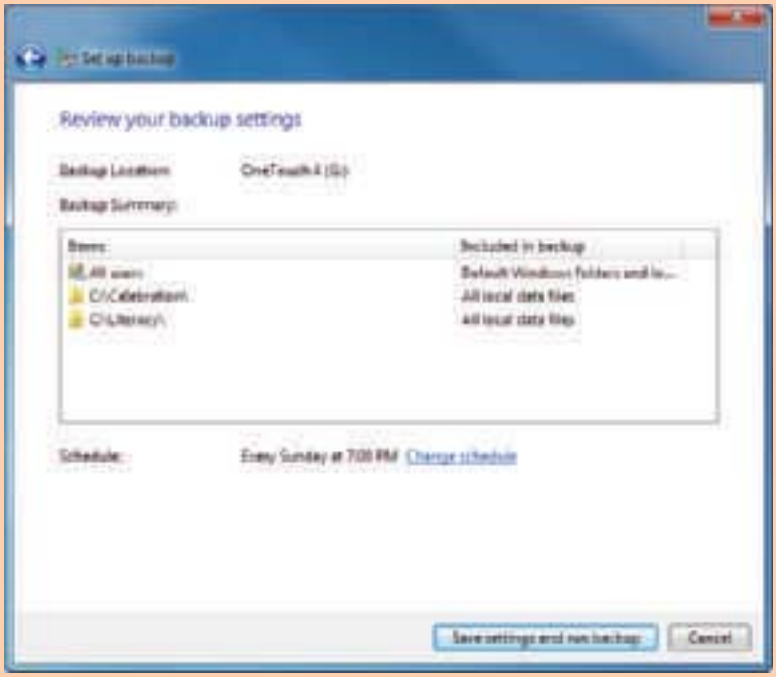


Source: Microsoft Windows 7

Figure 10-13 Select the folders or libraries to include in the backup

A+ 220-802 1.1, 1.7

5. In the next box, verify the correct folders and libraries are selected (see Figure 10-14). Notice in the figure, the backup is scheduled to run every Sunday at 7:00 PM. To change this schedule, click **Change schedule**. In the next box, you can choose to run the backup daily, weekly, or monthly and select the time of day. Make your selections and click **OK**.



Source: Microsoft Windows 7

Figure 10-14 By default, Windows runs a backup each week at the same day and time

6. Review your backup settings and click **Save settings and run backup**. The backup proceeds. A **shadow copy** is made of any open files so that files that are currently open are included in the backup.

A+ Exam Tip The A+ 220-802 exam expects you to know what a shadow copy is.

If you want to later change the settings for your scheduled backup, open the Backup and Restore window. Notice in Figure 10-15 the window has changed from that shown earlier in Figure 10-10. It now shows the details about the scheduled backup. To change the backup settings, click **Change settings**. Follow the process to verify or change each setting for the backup. Also notice in the left pane of Figure 10-15 that you can turn off the scheduled backup by clicking **Turn off schedule**.

Notes One limitation of Windows Backup and Restore is that you can have only one scheduled backup routine.

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Source: Microsoft Windows 7

Figure 10-15 View and change backup setting

Notes After Windows does a full backup, it only backs up files that have changed since the last full backup. Occasionally, it does another full backup. Each full backup is called a backup period. It keeps as many backup periods as it has space on the backup media. As the media fills, it deletes the oldest backup periods. To see how space is used on your backup media, click **Manage space** in the Backup and Restore window. In the Manage Windows Backup disk space, you can click **View backups** to delete a backup period, but be sure to keep the most recent backup periods.

10

Recover a Corrupted or Lost File or Folder

If a data file or folder later gets corrupted, you can recover the file or folder using the Backup and Restore window or using the Previous Versions tab of the file or folder Properties box. To use the Backup and Restore window, follow these steps:

1. Make the backup media available to the computer by inserting the backup disc, connecting the external hard drive, or other method.
2. Open the **Backup and Restore** window. Scroll down to the bottom of the window and click **Restore my files**. The Restore Files box appears (see Figure 10-16).

Notes If the *Restore my files* button is missing from the Backup and Restore window, your backup media might not be available to Windows. You might need to plug in the media and then use Windows Explorer to verify you can access the backup folder on the media.

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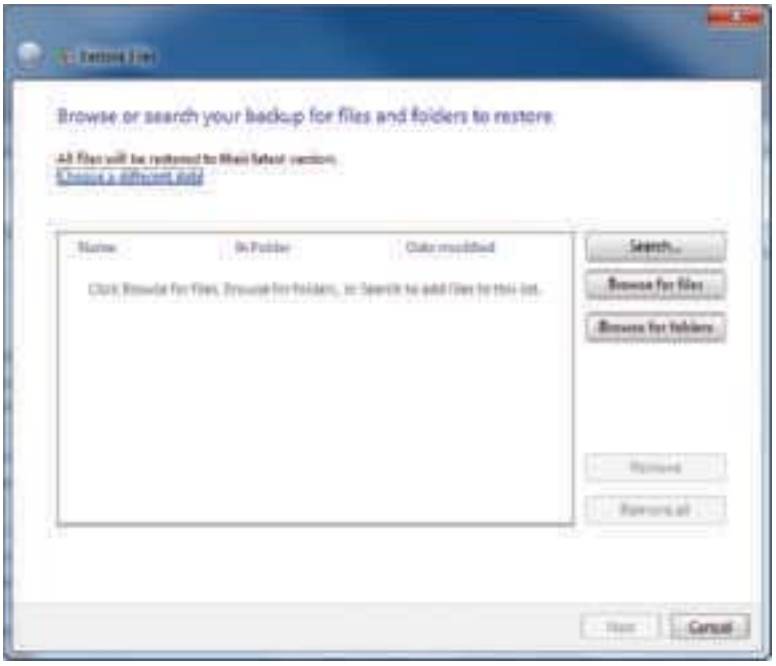


Source: Microsoft Windows 7

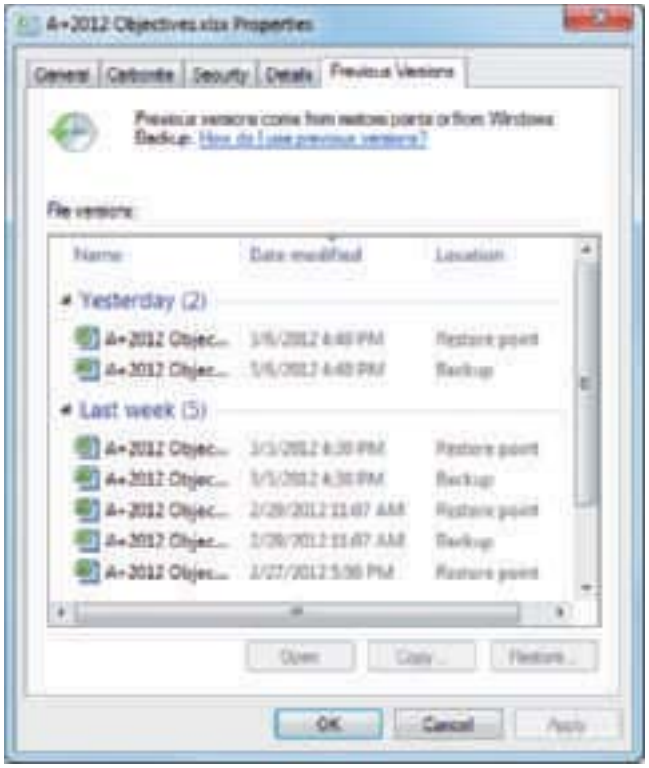
Figure 10-16 Locate the files and folders on the backup media to restore

3. Use one of the three buttons on the window to locate the file or folder. *Search* allows you to search for a file or folder when you only know part of the filename or folder name. *Browse for files* allows you to drill down to the file to restore. *Browse for folders* allows you to search for the folder to restore. You can locate and select multiple files or folders to restore. Then follow the directions on-screen to restore all the selected items.

A previous version of a file or folder is a version that was previously created by the Backup and Restore utility or by System Protection when it created a restore point for the system. To restore a folder or file to a previous version, follow these steps:

1. Use Windows Explorer to copy (do not move) the corrupted folder or file to a new location. When you restore a file or folder to a previous version, the current file or folder can be lost and replaced by the previous version. By saving a copy of the current file or folder to a different location, you can revert to the copy if necessary.
2. Right-click the file or folder and select **Restore previous versions** from the shortcut menu. The Properties box for the file or folder appears with the Previous Versions tab selected. Windows displays a list of all previous versions of the file or folder it has kept (see Figure 10-17).
3. Select the version you want and click **Restore**. A message box asks if you are sure you want to continue. Click **Restore** and then click **OK**.
4. Open the restored file or folder and verify it is the version you want. If you decide you need another version, delete the file or folder and copy the file or folder you saved in Step 1 back into the original location. Then return to Step 2 and try again, this time selecting a different previous version.

A+ 220-802 1.1, 1.7



Source: Microsoft Windows 7

Figure 10-17 Restore a file or folder from a previous version

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A+ 220-802 1.1, 1.5, 1.7, 1.8

BACK UP WINDOWS SYSTEM FILES

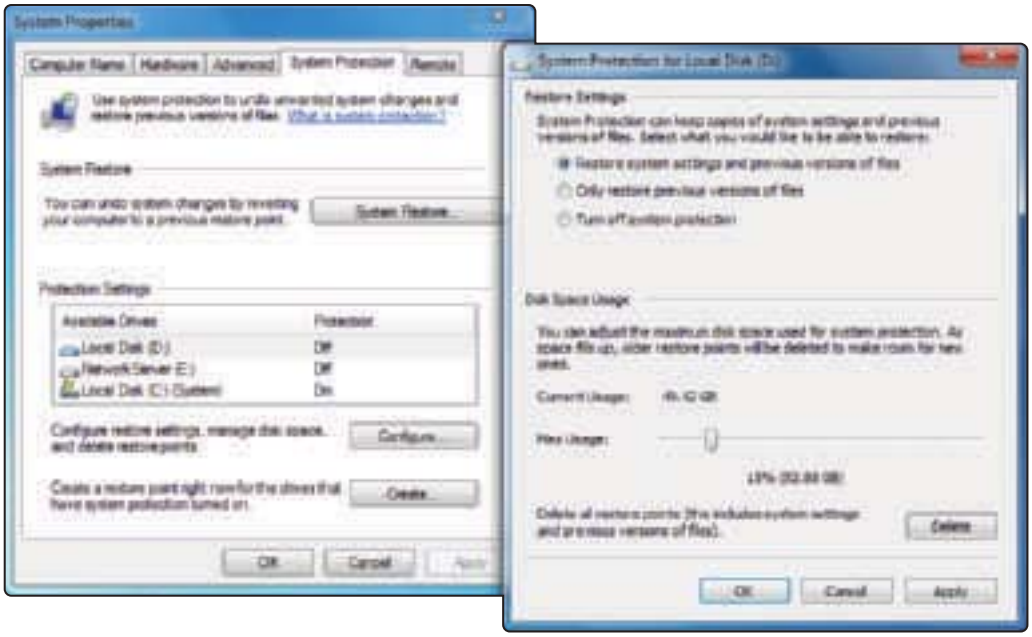
The Windows **System Protection** utility automatically backs up system files and stores them on the hard drive at regular intervals and just before you install software or hardware. These snapshots of the system are called **restore points** and include Windows system files that have changed since the last restore point was made. A restore point does not contain all user data, and you can manually create a restore point at any time.

Make Sure System Protection Is Turned On

To make sure System Protection has not been turned off, open the System window and click **System protection**. The System Protection tab of the System Properties box appears (see the left side of Figure 10-18). Make sure Protection is turned on for the drive containing Windows, which indicates that restore points are created automatically. In Figure 10-18, Protection for drive C: is on and other drives are not being protected. To make a change, click **Configure**. The System Protection box on the right side of the figure appears. If you make a change to this box, click **Apply** and then click **OK**.

Restore points are normally kept in the folder C:\System Volume Information, which is not accessible to the user. Restore points are taken at least every 24 hours, and they can use up to 15 percent of disk space. If disk space gets very low, restore points are no longer made, which is one more good reason to keep about 15 percent or more of the hard drive free.

A+ 220-802 1.1, 1.5, 1.7, 1.8



Source: Microsoft Windows 7

Figure 10-18 Make sure System Protection is turned on for the volume on which Windows is installed

Manually Create a Restore Point

To manually create a restore point, use the System Protection tab of the System Properties box, as shown on the left side of Figure 10-18. Click **Create**. In the System Protection box, enter a name for the restore point, such as "Before I tested software," and click **Create**. The restore point is created.

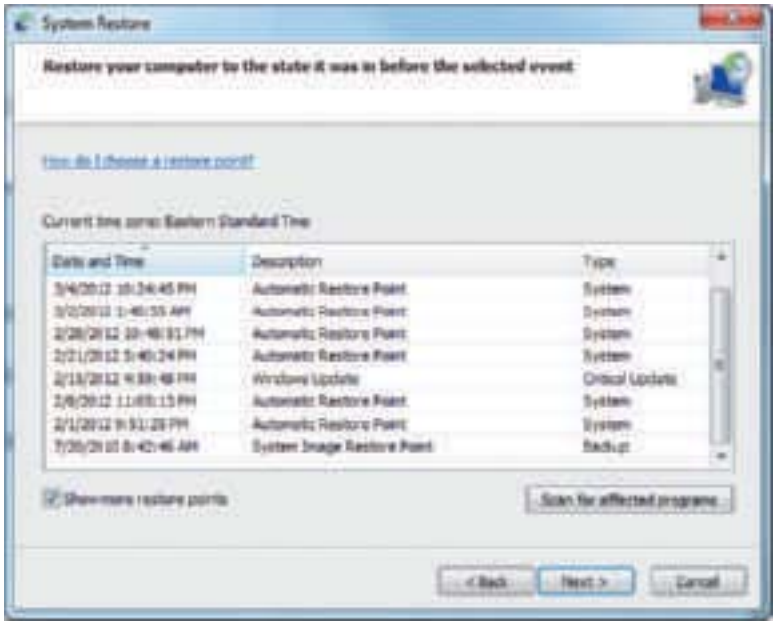
Apply a Restore Point

System Restore restores the system to its condition at the time a restore point was made. If you restore the system to a previous restore point, user data on the hard drive will not be altered, but you can affect installed software and hardware, user settings, and OS configuration settings. When you use System Restore to roll back the system to a restore point, any changes made to these settings after the restore point was created are lost; therefore, always use the most recent restore point that can fix the problem so that you make the least intrusive changes to the system.

