

# Portable Computing

In this chapter, you will learn how to

- Describe the many types of portable computing devices available
- Enhance and upgrade portable computers
- Manage and maintain portable computers
- Troubleshoot portable computers

There are times when the walls close in, when you need a change of scenery to get that elusive spark that inspires greatness ... or sometimes you just need to get away from your co-workers for a few hours because they're driving you nuts! For many occupations, that's difficult to do. You've got to have access to your documents and spreadsheets; you can't function without e-mail or the Internet. In short, you need a computer to get your job done.

Portable computing devices combine mobility with accessibility to bring you the best of both worlds; put more simply, portables let you take some or even all of your computing abilities with you when you go. Some portable computers feature Windows XP systems with all the bells and whistles and all your Microsoft Office apps for a seamless transition from desk to café table. Even the smallest portable devices enable you to check your appointments and address book, or play Solitaire during the endless wait at the doctor's office. This chapter takes an in-depth look at portables, first going through the major variations you'll run into and then hitting the tech-specific topics of enhancing, upgrading, managing, and maintaining portable computers. Let's get started!

## Essentials

### Portable Computing Devices

All portable devices share certain features. For output, they have LCD screens, although these vary from 20-inch behemoths to microscopic 2-inch screens. Portable computing devices employ sound of varying quality, from simple beeps to fairly nice music reproductions. All of them run on DC electricity stored in batteries, although several different technologies offer a range of battery life, lifespan, and cost. Other than screen,

sound, and battery, portable computing devices come in an amazing variety of shapes, sizes, and intended uses.



**EXAM TIP** Note that this chapter does not have an Historical/Conceptual section. Everything in here is on the CompTIA A+ certification exams, so pay attention!

LCD Screens

Laptops come in a variety of sizes and at varying costs. One major contributor to the overall cost of a laptop is the size of the LCD screen. Most laptops offer a range between 12-inch to 17-inch screens (measured diagonally), while a few offer just over 20-inch screens. Not only are screens getting larger, but also wider screens are becoming the status quo. Many manufacturers are phasing out the standard 4:3 aspect ratio screen in favor of the widescreen format. *Aspect ratio* is the comparison of the screen width to the screen height. Depending on screen resolution, widescreens can have varying aspect ratios of 10:6, 16:9, 16:9.5, or 16:10. The 16:9 aspect ratio is the standard for wide-screen movies while 16:10 is the standard for 17-inch LCD screens.

Laptop LCD screens come in a variety of supported resolutions, described with acronyms such as XGA, WXGA, WSXGA, and more. The *W* in front of the letters indicates widescreen. Table 19-1 lists commonly supported laptop display resolutions.

| Acronym | Name                               | Native Resolution |
|---------|------------------------------------|-------------------|
| XGA     | eXtended Graphics Array            | 1024 × 768        |
| SXGA    | Super eXtended Graphics Array      | 1280 × 1024       |
| SXGA+   | Super eXtended Graphics Array Plus | 1400 × 1050       |
| WSXGA+  | Widescreen SXGA                    | 1680 × 1050       |
| UXGA    | Ultra eXtended Graphics Array      | 1600 × 1200       |
| WUXGA   | Widescreen UXGA                    | 1920 × 1200       |

Table 19-1 Screen Resolutions

Laptop screens come with two types of finish: *matte* and *high gloss*. The matte finish was the industry standard for many years and offers a good trade-off between richness of colors and reflection or glare. The better screens have a wide viewing angle and decent response time. The major drawback for matte-finished laptop screens is that they wash out a lot in bright light. Using such a laptop at an outdoor café, for example, is almost hopeless during daylight.

Manufacturers released high-gloss laptop screens in 2006, and they’ve rapidly taken over many store shelves. The high-gloss finish offers sharper contrast, richer colors, and wider viewing angles when compared to the matte screens. Each manufacturer has a different name for high-gloss coatings. Dell calls theirs TrueLife; Acer calls theirs Crystal-Brite; and HP calls theirs BrightView. The drawback to the high-gloss screens is that, contrary to what the manufacturers’ claim, they pick up lots of reflection from nearby objects, including the user! So while they’re usable outside during the day, you’ll need to contend with increased reflection as well.

## Desktop Replacements

When asked about portable computing devices, most folks describe the traditional clamshell *laptop* computer, such as the one in Figure 19-1, with built-in LCD monitor, keyboard, and input device (a *touchpad*, in this case). A typical laptop computer functions as a fully standalone PC, potentially even replacing the desktop. The one in Figure 19-1, for example, has all of the features you expect the modern PC to have, such as a fast CPU, lots of RAM, a high-capacity hard drive, CD-RW and DVD drives, an excellent sound system, and a functioning copy of Windows XP. Attach it to a network and you can browse the Internet and send e-mail. Considering it weighs almost as much as a mini-tower PC (or at least it feels like it does when I'm lugging it through the airport!), such a portable can be considered a *desktop replacement*, because it does everything that most people want to do with a desktop PC and doesn't compromise performance just to make the laptop a few pounds lighter or the battery last an extra hour.

**Figure 19-1**  
A notebook PC



**NOTE** There's no industry standard naming for the vast majority of styles of portable computing devices, and thus manufacturers let their marketing folks have fun with naming. What's the difference between a portable, a laptop, and a notebook? Nothing. One manufacturer might call its 12-inch LCD, four-pound portable a notebook, while another manufacturer might call its much larger desktop-replacement portable a notebook as well. A laptop refers in general to the clamshell, keyboard-on-the-bottom and LCD-screen-at-the-top design that is considered the shape of mobile PCs.

## Laptop Input Devices

For input devices, desktop replacements (and other portables) used trackballs in the early days, often plugged in like a mouse and clipped to the side of the case. Other models with trackballs placed them in front of the keyboard at the edge of the case nearest the user, or behind the keyboard at the edge nearest the screen.

The next wave to hit the laptop market was IBM's *TrackPoint* device, a pencil eraser-sized joystick situated in the center of the keyboard. The TrackPoint enables you to move the pointer around without taking your fingers away from the "home" typing position. You use a forefinger to push the joystick around, and click or right-click using two buttons below the spacebar. This type of pointing device has since been licensed for use by other manufacturers, and it continues to appear on laptops today.

But by far the most common laptop pointing device found today is the *touchpad* (Figure 19-2)—a flat, touch-sensitive pad just in front of the keyboard. To operate a touchpad, you simply glide your finger across its surface to move the pointer, and tap the surface once or twice to single- or double-click. You can also click using buttons just below the pad. Most people get the hang of this technique after just a few minutes of practice. The main advantage of the touchpad over previous laptop pointing devices is that it uses no moving parts—a fact that can really extend the life of a hard-working laptop. Some modern laptops actually provide both a TrackPoint-type device and a touchpad, to give the user a choice.

**Figure 19-2**  
Touchpad  
on a laptop



## Weighty Issues

Manufacturers advertise the weight of portable PCs, for the most part, without the weight of the battery or the removable drives. Although this deception is deplorable, it's pretty much universal in the industry because no manufacturer wants to be the first to say that their desktop-replacement portable, including battery and DVD-RW drive, weighs 15 pounds when their competitor advertises the same kind of machine at 7.5 pounds! They'd lose market share quickly.

