

Chapter 7

The Mass Storage System

In This Chapter

- ▶ Recognizing storage devices
 - ▶ Working with removable storage
 - ▶ Inserting and removing media
 - ▶ Exploring external storage
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Your PC uses mass storage to keep digital stuff for the long haul. It's the equivalent of your closet, basement, garage, or any cubbyhole or cranny where you store your personal stuff. The big difference is that everything put into mass storage on a computer dwells within the digital realm.

The PC's Mass Storage System

The PC's mass storage system is far more interesting than computer memory. Face it: RAM is like dry toast. The mass storage system, on the other hand, is like a Cobb salad or beef stew. It's a single item with many separate components, all of which do the same thing: store information for the long run.

Mass storage is the home for the computer's operating system, programs, and all the stuff you create and use on the PC. It's a big deal. All PCs — all computers and computer-like devices — include some form of mass storage.

✔ You might refer to mass storage by its discrete names based on storage type or media. These names include hard drive (or hard disk), thumb drive, media card, and others. All those devices fall under the main category, mass storage.



- ✓ Mass storage might also be referred to as *memory*. Though it's a type of memory (long-term), it's not the same as RAM, or the PC's short-term memory, as covered in Chapter 6.
- ✓ As with computer memory, mass storage is measured in bytes. Chapter 6 offers a clever and interesting explanation on how bytes measure storage capacity.
- ✓ In the olden days, the PC's mass storage was referred to by one term: disk drive. Today's PC uses more than disk drives for storage, so the whole kit and caboodle is called *mass storage*.

Surveying the mass storage landscape

Your computer plays host to several forms of storage media. These devices all work together to form the PC's mass storage system.

The various storage devices fall into two broad categories: fixed and removable.

Fixed storage: This type of storage is located inside the PC's console. It's not "fixed" in the sense that it was ever broken; it's fixed in the sense that it's not removable. The two types of fixed media are the traditional hard drive and the newer solid-state drive, or SSD.

Removable storage: This storage category includes just about every type of storage media: the media card, thumb drive, optical drive (CD or DVD drive), external hard drive, and even the old floppy drive.

These two categories also reflect the media's location. Fixed storage is always located inside the console. Removable storage is external to the console. The oddball is the optical drive, which is internal, but its media (the discs) are removable.

- ✓ Removable storage most often uses the USB interface. See Chapter 10 for details on USB stuff.
- ✓ It's possible to expand your PC's storage system by adding more internal storage, such as a second hard drive or SSD. Depending on the size of the console, you may be able to add one or several — or none, for small-format PCs and laptops.
- ✓ The hard drive is also known as a hard disk drive or, sometimes, hard disk. See the nearby sidebar, "Mass storage technical terms to ignore."

- ✔ An SSD is essentially a large-capacity media card. SSDs are fast, but because of their higher cost, they're not as common as traditional hard drives.
- ✔ You use removable media such as optical discs, media cards, and thumb drives for a variety of purposes. Some common tasks include transferring files between computers and portable electronic gizmos and backing up important information.
- ✔ At one time, optical drives were the PC's primary removable storage device. Because the optical disc capacity hasn't increased over time, media cards now serve as the primary removable storage media.
- ✔ If your PC didn't come with an optical drive and you desperately want one, you can obtain an external, USB optical drive.

Identifying the primary storage device

Of all the storage media available to your PC, one has to be the head honcho, the big cheese, the A-number-one. That media is known as the PC's primary storage device.

The PC uses the primary storage device to start the computer and load the operating system. The primary storage device is also home to all the programs installed on the computer, and to your own personal storage area, and it's where programs prefer to save the stuff you create.