To return the system to a previous restore point, do the following:

1. Click **Start**, **All Programs**, **Accessories**, **System Tools**, and **System Restore**. The System Restore box opens. Click **Next**.
2. In the next box, the most recent restore points appear. For most situations, the most recent is the one to select so as to make the least possible changes to your system. If you want to see other restore points, check **Show more restore points**. Select a restore point (see Figure 10-19) and click **Next**.
3. Windows asks you to confirm your selection. Click **Finish** and respond to the warning box. The system restarts and the restore point is applied.

A+ 220-802 1.1, 1.5, 1.7, 1.8



Source: Microsoft Windows 7

Figure 10-19 Select a restore point

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Points to Remember About System Restore

System Restore is a great tool to try to fix a device that is not working, restore Windows settings that are giving problems, or solve problems with applications. Although it's a great tool in some situations, it does have its limitations. Keep these points in mind:

- ***Point 1:*** Restore points replace certain keys in the registry but cannot completely rebuild a totally corrupted registry. Therefore, System Restore can recover from errors only if the registry is somewhat intact.
- ***Point 2:*** The restore process cannot remove a virus or worm infection. However, it might help you start a system that is infected with a virus that launches at startup. After Windows has started, you can then use antivirus software to remove the infection.
- ***Point 3:*** System Restore might create a new problem. I've discovered that whenever I use a restore point, antivirus software gets all out of whack and sometimes even needs reinstalling. Therefore, use restore points sparingly.
- ***Point 4:*** System Restore might make many changes to a system. If you know which change caused a problem, try to undo that particular change first. The idea is to use the least invasive solution first. For example, if updating a driver has caused a problem, first try Driver Rollback to undo that change. Driver Rollback is performed using Device Manager.
- ***Point 5:*** System Restore won't help you if you don't have restore points to use. System Protection must be turned on so that restore points are automatically created.
- ***Point 6:*** Restore points are kept in a hidden folder on the hard drive. If that area of the drive is corrupted, the restore points are lost. Also, if a user turns System Protection off, all restore points are lost.
- ***Point 7:*** Viruses and other malware sometimes hide in restore points. To completely clean an infected system, you need to delete all restore points by turning System Protection off and back on.

A+ 220-802 1.1, 1.5, 1.7, 1.8

- *Point 8:* If Windows will not start, you can launch System Restore using startup recovery tools, which you will learn to use in Chapter 14.

Vista Differences Windows Vista uses different backup methods than Windows 7 to back up user data, system files, and the Windows volume. The backup of the Vista volume is called the **Complete PC Backup**. To find out more about Vista backups, see Appendix B.

XP Differences Windows XP uses the **Automated System Recovery (ASR)** tool to back up the Windows XP volume. XP calls the backed-up system files that are critical to Windows operation the **system state data**. To find out more about XP backups, see Appendix C.

Hands-on Project 10-2 Using System Restore

Do the following to find out how System Restore works and how it can affect a system:

1. Create a restore point.
2. Make a change to the display settings.
3. Change the desktop background.
4. Create a new text file in your My Documents folder.
5. Restore the system using System Restore.

Is the text file still in your My Documents folder? Are the other changes still in effect? Why or why not?

MANAGING FILES, FOLDERS, AND STORAGE DEVICES

A+ 220-802 1.2

In this part of the chapter, you learn to manage files and folders on the hard drive and other storage devices using commands in a command prompt window and to manage hard drive partitions and volumes using the Disk Management utility. We begin our discussion with how partitions and file systems work in Windows.

HOW PARTITIONS AND FILE SYSTEMS WORK

A hard drive is organized using sectors, partitions, volumes, and file systems. Here's how it all works:

- All data is stored on a hard drive in sectors, sometimes called records. Each **sector** on the drive is the same size, and for most hard drives, that size is 512 bytes. Sector markings used to organize the drive are done before it leaves the factory in a process called **low-level formatting**. The size of a sector and the total number of sectors on a drive determine the drive capacity. Today's drive capacities are measured in GB (gigabytes, roughly one million bytes) or TB (terabytes, roughly one trillion bytes).

A+ 220-802 1.2

Notes For magnetic hard drives, each platter is divided into concentric circles called **tracks**, and each track is divided into sectors (see Figure 10-20). Magnetic drive sectors are usually 512 bytes, but sectors on SSDs can be larger: 4 KB or 16 KB.

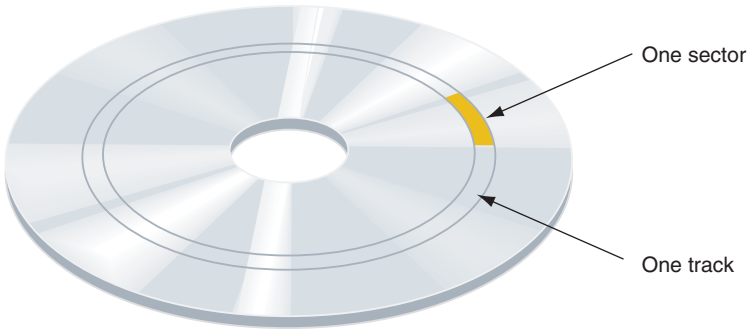


Figure 10-20 A magnetic hard drive is divided into concentric circles called tracks, and tracks are divided into sectors

- A drive is further divided into one or more **partitions**. Windows can track up to four partitions on a drive. It keeps a map of these partitions in a **partition table** stored in the very first sector on the hard drive called the **Master Boot Record (MBR)**.
- A drive can have one, two, or three **primary partitions**, also called **volumes**. The fourth partition is called an **extended partition** and can hold one or more volumes called **logical drives**. Figure 10-21 shows how a hard drive is divided into three primary partitions and one extended partition.

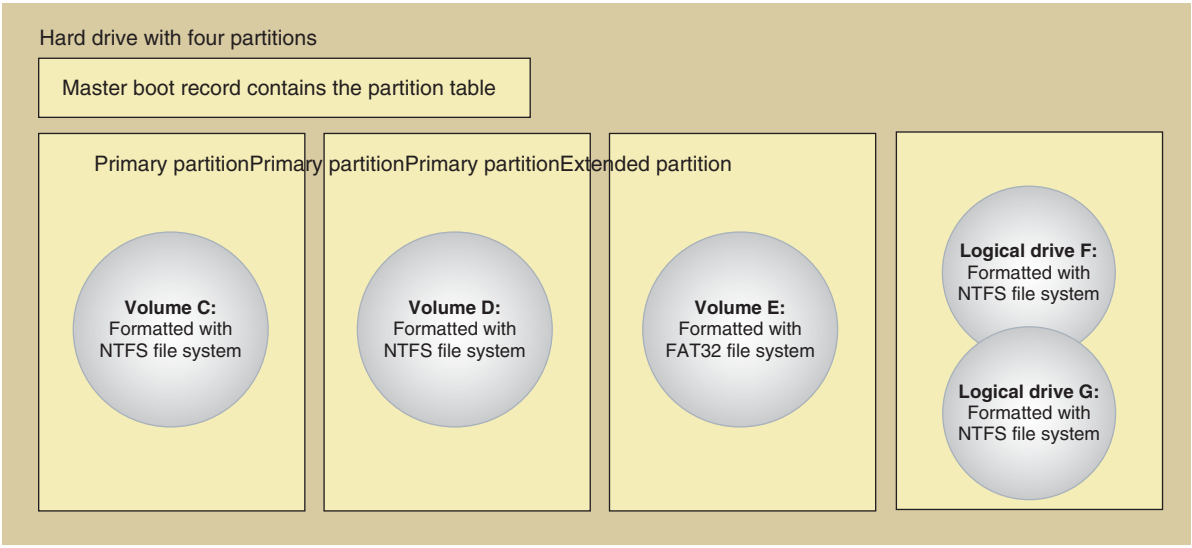


Figure 10-21 A hard drive with four partitions; the fourth partition is an extended partition

A+ Exam Tip The A+ 220-802 exam expects you to know the difference between a primary and extended partition and between a volume and logical drive.

A+ 220-802 1.2

- Before a volume or logical drive can be used, it must be assigned a drive letter such as C: or D: and formatted using a file system. A **file system** is the overall structure an OS uses to name, store, and organize files on a drive. Windows 7 supports three types of file systems for hard drives: NTFS, FAT32, and exFAT. NTFS is the most reliable and secure and is used for the volume on which Windows is installed. Installing a drive letter, file system, and root directory on a volume is called **formatting** the drive, also called a **high-level format**, and can happen during the Windows installation.
- One of the primary partitions can be designated the **active partition**, which is the bootable partition that startup BIOS turns to when searching for an operating system to start up.
- Windows assigns two different functions to hard drive partitions holding the OS (see Figure 10-22). The **system partition**, normally drive C:, is the active partition of the hard drive. This is the partition that contains the OS program to start up Windows. This boot program is called the OS boot manager or boot loader. The other partition, called the **boot partition**, is the partition where the Windows operating system is stored.

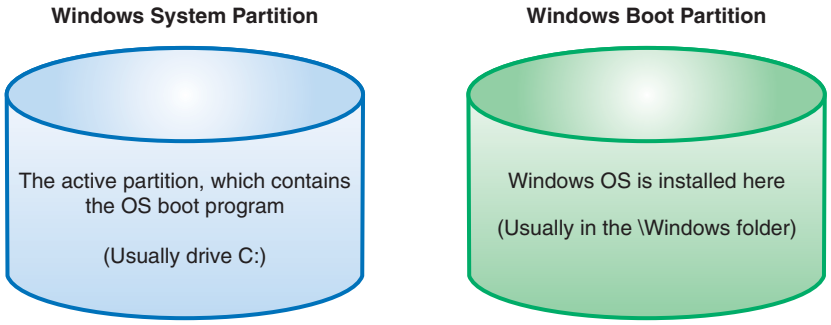
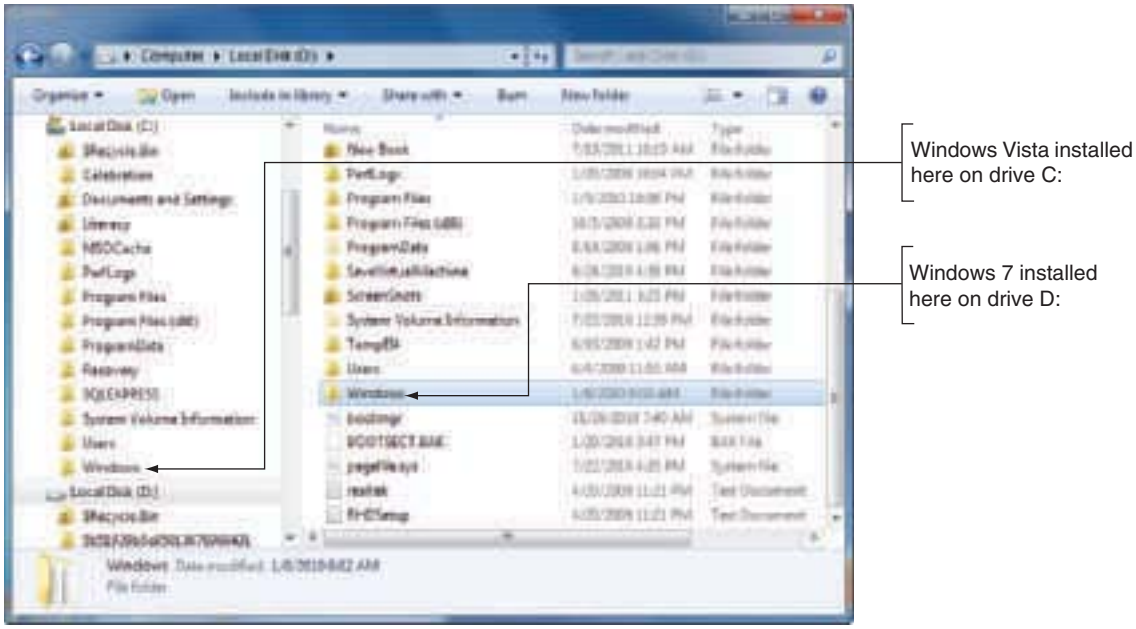


Figure 10-22 Two types of Windows hard drive partitions

Notes Don't be confused by the terminology here. It is really true that, according to Windows terminology, the Windows OS is on the boot partition, and the boot program is on the system partition, although that might seem backward. The computer starts or boots from the system partition and loads the Windows operating system from the boot partition.

For most installations, the system partition and the boot partition are the same (drive C:), and Windows is installed in C:\Windows. An example of when the system partition and the boot partition are different is when Windows 7 is installed as a dual boot with Windows Vista. Figure 10-23 shows how Windows 7 is installed on drive D: and Windows Vista is installed on drive C:. For Windows 7, the system partition is drive C: and the boot partition is drive D:. (For Windows Vista on this computer, the system and boot partitions are both drive C:.)

A+ 220-802 1.2



Source: Microsoft Windows 7

Figure 10-23 Windows 7 and Vista installed on the same system

10

Here is a list of file systems supported by Windows that you can choose for volumes and drives that don't hold the Windows installation:

- ***NTFS.*** Choose the NTFS file system for hard drives because it uses smaller allocation unit or cluster sizes than FAT32, which means it makes more efficient use of disk space when storing many small files. NTFS is more reliable, gives fewer errors, supports encryption, disk quotas (limiting the hard drive space available to a user), file and folder compression, and offers better security. As an example of the better security with NTFS, if you boot the system from another boot media such as a CD, you can access a volume using a FAT file system. If the volume uses NTFS, an administrator password is required to gain access.
- ***exFAT.*** Choose the exFAT file system for large external storage devices that you want to use with other operating systems. For example, you can use a smart card formatted with exFAT in a Mac or Linux computer or in a digital camcorder, camera, or smart phone. exFAT uses the same structure as the older FAT32 file system, but with a 64-bit-wide file allocation table (FAT). exFAT does not use as much overhead as the NTFS file system and is designed to handle very large files, such as those used for multimedia storage.
- ***FAT32.*** Use FAT32 for small hard drives or USB flash drives because it does not have as much overhead as NTFS.
- ***FAT16.*** The older FAT or FAT16 file system has a 16-bit file allocation table and is only recommended on volumes less than 4 GB.