So when you shop or recommend portable PCs, take the real weight into consideration. By the time you fill your laptop bag with power adapters, external mice, a spare battery, and all the extra accessories, you'll definitely be carrying more than the advertised 5–6 pounds.

## Desktop Extenders

Manufacturers offer *desktop extender* portable devices that don't replace the desktop, but rather extend it by giving you a subset of features of the typical desktop that you can take away from the desk. Figure 19-3 shows a portable with a good but small 13.3-inch wide screen. The system has 512 MB of RAM, a 2-GHz processor, a 60-GB hard drive, and a battery that enables you to do work on it for more than five hours while disconnected from the wall socket. Even though it plays music and has a couple of decent, tiny speakers, you can't game on this computer (Solitaire, perhaps, but definitely not Half-Life 2!). But it weighs only five pounds, nearly half the weight of the typical desktop replacement portable.

**Figure 19-3**  
Excellent mid-sized  
portable computer



Desktop extenders enable you to go mobile. When I'm on a roll writing, for example, I don't want to stop. But sometimes I do want to take a break from the office and stroll over to my favorite café for a latté or a pint of fine ale. At moments like these, I don't need a fully featured laptop with a monster 15-inch or 17-inch screen, but just a good word processing system—and perhaps the ability to surf the Internet on the café's wireless network so I can research other important topics once I finish my project for the day. A lightweight laptop with a 12–13-inch screen, a reasonably fast processor, and gobs of RAM does nicely.

## Ultralights

Ultralight portables are computers that normally weigh less than three pounds and are less than an inch in thickness. These machines usually have smaller displays, lower-capacity hard drives, and CPUs that operate at lower speeds than their more full-sized brethren. This class of portable computers is designed for the busy traveler who wants a nearly full-featured laptop in a small, easily transported package. Often, these laptops are much more expensive than larger, faster machines—think of it as paying more to get less! You'll hear the term *subnotebooks* used to describe ultralight portables; the terms aren't quite synonymous, but the marketing waters for all portable computing devices are pretty muddy.

## PDA's

Having a few computing essentials on hand at all times eases the day and makes planning and scheduling much more likely to succeed. Several companies, such as Palm, Sony, Toshiba, Hewlett-Packard, Dell, and Microsoft, manufacture tiny handheld portable computing devices that hold data such as your address book, personal notes, appointment schedules, and more. Such machines are called *personal digital assistants* (PDAs). All modern PDAs have many applications, such as word processors for jotting down notes or shopping lists, expense reports, and even image viewers. Figure 19-4 shows a Palm Zire 71 PDA.

**Figure 19-4**  
Palm Zire 71  
displaying a to-do list



PDAs don't run Windows XP or even 98, but rather require specialized OSs such as Windows CE, PocketPC, PalmOS, and Linux. All of these OSs provide a GUI that enables you to interact with the device by touching the screen directly. Many of today's

PDAs use handwriting recognition combined with modified mouse functions, usually in the form of a pen-like *stylus* to make a type of input called *pen-based computing*. To make an application load, for example, you would slide the stylus out of its holder in the PDA case and touch the appropriate icon with the stylus tip.

## HotSync

PDAs make excellent pocket companions because you can quickly add a client's address or telephone number, check the day's schedule before going to your next meeting, and modify your calendar entries when something unexpected arises. Best of all, you can then update all the equivalent features on your desktop PC automatically! PDAs synchronize with your primary PC so you have the same essential data on both machines. Many PDAs come with a cradle, a place to rest your PDA and recharge its battery. The cradle connects to the PC most often through a USB port. You can run special software to synchronize the data between the PDA and the main PC. Setting up the Zire 71 featured previously, for example, requires you to install a portion of the Palm desktop for Windows. This software handles all the synchronization chores. You simply place the PDA in the properly connected cradle and click the button to synchronize. Figure 19-5 shows a PDA in the middle of a *HotSync* operation, PalmOS's term for the process of synchronizing.

**Figure 19-5**  
HotSync in progress



## Beaming

Just about every PDA comes with an infrared port that enables you to transfer data from one PDA to another, a process called *beaming*. For example, you can readily exchange business contact information at a conference or share pictures that you carry around in your PDA. The process is usually as simple as clicking a drop-down list and selecting Beam or Beaming from the menu. The PDA searches the nearby area—infrared has a very limited range—to discover any PDA close by. The receiving PDA flashes a message to its owner asking permission to receive. Once that's granted, you simply stand there and wait for a moment while the PDAs transfer data. Click!



**NOTE** Chapter 21 goes into more detail on infrared networking.



## PDA Memory

Almost every PDA has both internal Flash ROM memory of 1 MB or more, and some sort of removable and upgradeable storage medium. Secure Digital (SD) technology has the strongest market share among the many competing standards, but you'll find a bunch of different memory card types out there. SD cards come in a variety of physical sizes (SD, Mini SD, and Micro SD) and fit in a special SD slot. Other popular media include CompactFlash (CF) cards and Sony's proprietary Memory Stick. You'll find capacities for all the standards ranging from 128 MB up to 8 GB—on a card the size of a postage stamp! Figure 19-6 shows some typical memory cards.

**Figure 19-6**  
SD, Mini SD, and  
Micro SD (photos  
courtesy of SanDisk)



**NOTE** Memory cards of all stripes made the leap in 2003 from the exclusive realm of tiny devices such as PDAs and digital photographic cameras to fully featured portable PCs and even desktop models. Some Panasonic PCs sport SD card slots, for example, and you can expect nearly every Sony PC—portable or otherwise—made in 2003 and later to offer a Memory Stick port.

## Tablet PCs

*Tablet PCs* combine the handwriting benefits of PDAs with the full-fledged power of a traditional portable PC to create a machine that perfectly meets the needs of many professions. Unlike PDAs, tablet PCs use a full-featured PC operating system such as Microsoft Windows XP Tablet PC Edition 2005. Instead of (or in addition to) a keyboard and



mouse, tablet PCs provide a screen that doubles as an input device. With a special pen, called a *stylus*, you can actually write on the screen (Figure 19-7). Just make sure you don't grab your fancy Cross ball-point pen accidentally and start writing on the screen! Unlike many PDA screens, most tablet PC screens are not pressure sensitive—you have to use the stylus to write on the screen. Tablet PCs come in two main form factors: *convertibles*, which include a keyboard that can be folded out of the way, and *slates*, which do away with the keyboard entirely. The convertible tablet PC in Figure 19-7, for example, looks and functions just like the typical clamshell laptop shown back in Figure 19-1. But here it's shown with the screen rotated 180 degrees and snapped flat so it functions as a slate. Pretty slick!

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**Figure 19-7**  
A tablet PC

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In applications that aren't "tablet-aware," the stylus acts just like a mouse, enabling you to select items, double-click, right-click, and so on. To input text with the stylus, you can either tap keys on a virtual keyboard (shown in Figure 19-8), write in the writing utility (shown in Figure 19-9), or use speech recognition software. With a little practice, most users will find the computer's accuracy in recognizing their handwriting to be sufficient for most text input, although speedy touch-typists will probably still want to use a keyboard when typing longer documents.