- ✔ Your PC's primary storage media is either a hard drive or SSD.
- ✔ The primary storage device is always fixed storage located inside the console.
- ✔ An SSD is like a giant media card, but with a capacity high enough that it can be used as the PC's primary mass storage device. Because the SSD is fully electronic, it's very fast.
- ✔ The PC's primary storage media is known as *Drive C* or the *C drive*. See the section "Handing out drive letters," later in this chapter, for an explanation.
- ✔ The primary storage media is also known as the *boot disk*. The PC's firmware looks to that location for the operating system when the computer first starts. The operating system could also be loaded from another source, such as an optical disc or thumb drive. If that source is available, a prompt appears when the computer first starts, inquiring whether you want to use the media as the boot device.





Mass storage technical terms to ignore

The following terms may rear their ugly heads when dealing with mass storage. You have no sane reason to know this stuff:

Disk: The disk is the part of a disk drive that holds information. It's the media upon which the bits and bytes are written. It really is a disk, too: round media with a hole in the middle.

Drive: The drive is the mechanism that reads the media. For a disk drive, the drive spins the disk upon which information is written to and read from. For a media card, the drive is the gizmo that accesses the information stored on the media card's flash memory chip. As an example, a media card requires a card reader (drive). A thumb drive contains both the media and the drive.

Interface: The interface refers to both the hardware and software that transfers information between the storage media and the rest of the computer. The current interface standard for hard drives, optical drives, and SSDs is called *SATA*, which stands for Serial Advanced Technology Attachment. For external storage, the interface standards include USB, IEEE, and eSATA. Chapter 10 offers scintillating details.

Media: The media is where information is recorded. Media is the disk in a disk drive or the CD or DVD in an optical drive. For a media card, media is the card itself, though some humans may insist that it's the *flash memory* inside the media card. Nerds.

Finding mass storage devices

Of the two types of mass storage devices — fixed and removable — removable is easier to locate and identify. After all, a thumb drive sticking out of the console like some tiny diving board is pretty obvious. External hard drives are obnoxiously present, thanks to their multitude of cables. Internally, however, fixed storage is more difficult to ID.

The primary storage device might be evident by a drive lamp on the console. This lamp flickers when the device is accessed. The lamp isn't as common a feature as it once was. In fact, the lamp was once part of the physical drive itself, the front part of which was exposed in the standard PC console. Today, it's just a lamp.

An optical drive is fixed in the console, but its media (the discs) are removable. Therefore, the drive requires exposure so that you can insert and remove the discs. Figure 7-1 illustrates the typical optical drive interface. It may be readily apparent on the front of the console or hidden behind a door.

The key elements of an optical drive are the disc tray, which slides out to accept a disc, and the Eject button, which pops out the tray. Some optical

drives use a slot instead of a tray, in which case the drive appears as a mysterious slit and not festooned with the fancy features shown in Figure 7-1.

If the PC sports a media card reader, its drive also appears on the console. Figure 7-2 illustrates the standard 19-in-1 media card reader, which contains slits and slots for all types of media cards.

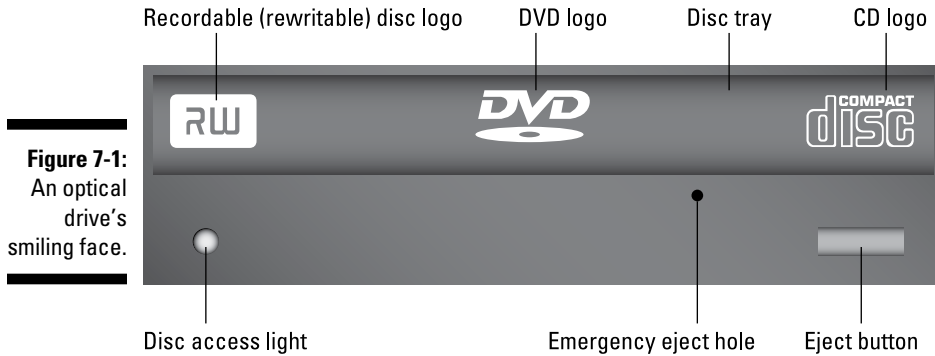


Figure 7-1:
An optical
drive's
smiling face.