A+ Exam Tip The A+ 220-802 exam expects you to know about the FAT, FAT32, NTFS, and CDFS file systems. It also expects you to know the difference between a quick format and a full format.

A+ 220-802 1.2

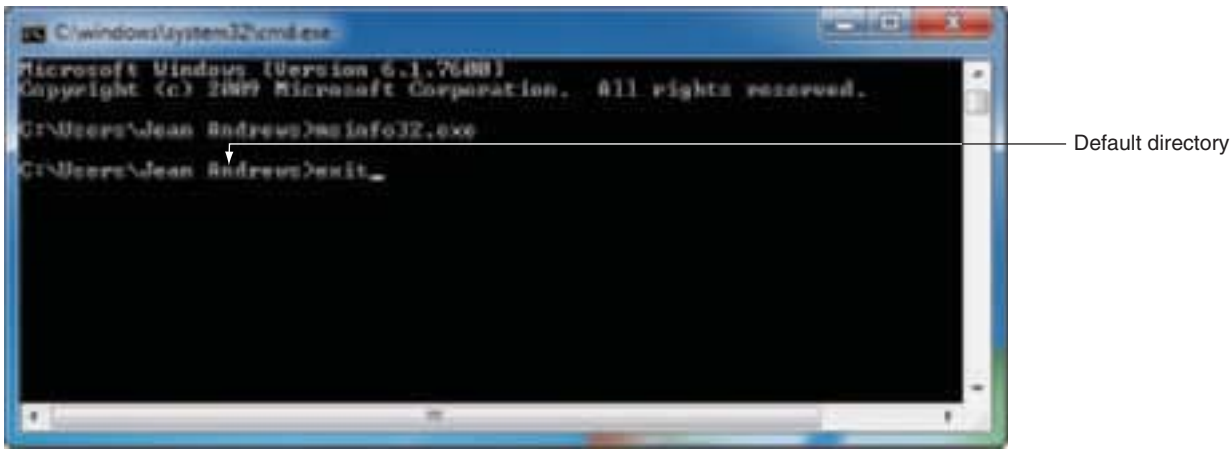
- *CDFS and UDF*. CDFS (Compact Disc File System) is an older file system used by optical discs (CDs, DVDs, and BDs), and is being replaced by the newer UDF (Universal Disc Format) file system.

Notes For Windows Vista, the exFAT file system is available if Service Pack 1 is installed. In XP, exFAT is available if Windows XP Service Packs 2 and 3 are installed and you download and install an additional update from Microsoft.

A+ 220-802 1.2, 1.3, 4.6

COMMANDS TO MANAGE FILES AND FOLDERS

PC support technicians find it is much faster to manipulate files and folders using commands in a command prompt window than when using Windows Explorer. In addition, in some troubleshooting situations, you have no other option but to use a command prompt window. To open the window, enter **cmd.exe** in the search box and press **Enter**. Alternately, you can click Start, All Programs, Accessories, and Command Prompt. The Command Prompt window is shown in Figure 10-24.



Source: Microsoft Windows 7

Figure 10-24 Use the exit command to close the command prompt window

Windows 7 and Vista have two levels of command prompt windows: a standard window and an elevated window. The standard window is shown in Figure 10-24. Notice in the figure that the default directory is the currently logged on user's folder. Commands that require administrative privileges will not work from this standard command prompt window. To get an elevated command prompt window, click **Start**, **All Programs**, **Accessories**, and right-click **Command Prompt**. Then select **Run as administrator** from the shortcut window. After you respond to the User Account Control (UAC) box, the Administrator: Command Prompt window appears (see Figure 10-25). Notice the word *Administrator* in the title bar, which indicates the elevated window, and the default directory, which is the C:\Windows\system32 folder.

A+ 220-802 1.2, 1.3, 4.6

Source: Microsoft Windows 7

Figure 10-25 An elevated command prompt window has administrative privileges

Here are some tips for working in a command prompt window:

- Type **cls** and press **Enter** to clear the window.
- To retrieve the last command you entered, press the up arrow. To retrieve the last command line one character at a time, press the right arrow.
- To terminate a command before it is finished, press **Ctrl+Break** or **Ctrl+Pause**.
- To close the window, type **exit** (see Figure 10-25) and press **Enter**.

10

Notes Many of the commands you learn about in this section can also be used from the Windows 7/Vista Recovery Environment or the Windows XP Recovery Console. These operating systems can be loaded from the Windows setup CD or DVD to troubleshoot a system when the Windows desktop refuses to load. How to use the Recovery Environment and the Recovery Console is covered in Chapter 14.

If the command you are using applies to files or folders, the path to these files or folders is assumed to be the default drive and directory. The default drive and directory, also called the current drive and directory, shows in the command prompt. It is the drive and directory that the command will use if you don't give a drive and directory in the command line. For example, in Figure 10-24, the default drive is C: and the default path is C:\Users\Jean Andrews. If you use a different path in the command line, the path you use overrides the default path. Also know that Windows makes no distinction between uppercase and lowercase in command lines.

Now let's look at the filenaming conventions you will need to follow when creating files, wildcard characters you can use in command lines, and several commands useful for managing files and folders.

FILENAMING CONVENTIONS

When using the command prompt window to create a file, keep in mind that filename and file extension characters can be the letters a through z, the numbers 0 through 9, and the following characters:

```
_ ^ $ ~ ! # % & - { } ( ) @ ' `
```

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In a command prompt window, if a path or filename has spaces in it, it is sometimes necessary to enclose the path or filename in double quotation marks.

WILDCARD CHARACTERS IN COMMAND LINES

As you work at the command prompt, you can use **wildcard** characters in a filename to say that the command applies to a group of files or to abbreviate a filename if you do not know the entire name. The question mark (?) is a wildcard for one character, and the asterisk (*) is a wildcard for one or more characters. For example, if you want to find all files in a directory that start with A and have a three-letter file extension, you would use the following command:

```
dir a*.???
```

A+ Exam Tip The A+ 220-802 exam expects you to know how to use the Shutdown, MD, RD, CD, Del, Format, Copy, Xcopy, Robocopy, Defrag, Chkdsk, and Help commands, which are all covered in this section.

Notes Many commands can use parameters in the command line to affect how the command will work. Parameters (also called options, arguments, or switches) often begin with a slash followed by a single character. In this chapter, you will learn about the basic parameters used by a command for the most common tasks. For a full listing of the parameters available for a command, use the Help command. Another way to learn about commands is to follow this link on the Microsoft web site: *technet.microsoft.com/en-us/library/cc772390(WS.10).aspx*.

HELP OR <*COMMAND NAME*> /?

Use the help command to get help about any command. You can enter help followed by the command name or enter the command name followed by /?. Table 10-1 lists some sample applications of this command:

Command	Result
`help xcopy` `xcopy /?`	Gets help about the Xcopy command
`help`	Lists all commands
`help xcopy | more`	Lists information one screen at a time

Table 10-1 Sample help commands

DIR [<*FILENAME*>] [/P] [/S] [/W]

Use the dir command to list files and directories. In Microsoft documentation about a command (also called the command syntax), the brackets [ ] in a command line indicate the parameter is optional. In addition, the parameter included in < >, such as <filename>, indicates that you can substitute any filename in the command. This filename can include a path or file extension. Table 10-2 lists some examples of the dir command.

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Command	Result
`dir /p`	Lists one screen at a time
`dir /w`	Presents information using wide format, where details are omitted and files and folders are listed in columns on the screen
`dir *.txt`	Lists all files with a .txt file extension in the default path
`dir d:\data\*.txt`	Lists all files with a .txt file extension in the D:\data folder
`dir myfile.txt`	Checks that a single file, such as myfile.txt, is present
`dir /s`	Includes subdirectory entries

Table 10-2 Sample dir commands

MD *[DRIVE:]PATH*

The MD command (Make Directory) creates a subdirectory under a directory. Note that in the command lines in this section, the command prompt is not bolded, but the typed command is in bold. To create a directory named \game on drive C:, you can use this command:

```
C:\> MD C:\game
```

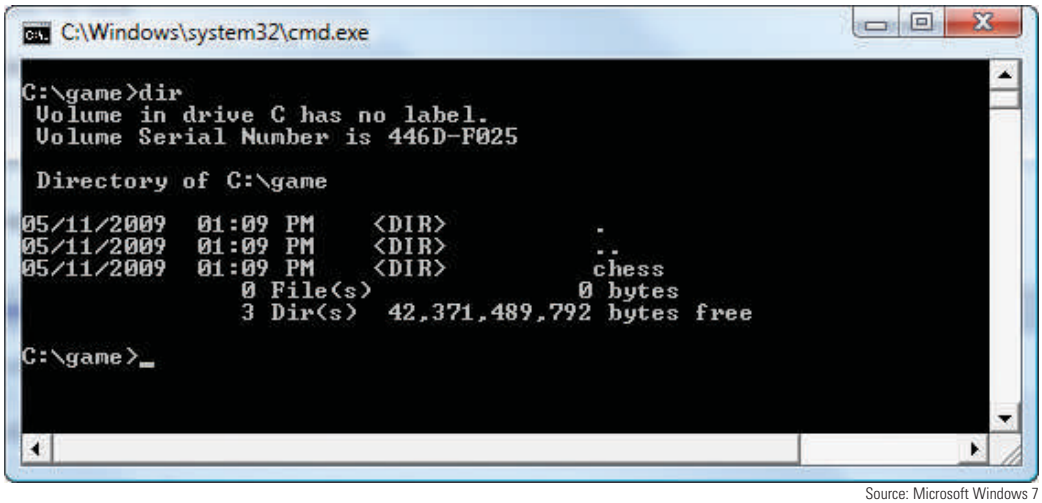
The backslash indicates that the directory is under the root directory. If a path is not given, the default path is assumed. This command also creates the C:\game directory:

```
C:\> MD game
```

To create a directory named chess under the \game directory, you can use this command:

```
C:\> MD C:\game\chess
```

Figure 10-26 shows the result of the dir command on the directory game. Note the two initial entries in the directory table: . (dot) and . . (dot, dot). The MD command creates these two entries when the OS initially sets up the directory. You cannot edit these entries with normal OS commands, and they must remain in the directory for the directory's lifetime. The . (dot) entry points to the subdirectory itself, and the .. (dot, dot) entry points to the parent directory, which, in this case, is the root directory.



Source: Microsoft Windows 7

Figure 10-26 Results of the dir command on the game directory

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CD [DRIVE:]PATH OR CD..

The CD command (Change Directory) changes the current default directory. You enter CD followed by the drive and the entire path that you want to be current, like so:

```
C:\> CD C:\game\chess
```

The command prompt now looks like this:

```
C:\game\chess>
```

To move from a child directory to its parent directory, use the .. (dot, dot) variation of the command:

```
C:\game\chess> CD..
```

The command prompt now looks like this:

```
C:\game>
```

Remember that .. (dot, dot) always means the parent directory. You can move from a parent directory to one of its child directories simply by stating the name of the child directory:

```
C:\game> CD chess
```

The command prompt now looks like this:

```
C:\game\chess>
```

Remember not to put a backslash in front of the child directory name; doing so tells the OS to go to a directory named Chess that is directly under the root directory.

RD [DRIVE:]PATH [/S]

The RD command (Remove Directory) removes a directory. Unless you use the /s switch, three things must be true before you can use the RD command:

- The directory must contain no files.
- The directory must contain no subdirectories.
- The directory must not be the current directory.

A directory is ready for removal when only the . (dot) and .. (dot, dot) entries are present. For example, to remove the \game directory when it contains the chess directory, the chess directory must first be removed, like so:

```
C:\> RD C:\game\chess
```

Or, if the \game directory is the current directory, you can use this command:

```
C:\game> RD chess
```

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After you remove the chess directory, you can remove the game directory. However, it's not good to attempt to saw off a branch while you're sitting on it; therefore, you must first leave the \game directory like so:

```
C:\game> CD..
C:\> RD \game
```

When you use the /s switch with the RD command, the entire directory tree is deleted, including all its subdirectories and files.

DEL OR ERASE <*FILENAME*>

The del or erase command erases files or groups of files. Note that in the command lines in this section, the command prompt is not bolded, but the typed command is in bold.

To erase the file named Myfile.txt, use the following command:

```
E:\> del myfile.txt
```

To erase all files in the current default directory, use the following command:

```
E:\Docs> del *.*
```

To erase all files in the E:\Docs directory, use the following command:

```
C:\> erase e:\docs\*.*
```

A few files don't have a file extension. To erase all files that are in the current directory and that have no file extensions, use the following command:

```
E:\Docs> del *.
```

REN <*FILENAME1*> <*FILENAME2*>

The ren (rename) command renames a file. <*Filename1*> can include a path to the file, but <*Filename2*> cannot. To rename Project.docx in the default directory to Project_Hold.docx:

```
E:\Docs> ren Project.docx Project_Hold.docx
```

To rename all .txt files to .doc files in the C:\Data folder:

```
ren C:\Data\*.txt *.doc
```

COPY <*SOURCE*> [<*DESTINATION*>] [/V] [/Y]

The copy command copies a single file or group of files. The original files are not altered. To copy a file from one drive to another, use a command similar to this one:

```
E:\> copy C:\Data\Myfile.txt E:\mydata\Newfile.txt
```

The drive, path, and filename of the source file immediately follow the copy command. The drive, path, and filename of the destination file follow the source filename. If you do

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not specify the filename of the destination file, the OS assigns the file's original name to this copy. If you omit the drive or path of the source or the destination, then the OS uses the current default drive and path.

To copy the file Myfile.txt from the root directory of drive C: to drive E:, use the following command:

```
C:\> copy myfile.txt E:
```

Because the command does not include a drive or path before the filename Myfile.txt, the OS assumes that the file is in the default drive and path. Also, because there is no destination filename specified, the file written to drive E: will be named Myfile.txt.