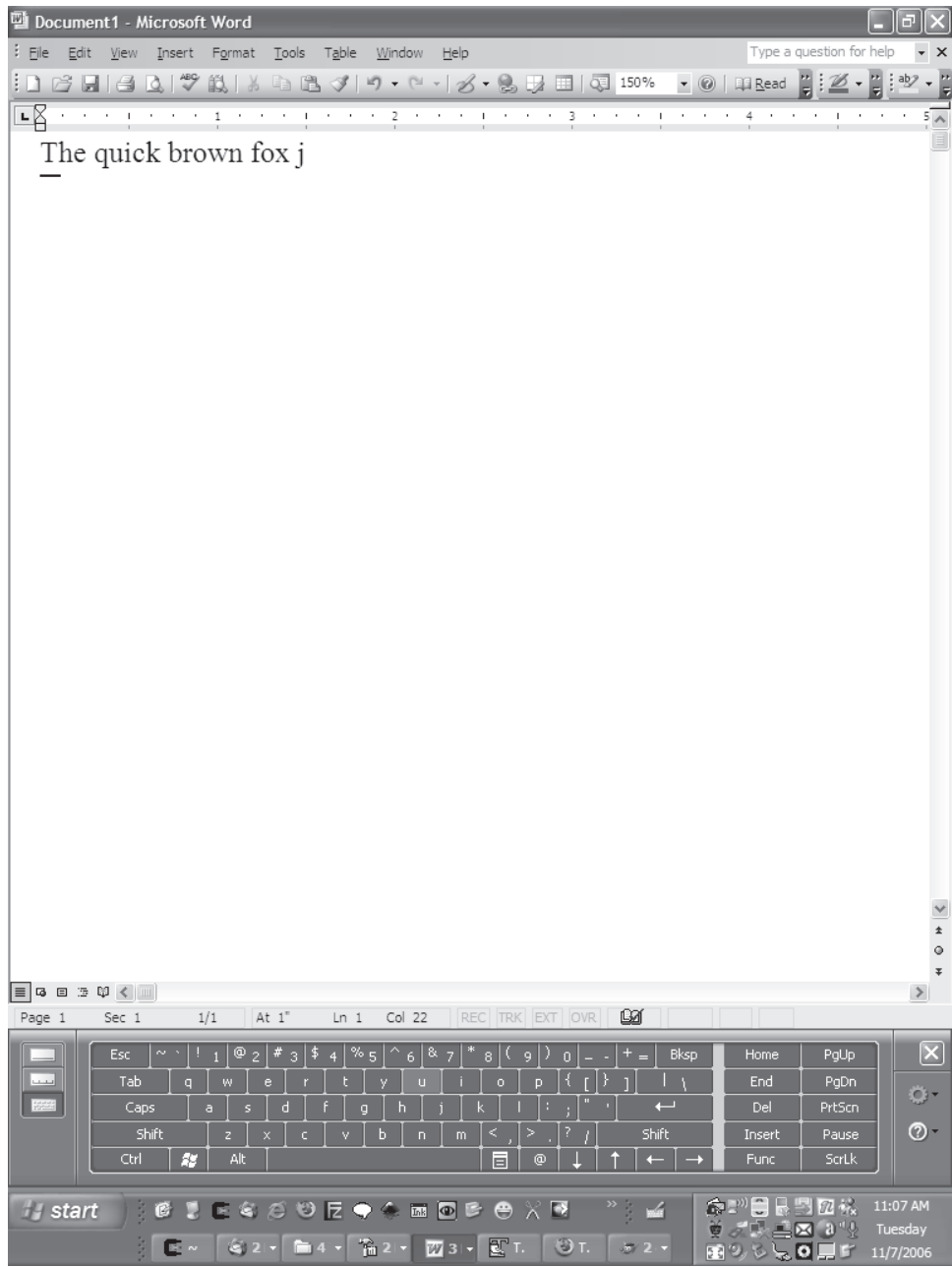
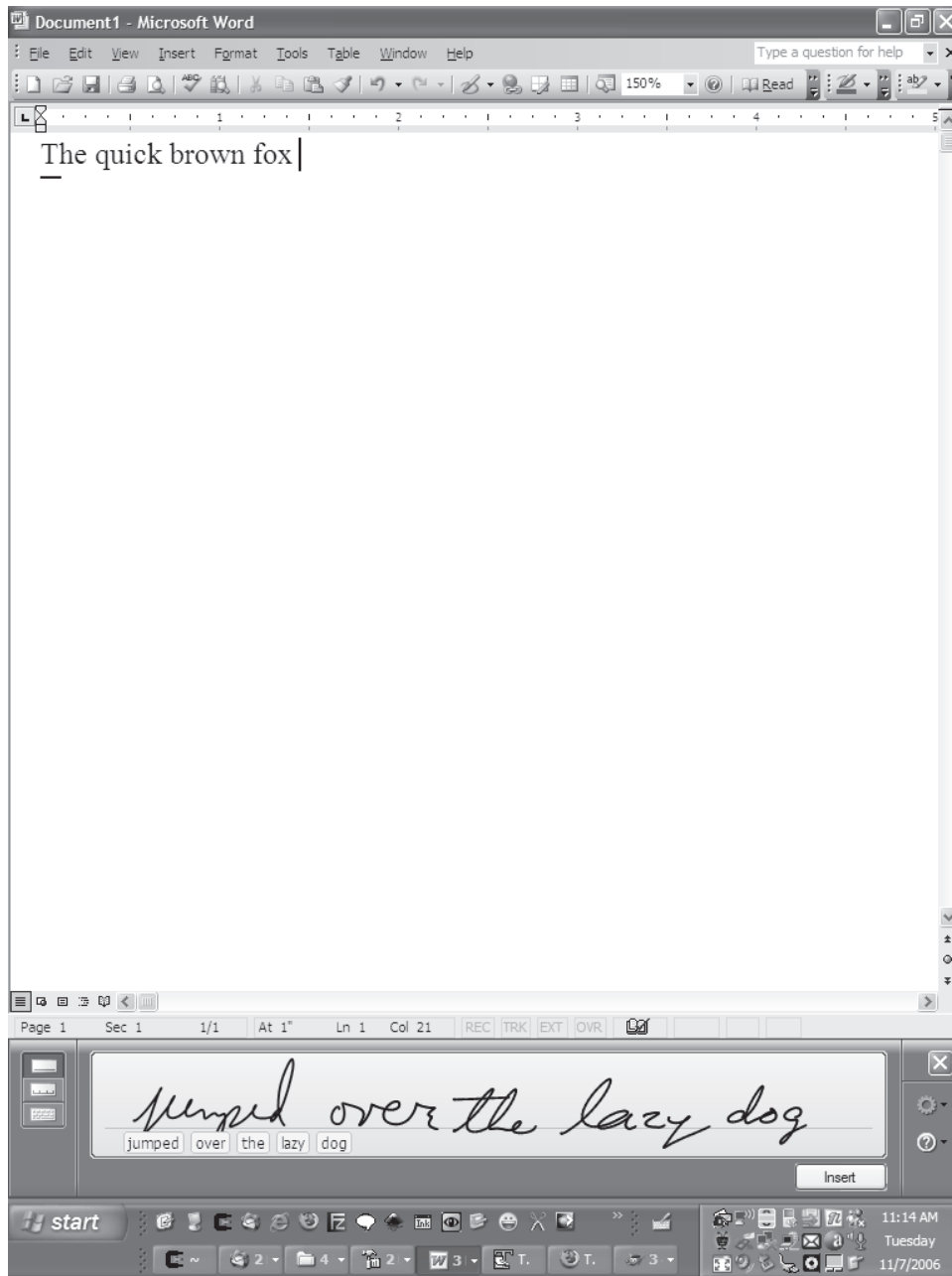