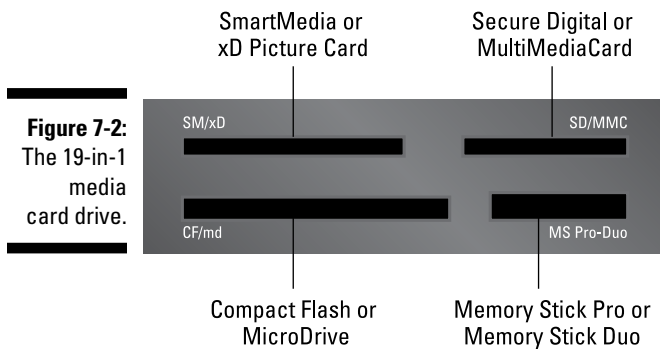


Figure 7-2:
The 19-in-1
media
card drive.

Some PCs may sport only a single media card slot — typically, for a Secure Digital (SD) card. Otherwise, whatever the media card type, you can jam it into one of the available holes on the 19-in-1 card interface.

- PCs with multiple internal hard drives still sport only one hard drive lamp on the console. Is it really a hard drive lamp? I think it's just a signal for when the hard drive manufacturer's stock price jumps.
- An important feature of the optical drive is the emergency eject hole (refer to Figure 7-1). If a disc becomes stuck or the computer is off, jab an unbent paperclip into the hole to pop out the tray. This feature explains why nerds keep unbent paperclips by their computers. The nerds most definitely don't use the paperclips to clean their ears.



- ✓ If your PC lacks an internal media card reader, you can buy a USB media card reader. Curiously, the media card reader is cheaper than the price of a typical media card.

Inserting a media card or thumb drive

The term *removable* implies the ability to both insert and remove storage media. You attach a thumb drive, insert a media card, or slide in a DVD. Then, when you're done using the storage, you eject the media.



Once inserted, the removable media is accessed on your computer system just like any other mass storage. It's given a drive letter, and the files and whatnot on that media are made instantly available for use.

- ✓ See the later section “Handing out drive letters” for information on the drive letter assigned to removable media.
- ✓ Also see the section “Accessing removable media” to see what you can do with media after it's added to the PC's storage system.
- ✓ Media cards are inserted label side up — unless the card reader is mounted vertically. Regardless of the drive's orientation, the card goes in only one way.
- ✓ To connect a thumb drive to your PC, plug the thumb drive into an available USB port. The drive plugs in only one way, and the odds are pretty good that your first attempt will be wrong, so just flip over the thumb drive and try again.
- ✓ The USB connector on some thumb drives is hidden. You must remove a cover or press a slide switch to reveal the connector.
- ✓ Don't force a media card into a slot! If the media card doesn't fit into one slot, try another.



Inserting an optical disc

An optical disc is inserted label side up — unless the drive is mounted vertically, such as in an all-in-one PC. In that case, the label faces you.

If the optical drive uses a tray to hold the disc, press the drive's Eject button. Out pops the tray. Drop the disc into the tray, label side up. Gently nudge the tray back into the computer. The tray slides back in the rest of the way on its own.

For the slot type of optical drive, push the disc into the slot. A gremlin inside the drive eventually grabs the disc and pulls it in all the way.

What happens after you insert the disc depends on the disc's content. You may see a prompt to install software, play a movie, or play or import music — or sometimes you don't see anything. In that case, to discover what to do next, you must heed whatever paltry directions came with the optical disc.

Ejecting media

You cannot just yank media out of a computer. Although nothing prevents you from being naughty and doing so, you run the risk of damaging the information stored on the media, not to mention having to endure a nasty warning message from Windows. That's the worst part.

Follow these steps to properly and politely remove media:

1. Ensure that you're done using the storage media.

Close any open files on the media, which may imply closing whatever program you used to access those files.

2. Summon a File Explorer window.

Press the Win+E keyboard shortcut. The File Explorer window appears.