To copy all files in the C:\Docs directory to the USB flash drive designated drive E:, use the following command:

```
C:\> copy c:\docs\*.* E:
```

To make a backup file named System.bak of the System file in the \Windows\system32\config directory of the hard drive, use the following command:

```
C:\Windows\system32\config> copy system system.bak
```

If you use the copy command to duplicate multiple files, the files are assigned the names of the original files. When you duplicate multiple files, the destination portion of the command line cannot include a filename.

Here are two switches or parameters that are useful with the copy command:

- */V*. When the /V switch is used, the size of each new file is compared to the size of the original file. This slows down the copying, but verifies that the copy is done without errors.
- */Y*. When the /Y switch is used, a confirmation message does not appear asking you to confirm before overwriting a file.

Notes When trying to recover a corrupted file, you can sometimes use the Copy command to copy the file to new media, such as from the hard drive to a USB drive. During the copying process, if the Copy command reports a bad or missing sector, choose the option to ignore that sector. The copying process then continues to the next sector. The corrupted sector will be lost, but others can likely be recovered. The Recover command can be used to accomplish the same thing.

RECOVER *<FILENAME>*

Use the recover command to attempt to recover a file when parts of the file are corrupted. The command is best used from the Windows 7/Vista Recovery Environment or the XP Recovery Console (discussed in Appendix C). To use it, you must specify the name of a single file in the command line, like so:

```
C:\Data> Recover Myfile.doc
```

XCOPY *<SOURCE> [<DESTINATION>]* [/S] [/C] [/Y] [*/D:DATE*]

The xcopy command is more powerful than the copy command. It follows the same general command-source-destination format as the copy command, but it offers several more options. Table 10-3 shows some of these options.

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Command	Result
`xcopy C:\docs\*.* E: /S`	Use the /S switch to include subdirectories in the copy; this command copies all files in the directory C:\docs, as well as all subdirectories under \docs and their files, to drive E
`xcopy C:\docs\*.* E: /E`	Same as /S but empty subdirectories are included in the copy
`xcopy C:\docs\*.* E: /D:03/14/12`	The /D switch examines the date; this command copies all files from the directory C:\docs created or modified on or after March 14, 2012
`xcopy C:\docs\*.* E: /Y`	Use the /Y switch to overwrite existing files without prompting
`xcopy C:\docs\*.* E: /C`	Use the /C switch to keep copying even when an error occurs

Table 10-3 Xcopy commands and results

ROBOCOPY *<SOURCE> [<DESTINATION>]* [/S] [/E] [/LOG:*FILENAME*] [*/LOG+:*FILENAME] [*/MOVE*] [*/PURGE*]

The robocopy (Robust File Copy) command is not included in Windows XP and is similar to the xcopy command. It offers more options than xcopy and is intended to replace xcopy. A few options for robocopy are listed in Table 10-4.

Command	Result
`robocopy C:\docs\*.* E: /S`	The /S switch includes subdirectories in the copy but does not include empty directories
`robocopy C:\docs\*.* E: /E`	The /E switch includes subdirectories, even the empty ones
`robocopy C:\docs\*.* E: /LOG:Mylog.txt`	Records activity to a log file and overwrites the current log file
`robocopy C:\docs\*.* E: /LOG+:Mylog.txt`	Appends a record of all activity to an existing log file
`robocopy C:\docs\*.* E: /move`	Moves files and directories, deleting them from the source
`robocopy C:\docs\*.* E: /purge`	Deletes files and directories at the destination that no longer exist at the source

Table 10-4 Robocopy commands and results

CHKDSK [*DRIVE:*] [/F] [/R]

The chkdsk command (Check Disk) fixes file system errors and recovers data from bad sectors. Earlier in the chapter, you learned to check for errors using the drive properties box, which does so by launching the chkdsk command. Recall that a file is stored on the hard drive as a group of clusters. The FAT, FAT32, and exFAT file systems use a **file allocation table (FAT)** to keep a record of each cluster that belongs to a file. The NTFS file system uses a database to hold similar information called the **master file table (MFT)**. In Figure 10-27, you can see that each cell in the FAT represents one cluster and contains a pointer to the next cluster in a file.

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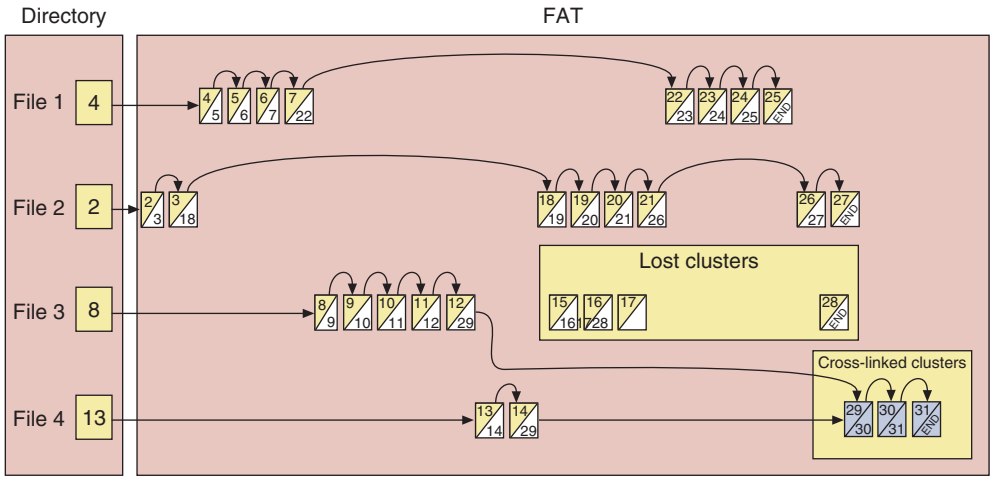

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Figure 10-27 Lost and cross-linked clusters

Notes For an interesting discussion of how the FAT works, see the document FAT Details.pdf on the companion web site for this book at *www.cengagebrain.com*. See the Preface for more information.

Used with the /F parameter, chkdsk searches for and fixes two types of file system errors made by the FAT or MFT:

- ***Lost clusters (also called lost allocation units)***—Lost clusters are clusters that are marked as used clusters in the FAT or MFT, but the cluster does not belong to any file. In effect, the data in these clusters is lost.
- ***Cross-linked clusters***—Cross-linked clusters are clusters that are marked in the FAT or MFT as belonging to more than one file.

Used with the /R parameter, chkdsk checks for lost clusters and cross-linked clusters and also checks for bad sectors on the drive. The FAT and MFT keep a table of bad sectors that they normally do not use. However, over time, a sector might become unreliable. If chkdsk determines that a sector is unreliable, it attempts to recover the data from the sector and also marks the sector as bad so that the FAT or MFT will not use it again.

Used without any parameters, the chkdsk command only reports information about a drive and does not make any repairs.

In the following sample commands, we're not showing the command prompt; the default drive and directory are not important. To check the hard drive for file system errors and repair them, use this command:

```
chkdsk C:/F
```

To redirect a report of the findings of the chkdsk command to a file that you can later print, use this command:

```
chkdsk C:>Myfile.txt
```

Use the /R parameter of the chkdsk command to fix file system errors and also examine each sector of the drive for bad sectors, like so:

```
chkdsk C:/R
```

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If chkdsk finds data that it can recover, it asks you for permission to do so. If you give permission, it saves the recovered data in files that it stores in the root directory of the drive.

Notes Use either the /F or /R parameter with chkdsk, but not both. Using both parameters is redundant. For the most thorough check of a drive, use /R.

The chkdsk command will not fix anything unless the drive is locked, which means the drive has no open files. If you attempt to use chkdsk with the /F or /R parameter when files are open, chkdsk tells you of the problem and asks permission to schedule the run the next time Windows is restarted. Know that the process will take plenty of time. For Windows 7/Vista, you must use an elevated command prompt window to run chkdsk.

Notes The chkdsk command is also available from the Windows 7/Vista Recovery Environment and the Windows XP Recovery Console.

DEFRAG [*DRIVE*:] [/C]

The defrag command examines a magnetic hard drive for **fragmented files** (files written to a disk in noncontiguous clusters) and rewrites these files to the drive in contiguous clusters. You use this command to optimize a hard drive's performance. Table 10-5 shows two examples of the command. Recall that it's not a good idea to defrag solid state storage devices such as an SSD, flash drive, or smart card. Doing so can shorten the life of the drive.

Command	Result
`defrag C:`	Defrag drive C
`defrag /c`	Defrag all volumes on the computer, including drive C

Table 10-5 Defrag commands and results

The defrag command requires an elevated command prompt window in Windows 7/Vista. It is not available under the Windows 7/Vista Recovery Environment or the XP Recovery Console. Earlier in the chapter, you learned to defrag a drive using the Windows drive properties box.

FORMAT <*DRIVE*:> [/V:*LABEL*] [/Q] [FS:<*FILESYSTEM*>]

You can format a hard drive or other storage device using Disk Management. In addition, you can use the format command from a command prompt window and from the Windows 7/Vista Recovery Environment and the XP Recovery Console. This high-level format installs a file system on the device and *erases all data on the volume*. Table 10-6 lists various sample uses of the Format command.

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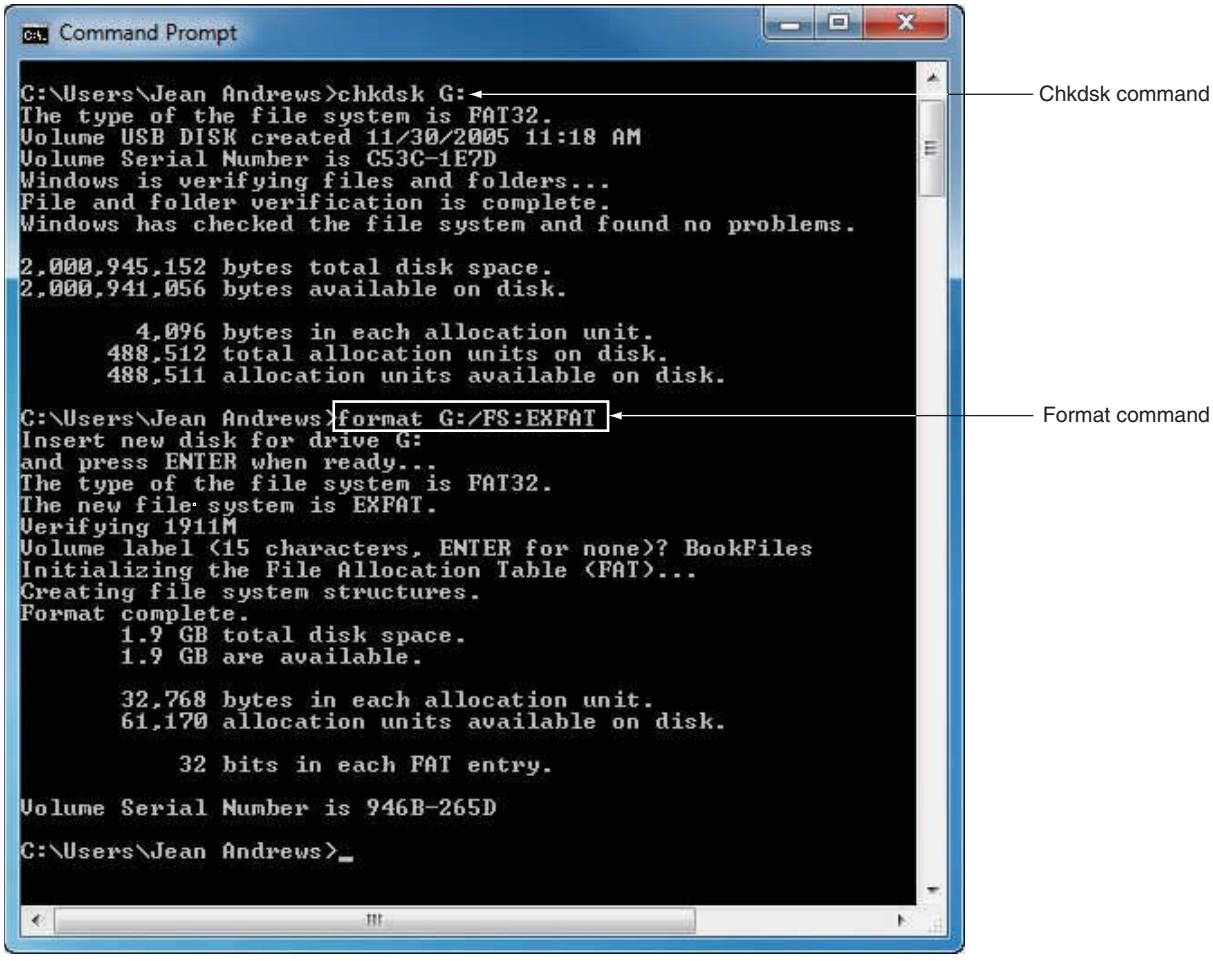
Command	Description
`Format A: /V:mylabel`	Allows you to enter a volume label only once when formatting several disks; the same volume label is used for all disks. A volume label appears at the top of the directory list to help you identify the disk.
`Format A: /Q`	Re-creates the root directory and FAT to quickly format a previously formatted disk that is in good condition; /Q does not read or write to any other part of the disk
`Format D: /FS:NTFS`	Formats drive D using the NTFS file system
`Format D: /FS:FAT32`	Formats drive D using the FAT32 file system
`Format D: /FS:EXFAT`	Formats drive D using the extended FAT file system

Table 10-6 Format commands and results

One use of the format command is to change the installed file system. For example, in Figure 10-28, the chkdsk command shows a USB flash drive is formatted using the FAT32 file system. The format command reformatted the drive using the exFAT file system.



Source: Microsoft Windows 7

Figure 10-28 The format command uses the exFAT file system to format a flash drive

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SHUTDOWN [/M *COMPUTERNAME*] [/I] [/R] [/S] [/F] [/T *XX*]

Use the shutdown command to shut down the local computer or a remote computer. You must be logged on with an administrator account to use this command. By default, the command gives users a 30-second warning before shutdown. To shut down a remote computer on the network, you must have an administrator account on that computer and be logged onto the local computer with that same account and password. Table 10-7 lists some shutdown commands.