Figure 19-8 The virtual keyboard



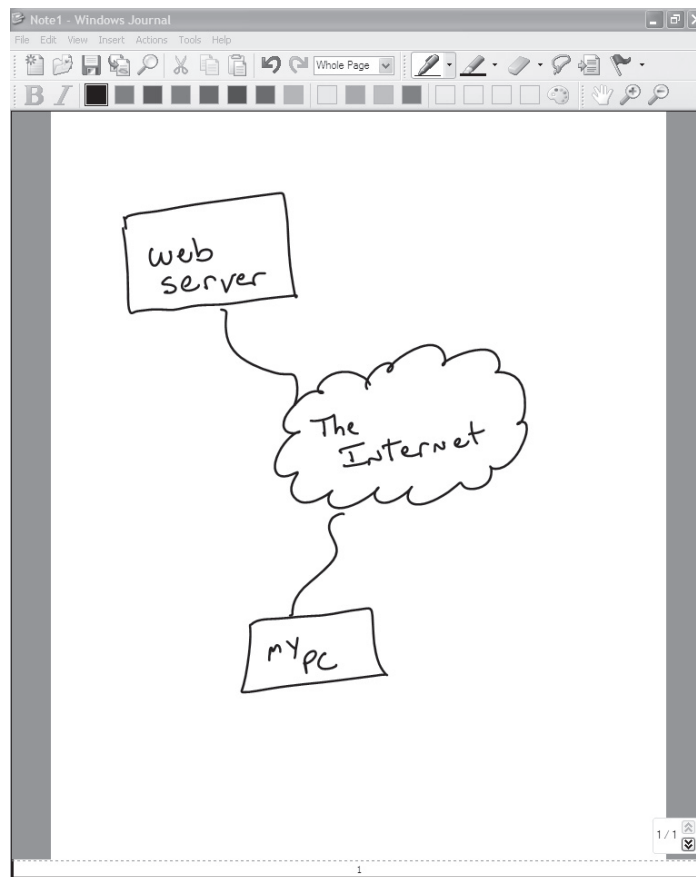
**Figure 19-9** The writing pad



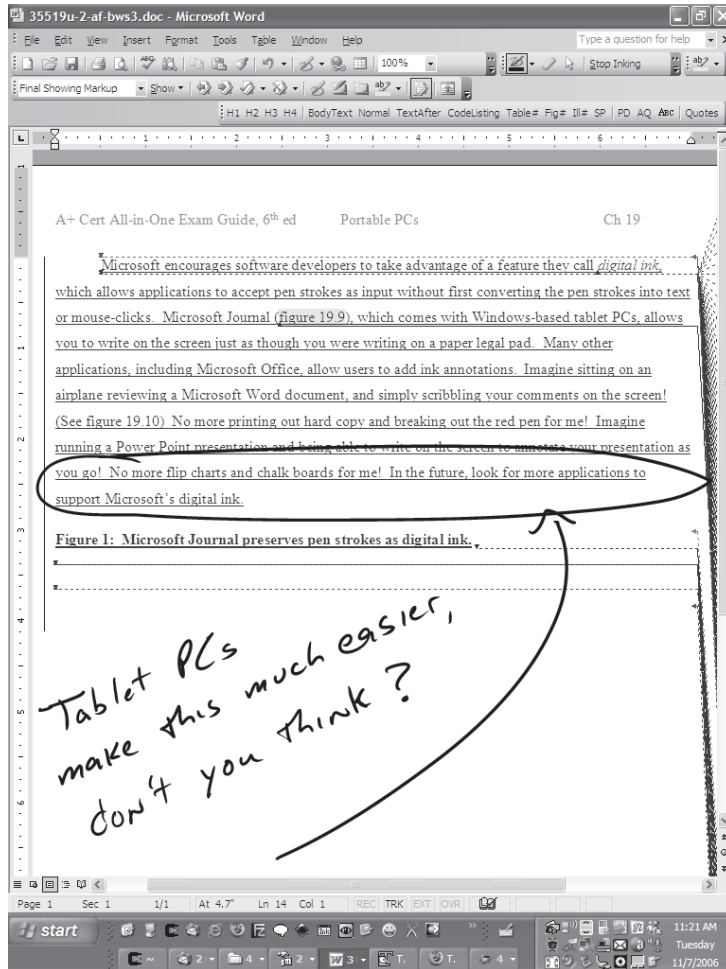
**NOTE** Handwriting recognition and speech recognition are two technologies that benefit greatly from increased CPU power. As multicore CPUs become more common, get ready to see more widespread adoption of these technologies!

Tablet PCs work well when you have limited space or have to walk around and use a laptop. Anyone who has ever tried to type with one hand, while walking around the factory floor holding the laptop with the other hand, will immediately appreciate the beauty of a tablet PC. In this scenario, tablet PCs are most effective when combined with applications designed to be used with a stylus instead of a keyboard. An inventory control program, for example, might present drop-down lists and radio buttons to the user, making a stylus the perfect input tool. With the right custom application, tablet PCs become an indispensable tool.

Microsoft encourages software developers to take advantage of a feature they call *digital ink*, which allows applications to accept pen strokes as input without first converting the pen strokes into text or mouse-clicks. Microsoft Journal (Figure 19-10), which comes with Windows-based tablet PCs, allows you to write on the screen just as though you were writing on a paper legal pad. Many other applications, including Microsoft Office, allow users to add ink annotations. Imagine sitting on an airplane reviewing a Microsoft Word document and simply scribbling your comments on the screen (Figure 19-11). No more printing out hard copy and breaking out the red pen for me! Imagine running a PowerPoint presentation and being able to annotate your presentation as you go. In the future, look for more applications to support Microsoft's digital ink.



**Figure 19-10** Microsoft Journal preserves pen strokes as digital ink.



**Figure 19-11** Microsoft Office supports digital ink.

There are many useful third-party applications designed specifically to take advantage of the tablet PC form factor. In fields such as law and medicine where tablet PCs have been especially popular, the choices are endless. One handy free utility that anyone who spends time in front of an audience (teachers, salespeople, cult leaders, and so on) will appreciate is InkyBoard ([www.cfcassidy.com/Inkyboard/](http://www.cfcassidy.com/Inkyboard/)). Inkyboard provides a virtual dry-erase board, eliminating the need to find a flip chart or dry-erase board when holding meetings. Ever wished you could have a record of everything that was written on the chalkboard in a class (or at a business meeting)? If the professor had used Inkyboard, creating and distributing a copy would be a snap.