3. In Windows 10, choose This PC from the list on the left side of the window.

The File Explorer window lists your PC's mass storage devices, including removable media, similar to what's shown in Figure 7-3.

4. Click to select the removable media's drive icon.

Just click once; you want to select the icon, not open it.

It's not always obvious which icon in the window represents a media card or thumb drive. Sometimes, you can tell because the name below the icon is something other than Removable Disk.

5. In Windows 10, click the Drive Tools Manage tab.

Refer to Figure 7-3 for its location.

6. Click the Eject button.

Optical drives spit out the disc automatically. Otherwise, you see a notification explaining that the media can be removed.

7. Remove the media.

Store the media in a safe location when you're not using it.



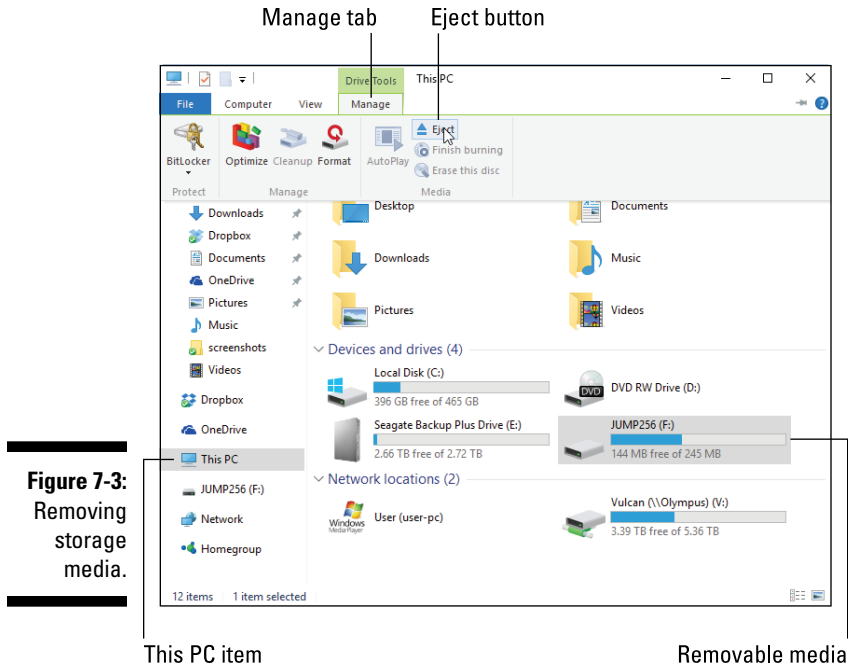


Figure 7-3:
Removing
storage
media.



Avoid temptation! Do not simply yank out a thumb drive or pinch free a media card. Never punch the Eject button on the front of the optical drive. If the media is in use, you witness an ugly, embarrassing, and potentially career-ending error message.

Adding more storage

You can increase your PC's mass storage by adding more drives and media, either internally or externally. The external choice is easier: You can connect an external USB hard drive, media card reader, optical drive, and so on. Plug in the drive and the storage is available.

Internally, you can add another hard drive, SSD, or optical drive to the PC — as long as that room is available inside the console. You can do this operation yourself, although I recommend having a dealer, computer repair place, or suitably nerdy teenager do the installation and setup for you.

- Many external hard drives require a power source, which makes for two cables total: USB and power. Unlike in the movies, real-life computers have way too many cables.



- ✓ If your PC uses a UPS, plug the external hard drive into the UPS to ensure that the storage doesn't go offline during a power dip or outage. See Chapter 3 for details.

The Mass Storage Alphabet

To keep your mass storage devices honest, the PC's operating system requires three forms of ID: a drive letter, an icon, and a name. Also in the mix is information about the media's capacity and how much of that capacity is being ravenously consumed. Then there's the media's superhero identity, which for national security reasons isn't disclosed in this book.