Command	Description
`shutdown /r`	Restart the local computer
`shutdown /s /m \\bluelight`	Shut down the remote computer named \\bluelight
`shutdown /s /m \\bluelight /t 60`	Shut down the \\bluelight computer after a 60-second delay
`shutdown /i`	Displays the Remote Shutdown Dialog box so you can choose computers on the network to shut down

Table 10-7 Shutdown commands and results

Hands-on Project 10-3 Using a Batch File

A file with a .bat file extension is called a batch file. You can use a batch file to execute a group of commands, sometimes called a script, from a command prompt. Do the following in order to learn to use a batch file:

1. Using a command prompt window, copy the files in your My Documents folder to a folder named \Save on a USB flash drive. Do not include subfolders in the copy.
2. Using Notepad, create a batch file named MyBatch.bat on the USB flash drive that contains the commands to do the following:
   a. Create the C:\Data folder and a subfolder named C:\Data\Documents.
   b. Copy all the files in your \Save folder to the C:\Data\Documents folder.
   c. List the contents of the C:\Data\Documents folder.
3. Using a command prompt window, execute the MyBatch.bat file and fix any problems you see. What happens when you execute the batch file and the C:\Data\Documents folder already exists?

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USE DISK MANAGEMENT TO MANAGE HARD DRIVES

The primary tool for managing hard drives is Disk Management. In Chapter 7, you learned how to install Windows on a new hard drive. This installation process initializes, partitions, and formats the drive. After Windows is installed, you can use Disk Management to install and manage drives. In this part of the chapter, you will learn to use Disk Management to manage partitions on a drive, prepare a new drive for first use, mount a drive, use Windows dynamic disks, and troubleshoot problems with the hard drive.

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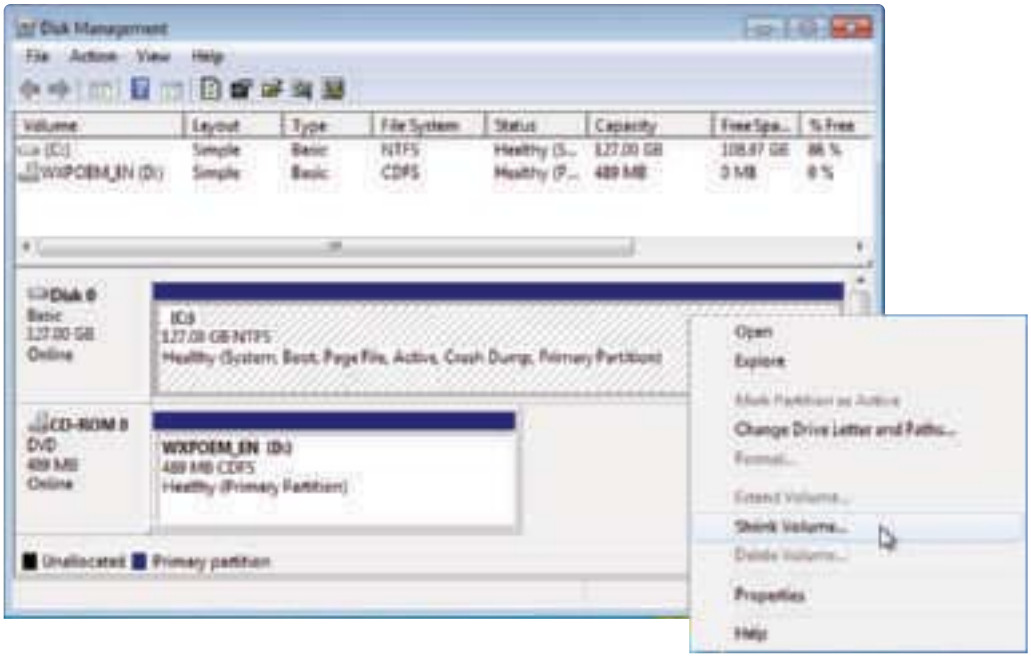
Notes In most Microsoft documentation, a partition is called a partition until it is formatted, and then it is called a volume.

RESIZE, CREATE, AND DELETE PARTITIONS

Suppose you have installed Windows 7 on a hard drive and used all available space on the drive for the one partition. Now you want to split the partition into two partitions so you can install Windows 8 in a dual boot installation with Windows 7. You can use Disk Management to shrink the original partition, which frees up some space for the new Windows 8 partition. Follow these steps:

1. To open the Disk Management window, use one of these methods:
   - **Click Start, right-click Computer, and select Manage from the shortcut menu. In the Computer Management window, click Disk Management.**
   - **Click Start, type Disk Management or diskmgmt.msc in the search box and press Enter.**
2. The Disk Management window opens (see Figure 10-29). To shrink the existing partition, right-click in the partition space and select **Shrink Volume** from the shortcut menu (see Figure 10-29). The Shrink dialog box appears showing the amount of free space on the partition. Enter the amount in MB to shrink the partition, which cannot be more than the amount of free space so that no data on the partition will be lost. (For best performance, be sure to leave at least 15 percent free space on the disk.) Click **Shrink**. The disk now shows unallocated space.



Source: Microsoft Windows 7

Figure 10-29 Shrink a volume to make room for a new partition

3. To create a new partition in the unallocated space, right-click in that space and select **New Simple Volume** from the shortcut menu (see Figure 10-30). The New Simple Volume Wizard opens.

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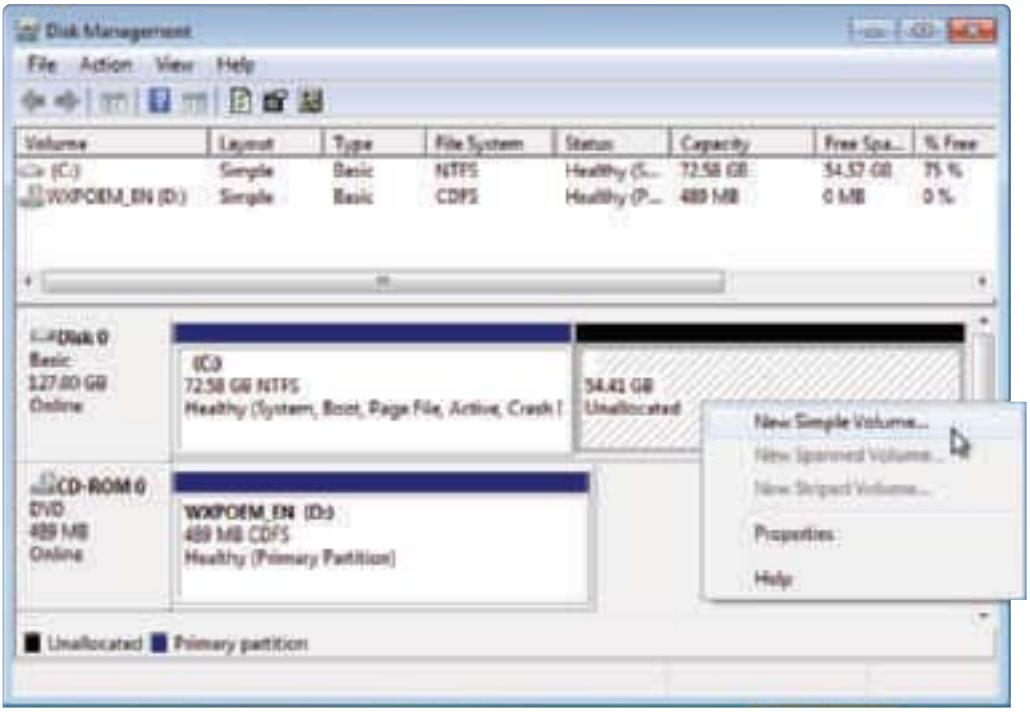

Source: Microsoft Windows 7

Figure 10-30 Use unallocated space to create a new partition

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4. Follow the directions on-screen to enter the size of the volume in MB and select a drive letter for the volume, a file system, and the size for each allocation unit (also called a cluster). It's best to leave the cluster size at the Default value. You can also decide to do a **quick format**, which doesn't scan the volume for bad sectors; use it only when a hard drive has been previously formatted and is in healthy condition. The partition is then created and formatted with the file system you chose.

Notice in Figure 10-29 the options on the shortcut menu that you can use to make the partition the active partition (the one the OS will boot from), change the drive letter for a volume, format the volume (erases all data on the volume), extend the volume (increase the size of the volume), and shrink and delete the volume. An option that is not available for the particular volume and situation is grayed.

Notes The size of a partition or volume cannot be changed in Windows XP unless you use third-party software.

A+ Exam Tip The A+ 220-802 exam expects you to know how to use Disk Management to extend and split partitions and configure a new hard drive in a system.

PREPARE A DRIVE FOR FIRST USE

When you install a new, second hard drive in a computer, use Disk Management to prepare the drive for use. This happens in a two-step process:

Step 1: Initialize the Disk

When the disk is initialized, Windows identifies the disk as a basic disk. A **basic disk** is a single hard drive that works independently of other hard drives. Windows also installs a partitioning system on the hard drive. You can choose the Master Boot Record (MBR)

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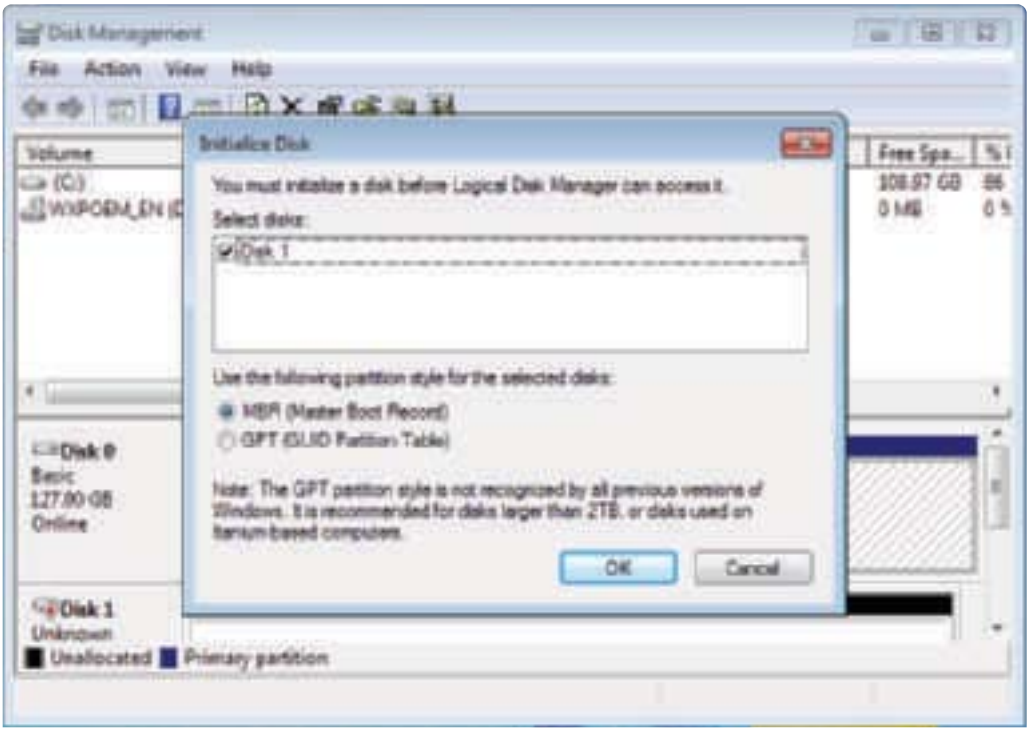
system or the **Globally Unique Identifier Partition Table (GUID or GPT)** system. Recall that the MBR system can have up to four partitions, although one of them can be an extended partition with multiple logical drives. The GPT system can support up to 128 partitions and is recommended for drives larger than 2 TB. The GPT system is more reliable, but it can only be used by 64-bit operating systems on computers that have an EFI or UEFI chip rather than the traditional BIOS chip. In this chapter, we focus on the MBR system, which is by far the most common system.

The MBR system writes an MBR record to the first sector of the disk (512 bytes) that contains two items:

- ***The master boot program (446 bytes)***. The purpose of this program is to begin the process of finding and loading an OS installed on the drive. If you were to make this hard drive your boot device, startup BIOS would look for and execute this program. The MBR program would then look for and execute an OS boot program. (This program begins the process of loading the OS.)
- ***The partition table***. Recall that the partition table contains the description, location, and size of each partition on the drive. For Windows-based systems, this table has space for four 16-byte entries that are used to define up to four partitions on the drive. For each partition, the 16 bytes are used to hold the beginning and ending location of the partition, the number of sectors in the partition, and whether or not the partition is bootable. Recall that the one bootable partition is called the active partition.

When you first open Disk Management after you have installed a new hard drive, the Initialize Disk box automatically appears (see Figure 10-31). If you don't see the box, right-click in the Disk area and select **Initialize Disk** from the shortcut menu (see Figure 10-32). Select the partitioning system and click **OK**. Disk Management now reports the hard drive as a Basic disk.