## Portable Computer Device Types

Sorting out all the variations of portable computing devices out there would take entirely too much ink (and go well beyond CompTIA A+). Table 19-2 lists the seven most common styles of portable computing devices, some of their key features, and the

intended use or audience for the product. This table is in no way conclusive, but lists the highlights.

|                      | <b>Screen Size</b> | <b>Weight</b> | <b>Features</b>                                                                                                            | <b>Uses</b>                                                                                                                                                         |
|----------------------|--------------------|---------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Desktop replacements | 14–20 inches+      | 8–12+ lbs     | Everything on a desktop                                                                                                    | Mobile multimedia editing, presentations, mobile gaming                                                                                                             |
| Desktop extenders    | 10–14 inches       | 4–7 lbs       | Almost everything you'll find on a desktop. Better battery life than desktop replacements                                  | Presentations, note-taking in class or meetings, traveling companion for business folks                                                                             |
| Ultralights          | 6–12 inches        | 2–3 lbs       | Ultimate mobility without sacrificing full PC status. Excellent battery life. Few have internal optical drives             | Long-term traveling companion, in the purse or pack for writing or doing e-mail on the road, coolness factor                                                        |
| Tablet PCs           | 10–12 inches       | 4 lbs         | Pen-based interface enables you to use them like a paper notepad; no optical drives, but integrated wireless networking    | Niche market for people who need handwritten notes that have to be transcribed to the PC                                                                            |
| Ultra mobile PCs     | 4–7 inches         | 1–2 lbs       | A variation of tablet PCs, UMPCs run Windows XP (Tablet or Home edition); pen-based interface and no optical drives        | More of a niche market than tablet PCs, but similar audience; see the “Beyond A+” section for details                                                               |
| PDA's                | 3–4 inches         | 1 lb          | Light, multifunction devices that carry address book, scheduler; many offer other features, such as MP3 and video playback | Helps busy people stay organized; helps get people organized; fun; can carry many electronic books (e-books) so you're never caught waiting in line and being bored |
| PDA phones           | 2 inches           | < 1 lb        | Tiny PDA built into a cell phone; some offer e-mail and other Internet connectivity                                        | Reduces the number of gadgets some folks carry                                                                                                                      |

**Table 19-2** Portable Computing Devices



**NOTE** Portables come in such a dizzying variety of sizes, styles, features, and shapes that a simple table in a book cannot do justice to the ingenuity and engineering of the manufacturers of these devices. If you want to wander into the realm of extremes, check out [www.dynamism.com](http://www.dynamism.com). They specialize in bringing Japanese-only products to the English-speaking market. You'll find the hottest desktop replacement laptops and the sleekest subnotebooks at the site, with all the details beautifully converted from native Japanese to English.

## IT Technician

### Enhance and Upgrade the Portable PC

In the dark ages of mobile computing, you had to shell out top dollar for any device that would unplug, and what you purchased was what you got. Upgrade a laptop? Add functions to your desktop replacement? You had few if any options, so you simply paid for a device that would be way behind the technology curve within a year and functionally obsolete within two.



**EXAM TIP** If you're studying for the Help Desk Technician exam (Exam 220-603), you don't have to worry as much about portable PCs as you would studying for Depot Technician (Exam 220-604). The latter exam has fully one out of every five questions on laptops and portable devices. In other words, if you're studying for the Depot Tech exam, pay careful attention to this section! All of this material is relevant for the Essentials exam, so don't skip the rest of this chapter regardless of which exams you plan to take.

Portable PCs today offer many ways to enhance their capabilities. Internal and external expansion buses enable you to add completely new functions to portables, such as attaching a scanner or mobile printer or both! You can take advantage of the latest wireless technology breakthrough simply by slipping a card into the appropriate slot on the laptop. Further, modern portables offer a modular interior. You can add or change RAM, for example—the first upgrade that almost every laptop owner wants to make. You can increase the hard drive storage space and, at least with some models, swap out the CPU, video card, sound card, and more. Gone forever are the days of buying guaranteed obsolescence! Let's look at four specific areas of technology that laptops use to enhance functions and upgrade components: PC Cards, single- and multiple-function expansion ports, and modular components.

### PC Cards

The *Personal Computer Memory Card International Association (PCMCIA)* establishes standards involving portable computers, especially when it comes to expansion cards, which are generically called PC Cards. *PC Cards* are roughly credit-card sized devices



that enhance and extend the functions of a portable PC. PC Cards are as standard on today's mobile computers as the hard drive. PC Cards are easy to use, inexpensive, and convenient. Figure 19-12 shows a typical PC Card.

**Figure 19-12**  
PC Card



**EXAM TIP** CompTIA uses the older term *PCMCIA cards* to describe PC Cards. Don't be shocked if you get that as an option on your exams! You'll hear many techs use the phrase as well, though the PCMCIA trade group has not used it for many years.

Almost every portable PC has one or two PC Card slots, into which you insert a PC Card. Each card will have at least one function, but many have two, three, or more! You can buy a PC Card that offers connections for removable media, for example, such as combination SD and CF card readers. You can also find PC Cards that enable you to plug into multiple types of networks. All PC Cards are hot-swappable, meaning you can plug them in without powering down the PC.



**EXAM TIP** Many manufacturers use the term *hot-pluggable* rather than hot-swappable to describe the ability to plug in and replace PC Cards on the fly. Look for either term on the exams.

The PCMCIA has established two versions of PC Cards, one using a parallel bus and the other using a serial bus. Each version, in turn, offers two technology variations as well as several physical varieties. This might sound complicated at first, but here's the map to sort it all out.

### Parallel PC Cards

Parallel PC Cards come in two flavors, *16-bit* and *CardBus*, and each flavor comes in three different physical sizes, called Type I, Type II, and Type III. The 16-bit PC Cards, as the name suggests, are 16-bit, 5-V cards that can have up to two distinct functions or devices, such as a modem/network card combination. CardBus PC Cards are 32-bit,

3.3-V cards that can have up to eight (!) different functions on a single card. Regular PC Cards will fit into and work in CardBus slots, but the reverse is not true. CardBus totally dominates the current PC Card landscape, but you might still run into older 16-bit PC Cards.

Type I, II, and III cards differ only in the thickness of the card (Type I being the thinnest, and Type III the thickest). All PC Cards share the same 68-pin interface, so any PC Card will work in any slot that's high enough to accept that card type. Type II cards are by far the most common of PC Cards. Therefore, most laptops will have two Type II slots, one above the other, to enable the computer to accept two Type I or II cards or one Type III card (Figure 19-13).

**Figure 19-13**  
PC Card slots



Although PCMCIA doesn't require that certain sizes perform certain functions, most PC Cards follow their recommendations. Table 19-3 lists the sizes and typical uses of each type of PC Card.

| Type     | Length  | Width   | Thickness | Typical Use                 |
|----------|---------|---------|-----------|-----------------------------|
| Type I   | 85.6 mm | 54.0 mm | 3.3 mm    | Flash memory                |
| Type II  | 85.6 mm | 54.0 mm | 5.0 mm    | I/O (Modem, NIC, and so on) |
| Type III | 85.6 mm | 54.0 mm | 10.5 mm   | Hard drives                 |

**Table 19-3** PC Card Types and Their Typical Uses



**NOTE** Most PC Cards normally come with a hard plastic storage case. Always be sure to use this case to store the cards when you're not using them. If dust, dirt, or grime gets into the array of contacts at the end of the card, the card won't work when you try to use it next. Also, be careful when using PC Cards that extend out of the PC Card slot past the edge of your laptop. One dark night I set my laptop on the floor with a PC Card NIC sticking out of it while I went to get a drink of water. On my way back, I accidentally stepped on the card sticking out of my laptop and nearly snapped it in half. Luckily, my laptop wasn't damaged, but the card was toast!