Handing out drive letters

Of all the forms of mass storage ID, the drive letter is the most important. Windows assigns each individual storage gizmo a drive letter. As you might suspect, these letters follow the Latin alphabet, which optimally ascends from A to Z. I assume that the drive letters go from A to Я in Russian, and the range is probably A to Ω in Greek. To access the media, you must know its drive letter.

Using logic found only in the computer industry, Windows assigns the most important letter to the PC's primary storage device. That letter is C.

Additional storage devices are assigned letters alphabetically, with internal storage coming next (Drive D and up). External media is assigned drive letters as the media is attached, although a media card reader may use preset drive letters.

Bottom line: Beyond drive C, the primary storage device, the drive letters used by storage media in your PC could be anything. And just because the optical drive on your computer is Drive D doesn't mean that it's Drive D on all PCs.

To overview all the storage devices available to your computer, follow these steps:

- 1. Press the Win+E keyboard shortcut.**

A File Explorer window appears.

- 2. In Windows 10, choose This PC from the items listed on the left side of the window.**

You see a window, either This PC (Windows 10) or Computer (earlier, cruder versions of Windows). Storage devices are listed, along with their assigned drive letters, as illustrated in Figure 7-4.

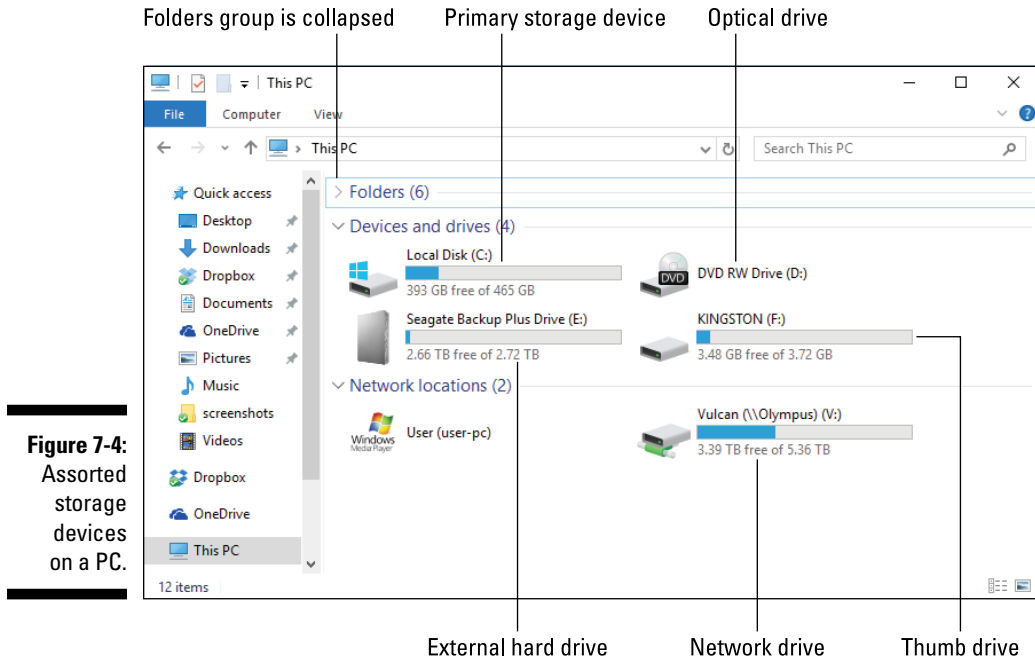


Figure 7-4:
Assorted
storage
devices
on a PC.

In Figure 7-4, the PC's storage media is assigned drive letters in this manner:

- Drive C is the primary hard drive, named Local Disk.
- Drive D is an optical drive (with no media).
- Drive E is an external hard drive.
- Drive F is a thumb drive.
- Drive V is a mapped network drive.

The letter assignments you see on your PC can be different, with only Drive C the constant.