Source: Microsoft Windows 7

Figure 10-31 Use the Initialize Disk box to set up a partitioning system on a new hard drive

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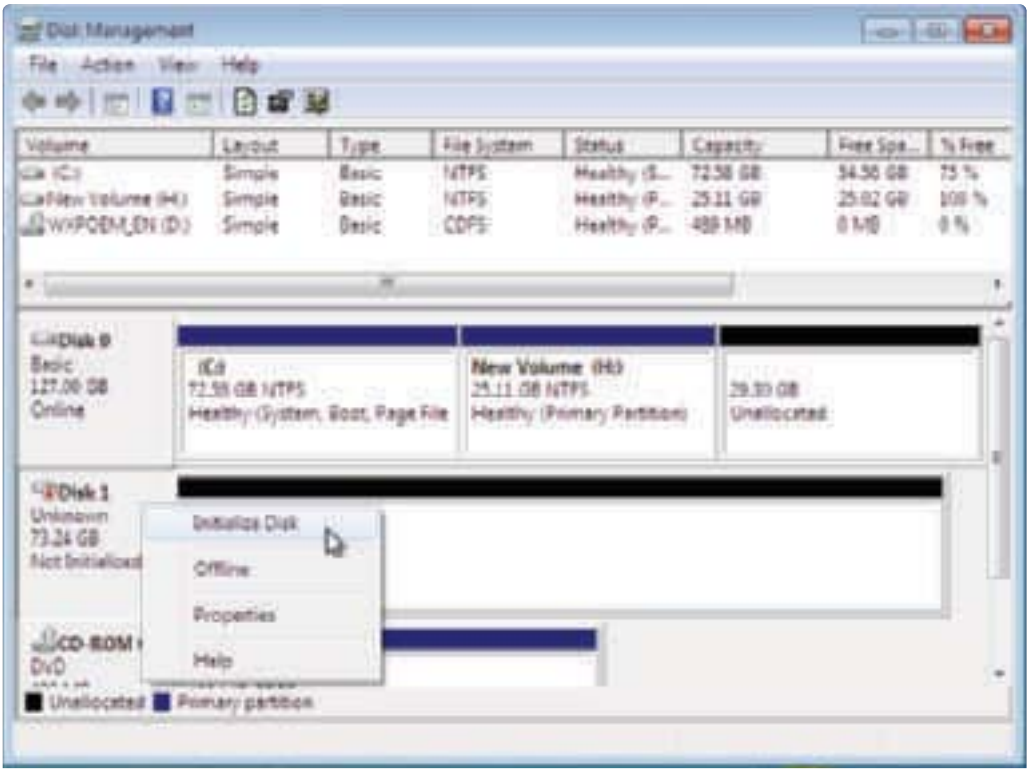

Source: Microsoft Windows 7

Figure 10-32 The first step to install a new hard drive is to initialize the disk

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Step 2: Create a Volume and Format It with a File System

To create a new volume on a disk, right-click in the unallocated space, select **New Simple Volume** from the shortcut menu, and follow the directions on-screen to select the size of the volume, assign a drive letter and name to the volume, and select the file system. When the process is finished, the drive is formatted and ready for use. When you open Windows Explorer, you should see the new volume available for use.

Notes In Chapter 14, you learn to use a command prompt to create and manage partitions on a hard drive.

HOW TO MOUNT A DRIVE

A **mounted drive** is a volume that can be accessed by way of a folder on another volume so that the folder has more available space. A mounted drive is useful when a folder is on a volume that is too small to hold all the data you want in the folder. In Figure 10-33, the mounted drive gives the C:\Projects folder a capacity of 30 GB. The C:\Projects folder is called the **mount point** for the mounted drive.

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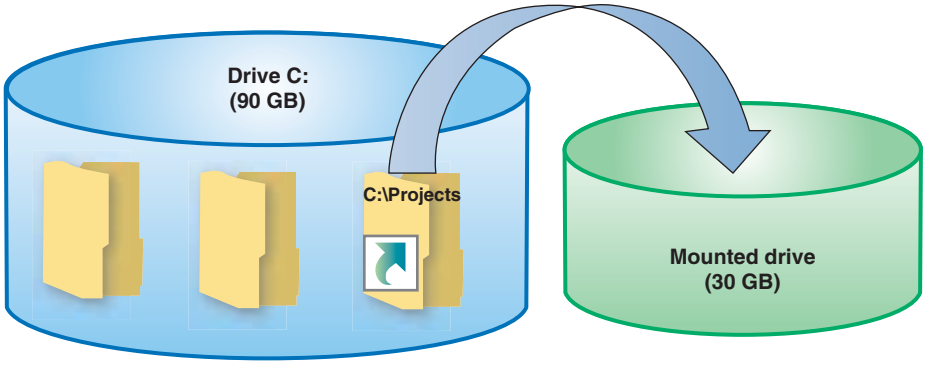
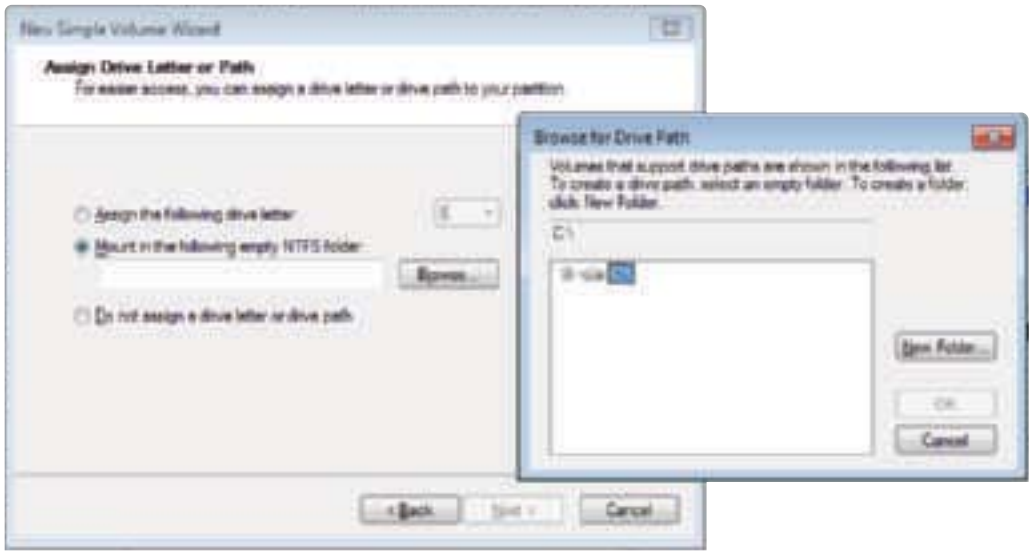


Figure 10-33 The C:\Projects folder is the mount point for the mounted drive

Follow these steps to mount a drive:

1. Make sure the volume that is to host the mounted drive uses the NTFS file system. The folder on this volume, called the mount point, must be empty. You can also create the folder during the mount process. In our example, we are mounting a drive to the C:\Projects folder.
2. Using Disk Management, right-click in the unallocated space of a disk. In our example, we're using Disk 1 (the second hard drive). Select **New Simple Volume** from the shortcut menu. The New Simple Volume Wizard launches. Using the wizard, specify the amount of unallocated space you want to devote to the volume. (In our example, we are using 30 GB, although the resulting size of the C:\Projects folder will only show about 29 GB because of overhead.)
3. As you follow the wizard, the box shown on the left side of Figure 10-34 appears. Select **Mount in the following empty NTFS folder**, and then click **Browse**. In the Browse for Drive Path box that appears (see the right side of Figure 10-34), you can drill down to an existing folder or click **New Folder** to create a new folder on drive C:.



Source: Microsoft Windows 7

Figure 10-34 Select the mount point for the new volume

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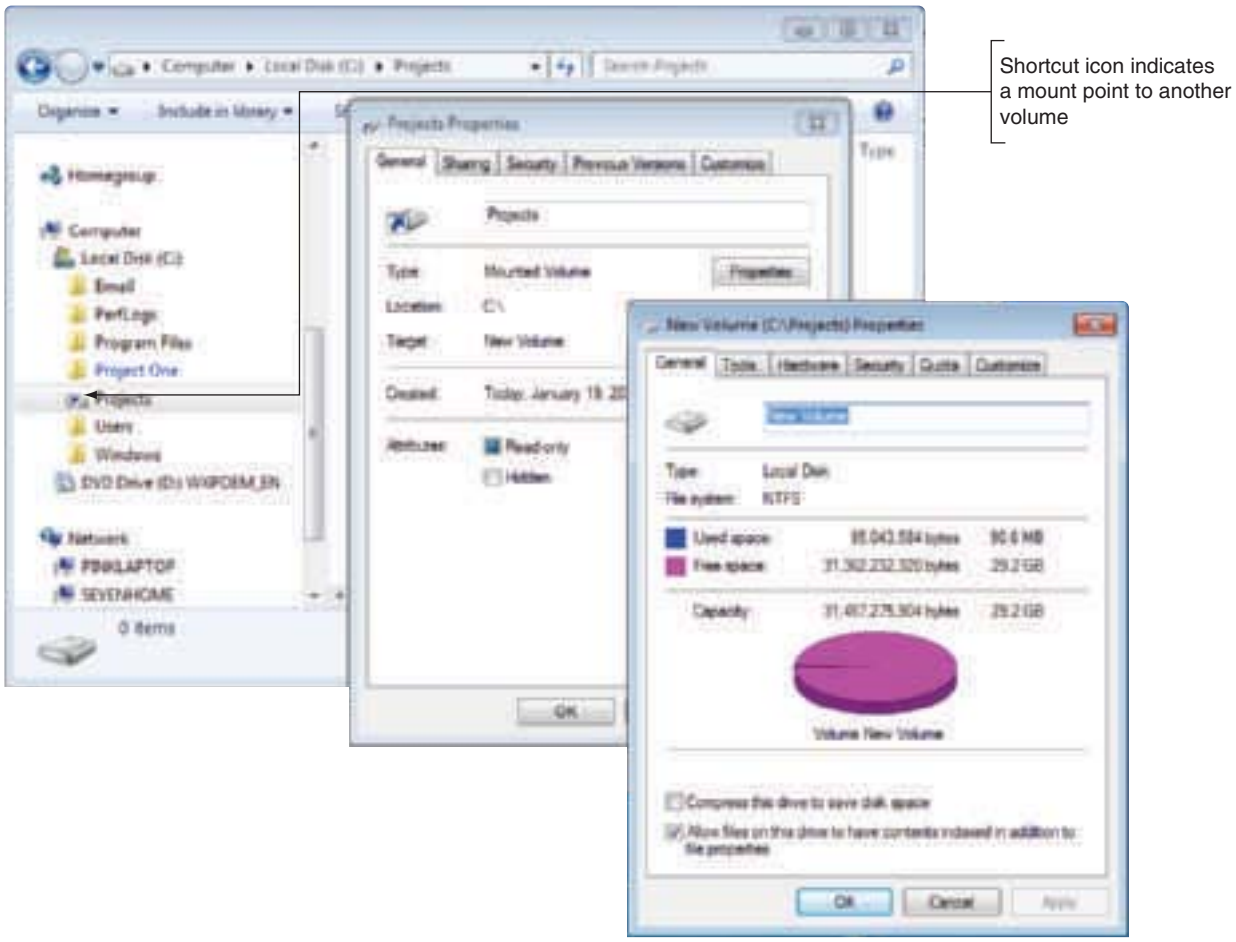
4. Complete the wizard by selecting a file system for the new volume and an Allocation unit size (the cluster size). The volume is created and formatted.
5. To verify the drive is mounted, open Windows Explorer and then open the Properties box for the folder. In our example, the Properties box for the C:\Projects folder is shown in the middle of Figure 10-35. Notice the Properties box reports the folder type as a Mounted Volume. When you click Properties in the Properties box, the volume Properties box appears (see the right side of Figure 10-35). In this box, you can see the size of the volume, which is the size of the mounted volume, less overhead.



Source: Microsoft Windows 7

Figure 10-35 The mounted drive in Windows Explorer appears as a very large folder

You can think of a mount point, such as C:\Projects, as a shortcut to a volume on a second drive. If you look closely at the left window in Figure 10-35, you can see the shortcut icon beside the Projects folder.

WINDOWS DYNAMIC DISKS

A basic disk works independently of other hard drives, but a **dynamic disk** can work with other hard drives to hold data. Volumes stored on dynamic disks are called **dynamic volumes**. Several dynamic disks can work together to collectively present a single dynamic volume to the system.

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When dynamic disks work together, data to configure each hard drive is stored in a disk management database that resides in the last 1 MB of storage space on each hard drive. Home editions of Windows do not support dynamic disks.

Here are four uses of dynamic disks:

- ***For better reliability, you can configure a hard drive as a dynamic disk and allocate the space as a simple volume.*** This is the best reason to use dynamic disks and is a recommended best practice. Because of the way a dynamic disk works, the simple volume is considered more reliable than when it is stored on a basic disk. A volume that is stored on only one hard drive is called a **simple volume**.
- ***You can implement dynamic disks on multiple hard drives to extend a volume across these drives (called spanning).*** This volume is called a spanned volume.
- ***Dynamic disks can be used to piece data across multiple hard drives to improve performance.*** The technology to configure two or more hard drives to work together as an array of drives is called **RAID (redundant array of inexpensive disks** or **redundant array of independent disks)**. Joining hard drives together to improve performance is called **striping** or **RAID 0**. The volume is called a striped volume (see Figure 10-36). When RAID is implemented in this way using Disk Management, it is called **software RAID**. A more reliable way of configuring RAID is to use BIOS setup on a motherboard that supports RAID, which is called **hardware RAID**.
- ***For Windows XP, you can use dynamic disks to mirror two hard drives for fault tolerance (called mirroring or RAID 1).*** This feature is not available in Windows 7/Vista and is not considered a good practice in XP.

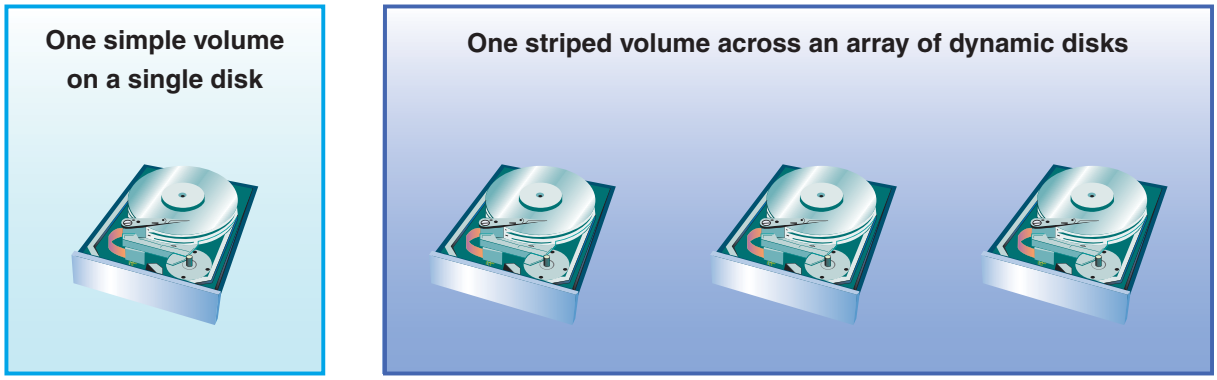

Figure 10-36 A simple volume is stored on a single disk, but a striped volume is stored on an array of dynamic disks

You can use Disk Management to convert two or more basic disks to dynamic disks. Then you can use unallocated space on these disks to create a simple, spanned, or striped volume. To convert a basic disk to dynamic, right-click the Disk area and select **Convert to Dynamic Disk** from the shortcut menu (see Figure 10-37), and then right-click free space on the disk and select **New Simple Volume**, **New Spanned Volume**, or **New Striped Volume** from the shortcut menu. If you were to use spanning or striping in Figure 10-37, you could make Disk 1 and Disk 2 dynamic disks that hold a single volume. The size of the volume would be the sum of the space on both hard drives.