ExpressCard

ExpressCard, the high-performance serial version of the PC Card, has begun to replace PC Card slots on newer laptop PCs. While ExpressCard offers significant performance benefits, keep in mind that ExpressCard and PC Cards are incompatible. You cannot use your PC Card in your new laptop's ExpressCard socket. The PC Card has had a remarkably long life in portable PCs, and you can still find it on some new laptops, but get ready to replace all your PC Card devices. ExpressCard comes in two widths: 54 mm and 34 mm. Figure 19-14 shows a 34-mm ExpressCard. Both cards are 75-mm long and 5-mm thick, which makes them shorter than all previous PC Cards and the same width as a Type II PC Card.

**Figure 19-14**  
34-mm ExpressCard  
(photo courtesy of  
PCMCIA)



ExpressCards connect to either the Hi-Speed USB 2.0 bus or a PCI Express bus. These differ phenomenally in speed. The amazingly slow-in-comparison USB version has a maximum throughput of 480 Mbps. The PCIe version, in contrast, roars in at 2.5 Gbps in unidirectional communication. Woot!

Table 19-4 shows the throughput and variations for the parallel and serial PC cards currently or soon to be on the market.

| Standard                      | Maximum Theoretical Throughput |
|-------------------------------|--------------------------------|
| PC Card using 16-bit bus      | 160 Mbps                       |
| CardBus PC Card using PCI bus | 1056 Mbps                      |
| ExpressCard using USB 2.0 bus | 2.5 Gbps                       |
| ExpressCard using PCIe bus    | 480 Mbps                       |

**Table 19-4** PC Card Speeds

Software Support for PC Cards

The PCMCIA standard defines two levels of software drivers to support PC Cards. The first, lower level is known as *socket services*. Socket services are device drivers that support the PC Card socket, enabling the system to detect when a PC Card has been inserted or removed, and providing the necessary I/O to the device. The second, higher level is known as *card services*. The card services level recognizes the function of a particular PC Card and provides the specialized drivers necessary to make the card work.

In today's laptops, the socket services are standardized and are handled by the system BIOS. Windows itself handles all card services and has a large preinstalled base of PC Card device drivers, although most PC Cards come with their own drivers.



**NOTE** ExpressCards don't require either socket or card services, at least not in the way PC Cards do. The ExpressCard modules automatically configure the software on your computer, which makes them truly plug and play.

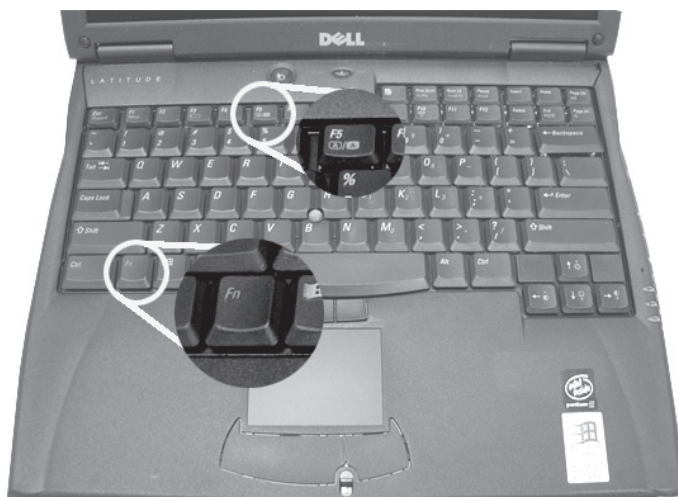
## Limited-function Ports

All portable PCs and many PDAs come with one or more single-function ports, such as an analog VGA connection for hooking up an external monitor and a PS/2 port for a keyboard or mouse. Note that contrary to the setup on desktop PCs, the single PS/2 port on most laptops supports both keyboards and pointing devices. Most portable computing devices have a speaker port, and this includes modern PDAs. My Compaq iPAQ doubles as an excellent MP3 player, by the way, a feature now included with most PDAs. Some portables have line-in and microphone jacks as well. Finally, most current portable PCs come with built-in NICs or modems for networking support. (See the section "The Modular Laptop" later in this chapter for more on networking capabilities.)

All limited-function ports work the same way on portable PCs as they do on desktop models. You plug in a device to a particular port and, as long as Windows has the proper drivers, you will have a functioning device when you boot. The only port that requires any extra effort is the video port.

Most laptops support a second monitor via an analog VGA port or a digital DVI port in the back of the box. With a second monitor attached, you can display Windows on only the laptop LCD, only the external monitor, or both simultaneously. Not all portables can do all variations, but they're more common than not. Most portables have a special Function (FN) key on the keyboard that, when pressed, adds an additional option to certain keys on the keyboard. Figure 19-15 shows a close-up of a typical keyboard with the Function key; note the other options that can be accessed with the Function key such as indicated on the F5 key. To engage the second monitor or to cycle through the modes, hold the Function key and press F5.

**Figure 19-15**  
Laptop keyboard  
with (FN) key that  
enables you to  
access additional  
key options, as on  
the F5 key





**NOTE** Although many laptops use the Function key method to cycle the monitor selections, that's not always the case. You might have to pop into the Display applet in the Control Panel to click a checkbox. Just be assured that if the laptop has a VGA or DVI port, you can cycle through monitor choices!

## General-purpose Ports

Sometimes the laptop doesn't come with all of the hardware you want. Today's laptops usually include several USB ports and a selection of the legacy general-purpose expansion ports (PS/2, RS-232 serial ports, and so on) for installing peripheral hardware. If you're lucky, you might even get a FireWire port so you can plug in your fancy new digital video camera. If you're really lucky, you might even have a docking station or port replicator so you don't have to plug in all of your peripheral devices one at a time.

## USB and FireWire

Universal serial bus (USB) and FireWire (or more properly, IEEE 1394) are two technologies that have their roots in desktop computer technology, but have also found widespread use in portable PCs. Both types of connections feature an easy-to-use connector and give the user the ability to insert a device into a system while the PC is running—you won't have to reboot a system in order to install a new peripheral. With USB and FireWire, just plug the device in and go! Because portable PCs don't have multiple internal expansion capabilities like desktops, USB and FireWire are two of the more popular methods for attaching peripherals to laptops (see Figure 19-16).