- Beyond Drive C, the drive letters used on one PC may not be the same for another PC. To know which letters are which, you have to view the This PC window or the Computer window, as described in this section.
- Drive V in Figure 7-4 is known as a *mapped* network drive. It exists on a network server (or another computer on the network) and is referenced locally by using drive letter V. See Chapter 17 for details on mapping network drives.
- The optical drive is represented by a single drive letter and icon in Windows. Similarly, each hole in the media card reader is represented by a drive letter. That letter stays the same no matter which media you place into the drive.



- ✔ Rumor has it that the letter *C* was chosen for the primary storage device because it was Bill Gates' college grade average.
- ✔ Here's a weird thing: If you attach a USB floppy disk drive to your PC, it's assigned drive letter A. See the nearby sidebar, "Crazy drive-letter rules."
- ✔ The issue I have with the Windows drive-lettering scheme is that it divides all mass storage by device. It's far more convenient for all mass storage to exist in a single structure and be referenced from a central starting point. The fact that the drive letter scheme is inconsistent from computer to computer further compounds the problem.

Exploring drive icons and names

To keep you entertained, and in addition to drive letters, Windows uses icons and names to help identify storage devices. Both are shown in Figure 7-4 and also appear on your own PC in the This PC window or Computer window.

The icons are pulled from an assortment stored within Windows. They typically represent an image of the storage device or what Windows believes the storage device might look like. The primary storage device features a Windows logo; in Figure 7-4, the Windows 10 logo is shown affixed to Drive C.

The device names are a joke. They appear by the drive icons, as shown in Figure 7-4. The names are rather dull, such as Local Disk and Seagate Backup Plus Drive. That's okay because nothing I know of uses the name, other than the name of the primary storage device, and even that can be changed.



- ✔ You can change a drive name just as you can rename any file: Click the drive icon and press the F2 key. Type in a new name. Change the name Thumb Drive to the name This Is Not Where I Keep My Porn or something even more exciting.
- ✔ See Chapter 15 for official information on renaming files.
- ✔ You need Administrator privileges to change the name of the primary storage device. This is supposedly some type of security, although nothing catastrophic happens when you change the name.
- ✔ Some versions of Windows categorize the storage devices as internal, external, and network. These categories are shown in the Computer window. Otherwise, you have no visual clue to where a storage device is physically located.



- ✔ I recommend changing the name of removable media, simply to keep the devices organized. For example, all your thumb drives might be named KINGSTON (refer to Figure 7-4). Changing the name may help you recognize the thumb drive and its contents.



Crazy drive-letter rules

Windows uses a storage media lettering scheme that is rife with confusion, mostly because it's buried in a tradition that dates back to 1981 and the original IBM PC. Back then, mass storage devices were a rare commodity on a personal computer.

The original IBM PC came with one or two floppy drives, named A and B. When the IBM PC XT model was introduced, it sported a whopping 10MB hard drive, which was given drive letter C. Since then, the first, or primary, storage device in all PCs is given drive letter C, with letters A and B reserved for floppy drives, if available.

Any additional internal storage after the primary hard drive is assigned the next letter of the alphabet after C. So, if you have a second internal hard drive, it becomes Drive D. A third internal hard drive would be Drive E. The

internal optical drive is given the next drive letter after the last internal hard drive. Any additional internal optical drives are given the next letter (or letters) of the alphabet.

After the optical drive, any internal media card readers are given the next few drive letters, one for each media card slot.

After all internal storage has been assigned letters, Windows begins assigning letters to external storage devices in the order in which they're found when the PC was first turned on or when the drives were attached. Each new storage device is given the next letter in the alphabet.

Network drives are assigned, or *mapped*, to drive letters. So you can pick any available letter of the alphabet to use for a mapped network drive.

➤ The optical drive icon changes to reflect the media. When you insert a music CD, the icon turns into a music CD icon. Windows also uses a DVD movie icon, and programs installed from an optical disc also sport their own fun and non-offensive icons.