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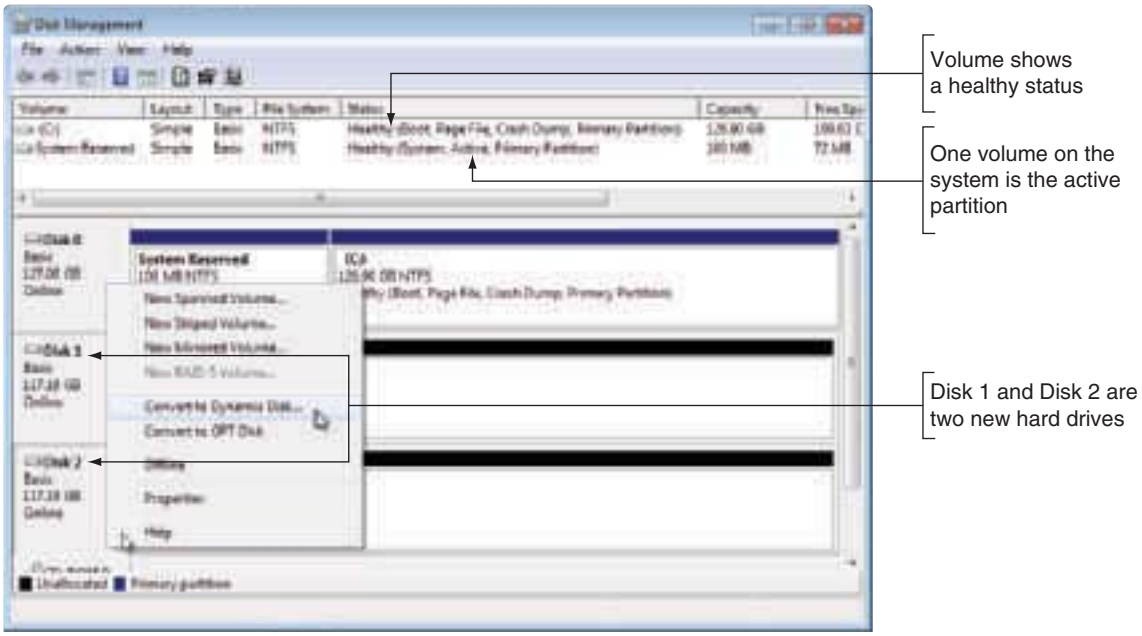

Source: Microsoft Windows 7

Figure 10-37 Convert a basic disk to a dynamic disk

Now for some serious cautions about software RAID where you use Windows for spanning and striping: Microsoft warns that when Windows is used for software RAID, the risk of catastrophic failure increases and can lead to data loss. Microsoft suggests you only use Windows spanning or striping when you have no other option. In other words, spanning and striping in Windows aren't very safe—to expand the size of a volume, use a mounted drive or use hardware RAID.

Notes When Windows implements RAID, know that you cannot install an OS on a spanned or striped volume that uses software RAID. You can, however, install Windows on a hardware RAID drive.

Also, after you have converted a basic disk to a dynamic disk, you cannot revert it to a basic disk without losing all data on the drive.

USE DISK MANAGEMENT TO TROUBLESHOOT HARD DRIVE PROBLEMS

Notice in Figure 10-37 that this system has three hard drives, Disk 0, Disk 1, and Disk 2, and information about the disks and volumes is shown in the window. When you are having a problem with a hard drive, it helps to know what the information in the Disk Management window means. Here are the drive and volume statuses you might see in this window:

- ***Healthy***. The healthy volume status shown in Figure 10-37 indicates that the volume is formatted with a file system and that the file system is working without errors.
- ***Failed***. A failed volume status indicates a problem with the hard drive or that the file system has become corrupted. To try to fix the problem, make sure the hard drive data cable and power cable are secure. Data on a failed volume is likely to be lost. For dynamic disks, if the disk status is Offline, try bringing the disk back online (how to do that is coming up in this chapter).

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- ***Online***. An online disk status indicates the disk has been sensed by Windows and can be accessed by either reading or writing to the disk.
- ***Active***. One volume on the system will be marked as Active. This is the volume that startup BIOS looks to in order to load an OS.
- ***Unallocated***. Space on the disk is marked as unallocated if it has not yet been partitioned.
- ***Formatting***. This volume status appears while a volume is being formatted.
- ***Basic***. When a hard drive is first sensed by Windows, it is assigned the Basic disk status. A basic disk can be partitioned and formatted as a stand-alone hard drive.
- ***Dynamic***. The following status indicators apply only to dynamic disks:
  - ***Offline***. An offline disk status indicates a dynamic disk has become corrupted or is unavailable. The problem can be caused by a corrupted file system, the drive cables are loose, the hard drive has failed, or another hardware problem. If you believe the problem is corrected, right-click the disk and select **Reactivate Disk** from the shortcut menu to bring the disk back online.
  - ***Foreign drive***. If you move a hard drive that has been configured as a dynamic disk on another computer to this computer, this computer will report the disk as a foreign drive. To fix the problem, you need to import the foreign drive. To do that, right-click the disk and select **Import Foreign Disks** from the shortcut menu. You should then be able to see the volumes on the disk.
  - ***Healthy (At Risk)***. The dynamic disk can be accessed, but I/O errors have occurred. Try returning the disk to online status. If the volume status does not return to healthy, back up all data and replace the drive.

If you are still having problems with a hard drive, volume, or mounted drive, check Event Viewer for events about the drive that might have been recorded there. These events might help you understand the nature of the problem and what to do about it. How to use Event Viewer is covered in Chapter 11.

Hands-on Project 10-4 Using Disk Management on a Virtual Machine

In Project 7-7 of Chapter 7, you installed Virtual PC software and used it to install Windows 7 in a virtual machine. Use this VM to practice using Disk Management. Do the following:

1. Open Windows Virtual PC, but do not open the virtual machine.
2. With the virtual machine selected, click **Settings**. Use the Settings box to add a new hard drive to the VM.
3. Start up the VM, log on to Windows, and open Disk Management.
4. Use Disk Management to initialize the new disk and partition it. Create two partitions on the disk, one formatted using the NTFS file system and one using the FAT32 file system.
5. View the new volumes using Windows Explorer.
6. Create and save a snip of your screen showing the virtual machine with the new volumes created. Email the snip to your instructor.

REGIONAL AND LANGUAGE SETTINGS

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One more task you might be called on to do as a part of maintaining a computer is to help a user configure a computer to use a different language. Suppose a user needs to see Windows messages in Spanish and wants to use a Spanish keyboard, such as the one in Figure 10-38. Configuring a computer for another language involves downloading and installing the language pack, changing the Windows display language, changing regional settings for dates, time, and numbers, and changing the language used for keyboard input.

Figure 10-38 Spanish keyboard

Two ways to install a different language in Windows are:

- For Windows 7/Vista Ultimate and Enterprise editions, you can use Windows Update to download and install a language pack that translates most of the Windows user interface. Microsoft offers language packs for many languages.
- For all editions of Windows 7/Vista/XP, you can download and install a Language Interface Pack (LIP) that translates only some of the Windows user interface.

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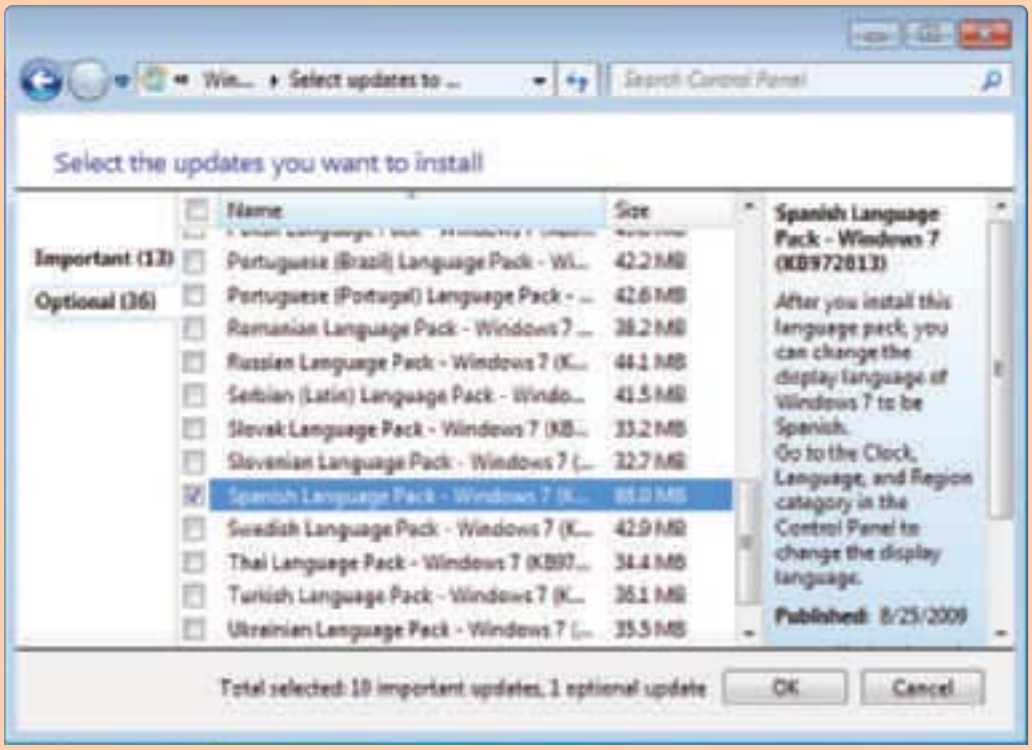
APPLYING CONCEPTS

Using Windows 7 Ultimate, follow these steps to configure the computer to use Spanish for the display:

1. To download the Spanish pack using Windows Update, click **Start**, **All Programs**, and **Windows Update**. If important updates are listed in the Windows Update window, first install any of these updates your system needs.
2. In the Windows Update window, if optional updates are not listed, click **Check for updates**. If you see optional updates listed, click **optional updates are available**.
3. In the Select updates to install window (see Figure 10-39), in the list of Windows 7 Language Packs, select the **Spanish Language Pack**. Make sure other updates that you don't want are not selected. Click **OK** and click **Install updates**.



Source: Microsoft Windows 7

Figure 10-39 Select the language to download and install

4. You are now ready to configure the computer to use the new language. Open Control Panel and click **Clock, Language, and Region**. In the Clock, Language, and Region window, click **Change the date, time, or number format**. The Region and Language box opens (see Figure 10-40).

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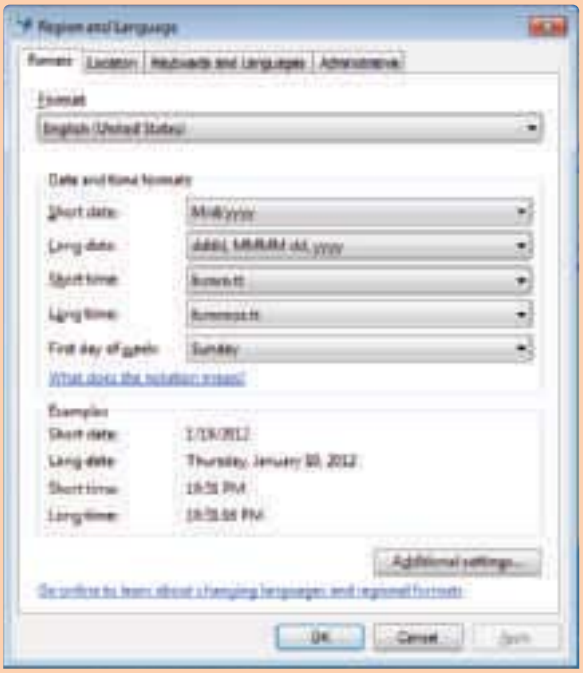
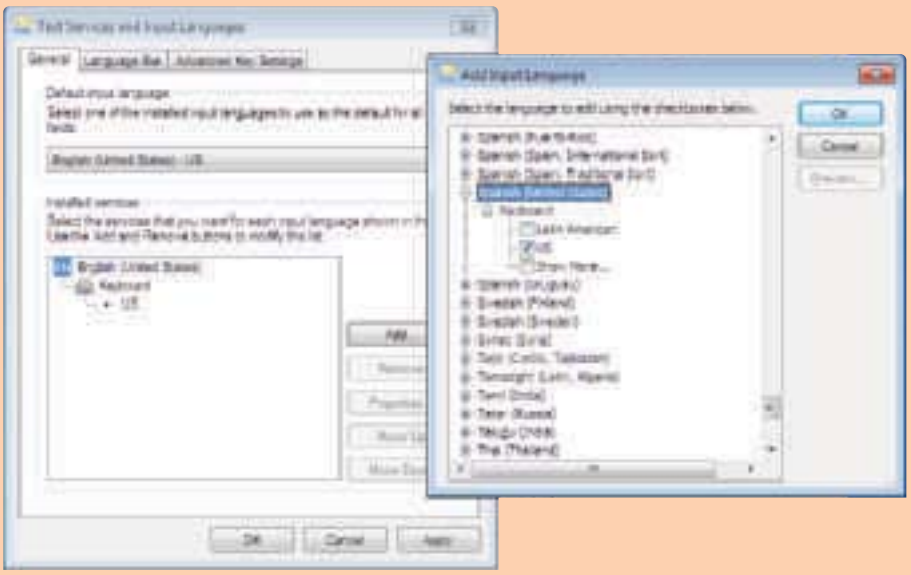


Source: Microsoft Windows 7

Figure 10-40 Use the Region and Language box to change how dates, times, and numbers display

5. To change the format used to display dates, times, and numbers, select the language from the drop-down list under Format.