**Figure 19-16**  
Devices attached  
to USB or FireWire  
connector on  
portable PC

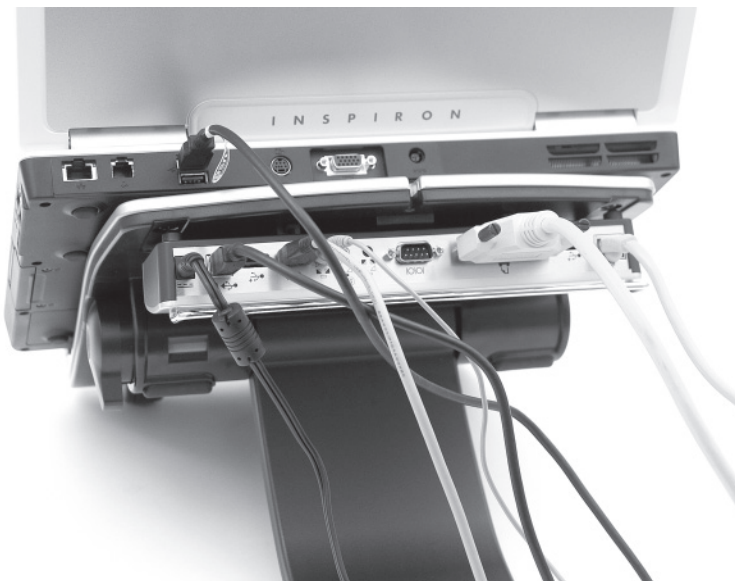


**NOTE** Almost all PDAs and other handheld devices—such as iPod music players—connect to PCs through USB ports. Most come with a USB cable that has a standard connector on one end and a proprietary connector on the other. Don't lose the cable!

## Port Replicators

A *port replicator* plugs into a single port on the portable computer—often a USB port, but sometimes a proprietary port—and offers common PC ports, such as serial, parallel, USB, network, and PS/2. By plugging the port replicator into your notebook computer, you can instantly connect it to nonportable components such as a printer, scanner, monitor, or a full-sized keyboard. Port replicators are typically used at home or in the office with the non-portable equipment already connected. Figure 19-17 shows an Dell Inspiron laptop connected to a port replicator.

**Figure 19-17**  
Port replicator  
for a Dell portable  
computer



Once connected to the port replicator, the computer can access any devices attached to it; there's no need to connect each individual device to the PC. As a side bonus, port replicators enable you to attach legacy devices, such as parallel printers, to a new laptop that only has modern multifunction ports such as USB and FireWire, and not parallel or serial ports.



**NOTE** Although portable PCs most often connect to port replicators via USB ports, some manufacturers have proprietary connections for proprietary port replicators. As long as such a portable PC has a USB port, you can use either the proprietary hardware or the more flexible USB devices.

## Docking Stations

*Docking stations* (see Figure 19-18) resemble port replicators in many ways, offering legacy and modern single- and multi-function ports. The typical docking station uses a proprietary connection, but has extra features built in, such as a DVD drive or PC card slot for extra enhancements. You can find docking stations for most laptop models, but



you'll find them used most frequently with the desktop extender and ultralight models. Many ultralights have no internal CD or DVD media drive (because the drives weigh too much), and so must rely on external drives for full PC functionality. Docking stations make an excellent companion to such portables.



**Figure 19-18** Docking station

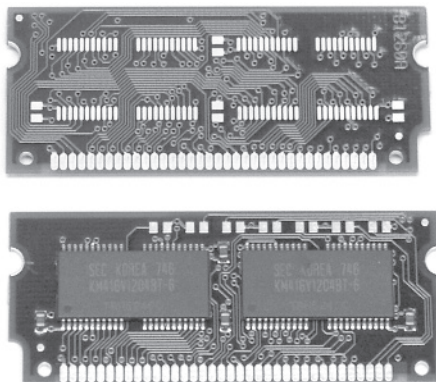
## The Modular Laptop

For years, portable PC makers required completely proprietary components for each system model they developed. For the most part, this proprietary attitude still prevails, but manufacturers have added some modularity to today's portable PCs, enabling you to make basic replacements and upgrades without going back to the manufacturer for expensive, proprietary components. You need to surf the Web for companies that sell the components, because very few storefronts stock them. The most common modular components are RAM, hard drives, CPUs, video cards, optical drives, and network cards.

### RAM

Stock factory portable PCs almost always come with a minimal amount of RAM, so one of the first laptop upgrades you'll be called on to do is to add more RAM. Economy laptops running Windows XP Home routinely sit on store shelves and go home to consumers with as little 256 MB of RAM, an amount guaranteed to limit the use and performance of the laptop. The OS alone will consume more than half of the RAM! Luckily, every decent laptop has upgradeable RAM slots. Laptops use one of four types of RAM. Most older laptops use either 72-pin or 144-pin SO-DIMMs with SDRAM technology (Figure 19-19). DDR and DDR2 systems primarily use 200-pin SO-DIMMs although some laptops use micro-DIMMs.

**Figure 19-19**  
72-pin SO-DIMM  
stick (front and back)



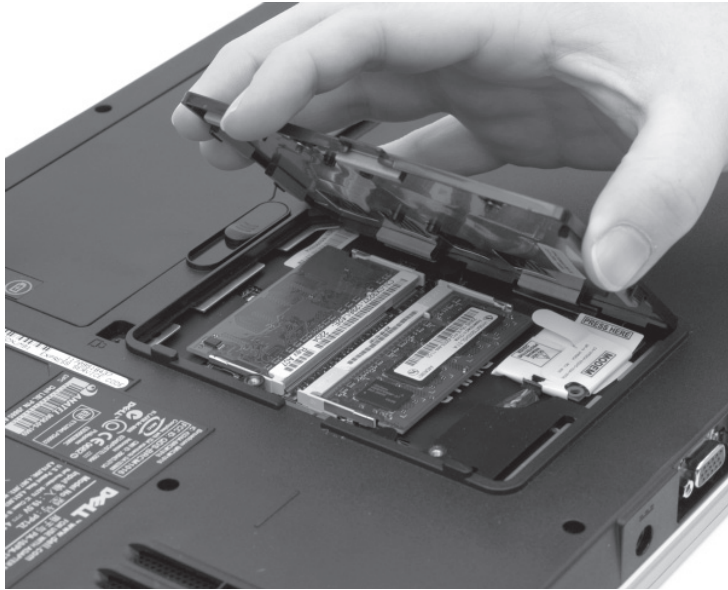
**TIP** The amount of RAM needed to run a PC—portable or otherwise—smoothly and stably depends on both the type of applications that it will run and the needs of the OS. When making a recommendation to a client about upgrading a laptop's memory, you should ask the basic questions, such as what he or she plans to do on the laptop. If the laptop will be used for e-mail, word processing, and Web surfing, in contrast, a medium level of RAM, such as 256 MB, might be adequate. If the user travels, uses a high-end digital camera, and wants to use Photoshop to edit huge images, you'll need to augment the RAM accordingly. Then you need to add the needs of the OS to give a good recommendation. Refer back to Chapter 13, "Understanding Windows," for specific OS RAM needs.

**How to Add or Replace RAM** Upgrading the RAM in a portable PC requires a couple of steps. First, you need to get the correct RAM. Many older portable PCs use proprietary RAM solutions, which means you need to order directly from Dell, HP, or Sony and pay exorbitant prices for the precious extra megabytes. Most manufacturers have taken pity on consumers in recent years and use standard SO-DIMMs or micro-DIMMs. Refer to the manufacturer's Web site or to the manual (if any) that came with the portable for the specific RAM needed.