Checking drive capacity

One vital storage information tidbit is the media's capacity. Specifically, you want to ensure that free storage space on a device doesn't get too low. If it does, the PC starts acting sluggish and might even refuse to install new software or save files. As with feeding peas to a 3-year-old, it's a situation you want to avoid.

In Figure 7-4, you see storage capacity shown by each device. A thermometer bar graphically indicates how much storage is used and how much is available. A better way to gauge capacity is to check the storage device's Properties icon. Follow these steps:

1. Bring up a File Explorer window.

Press the Win+E keyboard shortcut.

2. In Windows 10, choose This PC on the left side of the window.

3. Right-click a storage device icon and choose Properties from the shortcut menu.

The device's Properties dialog box appears, similar to what's shown in Figure 7-5.

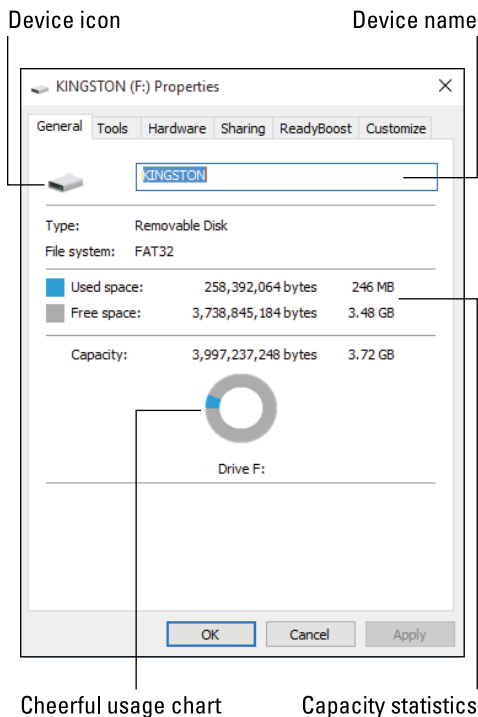


Figure 7-5:
Checking
storage
device info.

The information shown in the dialog box is unique to the storage device. Shown are the device's name, type of storage, cryptic file system info, as well as used and free space. A handy chart illustrates storage capacity graphically, as shown in Figure 7-5.

4. Close the Properties dialog box when you're done gawking.

When a device's storage nears capacity, Windows displays a warning. Your job is to free space on the storage device or begin using another storage device. See Chapter 24 for details.

Although watching capacity is a good thing to do, be aware that optical drives are always shown at full capacity. Unless you're creating (burning) your own optical disc, the media appears to be full. This situation isn't a problem.

Using mass storage

All mass storage available to the computer is available for your use. You can use a File Explorer window to manage files directly. You also use Open and Save As dialog boxes to access media for retrieving and saving items, respectively.

- ✔ Anytime you use the Save As or Save command, you're putting information into mass storage. That information is transferred from computer memory (RAM) to long-term storage.
- ✔ When you use the Open command, you're taking information out of long-term storage and copying it to computer memory. That's because information can only be examined, used, changed, or created in computer memory.
- ✔ The Open and Save As dialog boxes are covered in Chapter 15.

Accessing removable media

The key to using external storage is to first insert the media card or thumb drive, or attach the storage device. After the storage device is available, you can start using it. How do you know the device is available? Its icon appears in the This PC or Computer window.

- ✔ The key to stopping the use of external storage is to properly eject it, which is covered in the section "Ejecting media," earlier in this chapter.
- ✔ After inserting a media card, a thumb drive, or an optical disc, you may see a flurry of activity in Windows. A notification might appear (explaining that drivers are being installed), an AutoPlay message might pop in, a prompt to install software may show up, music can start playing, or any number of wild and exciting things can happen. Refer to Chapter 19 for information on AutoPlay.
- ✔ Another term for adding storage to a computer is *mount*. For example, you mount an external hard drive. Only fully confessed nerds should use the term *mount*.