6. To change the keyboard layout, select the Keyboards and Languages tab. Click **Change keyboards**. The Text Services and Input Languages box appears. In the list of installed services, only English is listed (see the left side of Figure 10-41). Click **Add**. In the Add Input Language box, select a Spanish keyboard, as shown on the right side of Figure 10-41. Click **OK**. The Spanish keyboard is now added to the list of input languages. Under Default input language, select the Spanish language and click **Apply**. Click **OK** to close the dialog box.



Source: Microsoft Windows 7

Figure 10-41 Add an input language

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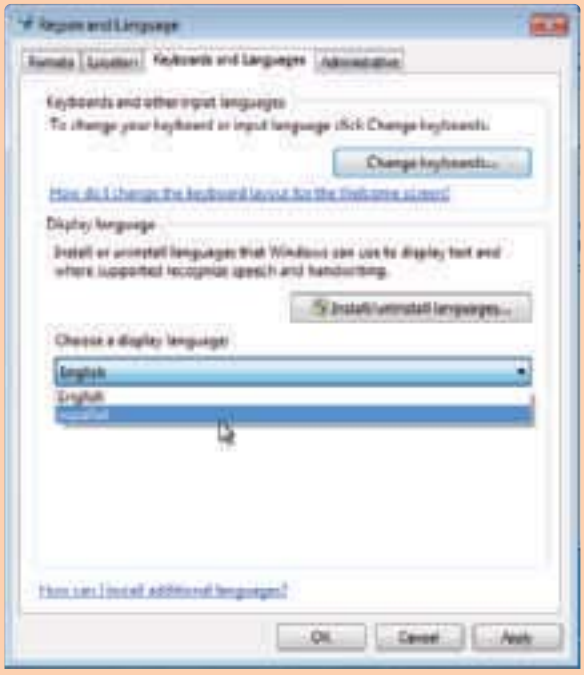
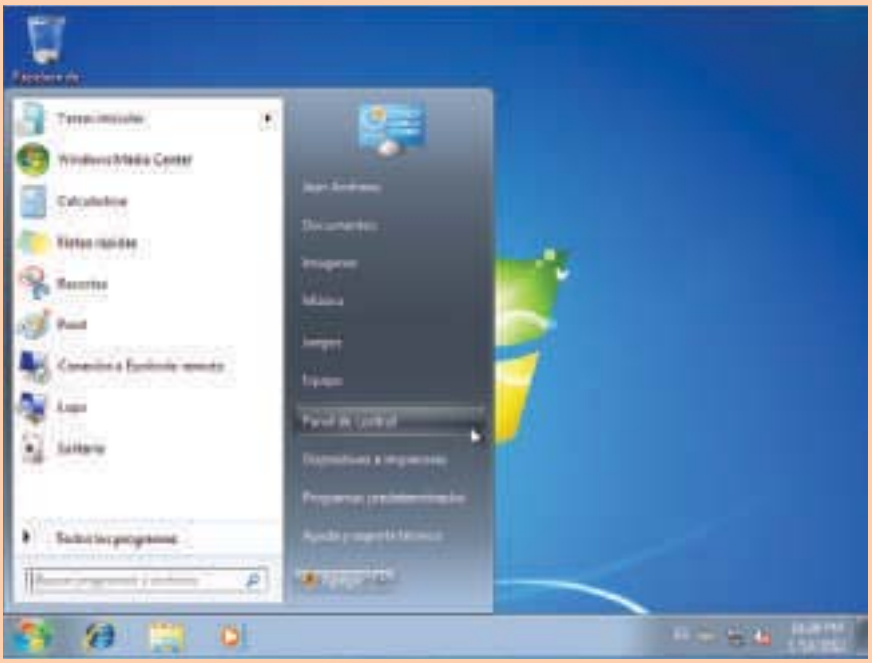
7. To change the display language on the Keyboards and Languages tab, select **español** from the drop-down menu (see Figure 10-42). The language appears in the list of installed languages because the Spanish language was installed in Step 3.



Source: Microsoft Windows 7

Figure 10-42 Select the display language

8. Click **Apply**. A message appears that says you must log off before changes will take effect. Click **Log off now**. After logging back on the system, the Windows interface is now translated into Español (see Figure 10-43).



Source: Microsoft Windows 7

Figure 10-43 Display language in Spanish

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Windows 7/Vista Ultimate offers language packs through Windows Update. For other Windows editions, you can go to the Microsoft web site (*www.microsoft.com*) and download the Language Interface Pack (LIP). Then double-click the downloaded file to install the language. After the language pack is installed, use Control Panel to change the Windows display for the installed language. You also need to change the format used for numbers, currencies, dates, and time. And, if a special keyboard is to be used, you need to change the input language.

Hands-on Project 10-5 Installing Spanish Using Windows 7/Vista Ultimate

Download and install the Spanish language pack on a Windows 7 or Vista computer. If you like, you can use the virtual machine used in Hands-on Project 10-4 for the installation. Configure the machine to use Spanish as the display language and for keyboard input. Print a screen shot of your Windows desktop that appears in Spanish. Return your language settings to English.

>> CHAPTER SUMMARY

Scheduled Preventive Maintenance

- Regular preventive maintenance includes verifying Windows settings, cleaning up the hard drive, defragmenting the hard drive, checking the drive for errors, uninstalling unwanted software, and doing whatever else is necessary to free up enough space on the hard drive for Windows to perform well.
- Windows 7/Vista stores user profiles in the C:\Users folder, and XP stores them in the C:\Documents and Settings folder.
- For best performance, allow at least 15 percent of free space on the Windows volume. The easiest way to clean up temporary files is to use the Disk Cleanup utility in the drive properties box.
- You can defrag the hard drive by using the drive properties box or the Defrag command. By default, Windows 7/Vista automatically defrags weekly.
- Use the Chkdsk utility to check the drive for errors and recover data. The utility can be accessed from a command prompt or the drive properties box.
- Windows 7/Vista supports compressed (zipped) folders and NTFS folder and file compression. You can also compress an NTFS volume.
- Virtual memory uses hard drive space as memory to increase the total amount of memory available. Virtual memory is stored in a paging file named Pagefile.sys. To save space on drive C:, you can move the file to another volume.

Backup Procedures

- You need a plan for disaster recovery in the event the hard drive fails. This plan needs to include routine backups of data and system files.
- A system image of the Windows 7 volume can be created using the Backup and Restore utility. The Complete PC Backup in Vista is a backup of the Vista volume. Windows XP Automated System Recovery can back up the entire hard drive.
- Windows 7 Backup and Restore can be used to schedule routine backups of user data files.

Managing Files, Folders, and Hard Drives

- Commands useful to manage files, folders, and storage media include Help, Dir, Del, Copy, Recover, Xcopy, Robocopy, MD, CD, RD, Chkdsk, Defrag, and Format.
- Use Disk Management to manage hard drives and partitions. Use it to create, delete, and resize partitions, mount a drive, manage dynamic disks, and solve problems with hard drives. XP Disk Management cannot resize a partition.

Regional and Language Settings

- A language pack to display and input the Windows user interface in a language other than English can be downloaded and installed in Windows 7/Vista Ultimate and Enterprise editions. A limited Language Interface Pack (LIP) can be downloaded and installed using any edition of Windows 7/Vista.
- Change the display and input language and the format used for numbers, currencies, dates, and times using the Regional and Language Options dialog box accessed from Control Panel.

>> KEY TERMS

For explanations of key terms, see the Glossary near the end of the book.

active partition
Automated System Recovery (ASR)
basic disk
boot partition
cluster
Compact Disc File System (CDFS)
Complete PC Backup
defragment
Disk Cleanup
dynamic disk
dynamic volumes
elevated command prompt window
extended partition
file allocation table (FAT)
file allocation unit
file system
formatting
fragmented files
Globally Unique Identifier Partition Table (GUID or GPT)
hardware RAID
high-level format
initialization files
logical drives
low-level formatting
Master Boot Record (MBR)
master file table (MFT)
mirroring
mount point
mounted drive
Offline Files
Pagefile.sys
partition
partition table
primary partition
quick format
RAID (redundant array of inexpensive disks or redundant array of independent disks)
RAID0
RAID1
registry
restore point
sector
shadow copy
simple volume
slack
software RAID
striping
system image
system partition
System Protection
System Restore
system state data
track
Universal Disc Format (UDF)
user profile
user profile namespace
virtual memory
volume
wildcard

>> REVIEWING THE BASICS

1. What are the three Windows settings critical to securing a computer that need to be verified as part of regular maintenance?
2. What folder holds the Windows registry? What folder holds a backup of the registry?
3. What folder holds 32-bit programs installed in a 64-bit installation of Windows?
4. What file in the user account folder stores user settings?
5. What is the purpose of the C:\Windows\CSC folder?
6. What is the purpose of the Windows.old folder?
7. How can you delete the Windows.old folder?
8. By default, how often does Windows 7 automatically defrag a drive?
9. What is another name for a file allocation unit, which is used to hold parts of a file on the hard drive?
10. On what type of hard drive does Windows 7 disable defragmenting?
11. What are two reasons to uninstall software you no longer use?
12. What is the filename and normal path of the Windows paging file used for virtual memory?
13. What type of storage media must be used to create a Windows 7 system image?
14. What two Windows utilities are used to create previous versions of files that can be recovered from the file properties dialog box?
15. Why is it important to not store a backup of drive C onto another partition on the same hard drive?
16. What does Windows XP call a backup of the critical system files it needs for Windows operations?
17. What is the *%SystemRoot%* folder as used in Microsoft documentation?
18. What Windows 7/Vista utility creates restore points?
19. How can you delete all restore points?
20. In what folder are restore points kept?
21. Which dialog box can you use to manually create a restore point?
22. What is the difference between the file allocation table used by the exFAT file system and the one used by the FAT32 file system?
23. List the steps to open an elevated command prompt window.
24. In a command line, what is the purpose of the ? in a filename?
25. What is the purpose of the more parameter at the end of a command line?
26. What is the command to list all files and subdirectories in a directory?
27. Using Windows 7 or Vista, what type of command prompt window is needed to run the Chkdsk command?

28. When you want to use Chkdsk to fix file system errors and the drive is not locked, when does Windows schedule the Chkdsk command to run?
29. What command is intended to replace Xcopy?
30. Which Windows tool can you use to split a partition into two partitions?
31. Which is more stable, RAID implemented by Windows or RAID implemented by hardware?
32. When you move a dynamic disk to a new computer, what status will Disk Management first assign the drive?
33. Which editions of Windows 7 allow you to install a language pack by using Windows Update?

>> THINKING CRITICALLY

1. Write and test commands to do the following:
(Answers can vary.)
   a. Create a folder named C:\data.
   b. Create a folder named C:\data\test1 and a folder named C:\data\test2.
   c. Copy Notepad.exe to the Test1 folder.
   d. Move Notepad.exe from the Test1 folder to the Test2 folder.
   e. Make C:\ the default folder.
   f. Without changing the default folder, list all files in the Test2 folder.
   g. Delete the Test2 folder.
   h. Delete the C:\data folder.
2. You are trying to clean up a slow Windows 7 system and discover that the 75 GB hard drive has only 5 GB free space. The entire hard drive is taken up by drive C. What is the best way to free up some space?
   a. Compress the entire hard drive.
   b. Move the \Program Files folder to an external hard drive.
   c. Delete the Windows.old folder.
   d. Reduce the size of the paging file.
3. Which is the best first step to protect important data on your hard drive?
   a. Use dynamic disks to set up a striped volume so that the data has redundancy.
   b. Back the data up to another media.
   c. Compress the folder that holds the data.
   d. Put password protection on the data folder.

>> REAL PROBLEMS, REAL SOLUTIONS

REAL PROBLEM 10-1: Researching the Winsxs Folder

While cleaning up a hard drive, you begin to look for folders that are excessively large and discover the C:\Windows\winsxs folder is more than 7 GB. That's almost half the size of the entire C:\Windows folder. Use the web to research the purpose of the winsxs folder. What goes in this folder and how does it get there? How can the size of the folder be reduced without causing major trouble with the OS? Write a brief one-page paper about this folder and cite at least three articles you find on the web about it.

REAL PROBLEM 10-2: Using Microsoft SyncToy

You own a small computer service company and have several clients who work out of a home office. Jason is one of them. Jason uses Windows XP on his desktop and Windows 7 on his laptop. He travels with his laptop but uses his desktop computer when he's at home. He keeps all his important data files in a folder, C:\Data, on his desktop computer. When he leaves for a business trip, he copies only the files from the \Data folder to his laptop that he expects to use on the trip. On the trip, some of these files are edited or deleted, and some new files are created. When he gets back home, he copies one file at a time from the laptop to the desktop using his home network. However, he has told you that occasionally he forgets to copy the files from the laptop to the desktop before he makes changes in the desktop files. Therefore, he's concerned that if he copied the entire \Data folder from the laptop to the desktop, he might lose an important change.

He has asked you to help him find a better method to synchronize his \Data folders on these two computers. After a little research, you find the free Microsoft SyncToy utility on the Microsoft web site and decide you need to test it to see if it will meet Jason's needs. Set up a testing situation and then answer the following questions:

1. List the high-level steps (not the keystrokes) you used to test the utility.
2. What test files did you use to test it?
3. What problems, if any, did you encounter in the testing process?
4. Do you think the utility is a good fit for Jason? Why or why not?

REAL PROBLEM 10-3: Cleaning Up a Sluggish Windows System

Do you have a Windows system that is slow and needs optimizing? If not, talk with family and friends and try to find a slow system that can use your help. Using all the tools and techniques presented in this chapter, clean up this sluggish Windows system. Take detailed notes as you go, showing what you checked before you started to solve the problems, what you did to solve the problems, and what were the results of your efforts. What questions did you have along the way? Bring these questions to class for discussion.