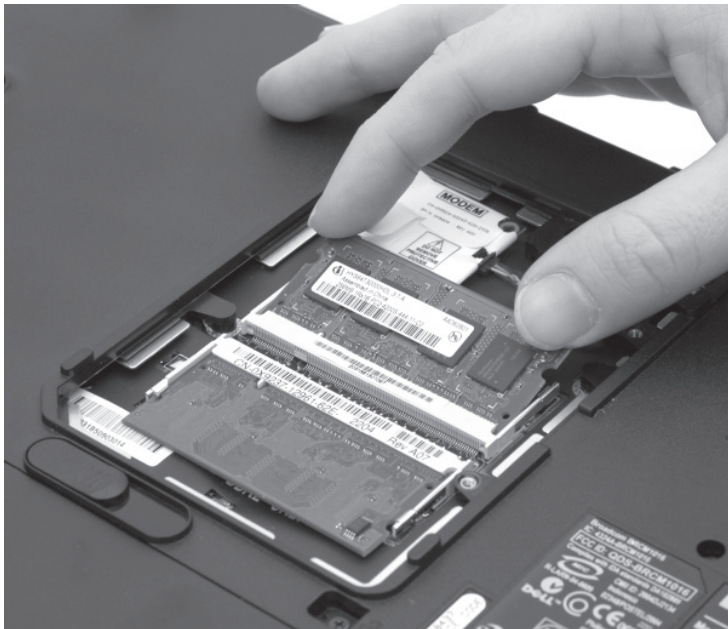
Second, every portable PC offers a unique challenge to the tech who wants to upgrade the RAM because there's no standard for RAM placement in portables. More often than not, you need to unscrew or pop open a panel on the underside of the portable (Figure 19-20). Then you press out on the restraining clips and the RAM stick will pop up (Figure 19-21). Gently remove the old stick of RAM and insert the new one by reversing the steps.



**Figure 19-20**  
Removing a  
RAM panel



**Figure 19-21**  
Releasing the RAM



**Shared Memory** Some laptops (and desktops) support *shared memory*. Shared memory is a means of reducing the cost of video cards by reducing the amount of memory on the video card itself. Instead of a video card with 256 MB of RAM, it might have only 64 MB of RAM but can borrow 192 MB of RAM from the system. This equates to a 256-MB video card. The video card uses regular system RAM to make up for the loss.

The obvious benefit of shared memory is a less expensive video card with performance comparable to its mega-memory alternative. The downside is your overall system performance will suffer because a portion of the system RAM is no longer available to programs. (The term *shared* is a bit misleading because the video card takes control of a portion of RAM. The video portion of system RAM is *not* shared back and forth between the video card processor and the CPU.) Shared memory technologies include TurboCache (developed by nVidia) and HyperMemory (developed by ATI).

Some systems give you control over the amount of shared memory while others simply allow you to turn shared memory on or off. The settings are found in CMOS setup and only on systems that support shared memory. Shared memory is not reported to Windows so don't panic if you've got 1 GB of RAM in your laptop, but Windows only sees 924 MB—the missing memory is used for video!

Adding more system RAM to a laptop with shared memory will improve laptop performance. Although it might appear to improve video performance, that doesn't tell the true story. It'll improve overall performance because the OS and CPU get more RAM to work with. On some laptops, you can improve video performance as well, but that depends on the CMOS setup. If the shared memory is not set to maximum by default, increasing the overall memory and upping the portion reserved for video will improve video performance specifically.

## Hard Drives

ATA drives in the 2.5-inch drive format now rule in all laptops. Although much smaller than regular ATA drives, they still use all the same features and configurations. These smaller hard drives have suffered, however, from diminished storage capacity compared to their 3.5-inch brothers. Currently, large 2.5-inch hard drives hold up to 120 GB, while the 3.5-inch hard drives can hold more than 750 GB of data! Some manufacturers may require you to set the drive to use a cable select setting as opposed to master or slave, so check with the laptop maker for any special issues. Otherwise, no difference exists between 2.5-inch drives and their larger 3.5-inch brethren (Figure 19-22).

**Figure 19-22**

The 2.5-inch and 3.5-inch drives are mostly the same.



## Modular CPUs

You know from Chapter 3, “Microprocessors,” that both AMD and Intel make specialized CPUs for laptops that produce less heat and consume less power, yet only now are folks realizing that they can easily upgrade many systems by removing the old CPU and replacing it with a new one. Be very careful to follow manufacturer’s specifications! You should keep in mind, however, that replacing the CPU in a laptop often requires that you disassemble the entire machine. This can be a daunting task, even for professionals. If you want to upgrade the CPU in your laptop, it’s often best to let the professionals take care of it.

## Video Cards

Some video card makers make modular video cards for laptops. Although no single standard works in all systems, a quick phone call to the tech support department of the laptop maker often reveals upgrade options (if any). Modular video cards are the least standardized of all modular components, but as manufacturers adopt more industry-wide standards, we’ll be able to replace video cards in laptops more readily.

## Going Inside

To reach most modular components on a laptop, you need to do more than remove an exterior panel. You need to go inside to get access to devices directly connected to the motherboard. Many laptops have an easily removable keyboard that, once removed, gives you access to a metal heat spreader (just a plate that sits over the motherboard) and a half-dozen or more tiny screws. You’ll need a special screwdriver to avoid stripping the screws—check a watch or eyeglass shop if your local hardware store doesn’t carry anything appropriate.

You need to take major precautions when you remove the keyboard and heat spreader. The keyboard will be attached to a small cable that can easily disconnect if you pull hard. Don’t forget to check this connection before you reinsert the keyboard at the end of the procedure! Avoid ESD like you would with any other PC, and definitely unplug the laptop from the wall and *remove the battery* before you do any work inside!

## Modular Drives

In order to add functionality to laptops, manufacturers include “modular drives” with their machines. CD-ROM, DVD-ROM, CD-R/RW, and CD-RW/DVD-ROM drives are the most common modular drives that are included with portables. The beauty of modular drives is that you can swap easily back and forth between different types of drives. Need more storage space? Pull out the CD-ROM drive and put in another hard drive. Many laptops enable you to replace a drive with a second battery, which obviously can extend the time you can go before you have to plug the laptop into an AC outlet.

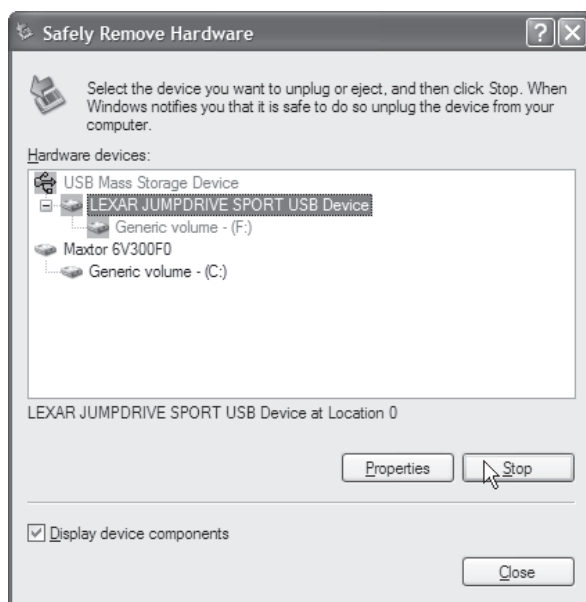
I have a laptop that allows me to swap out my CD-ROM drive for a second battery. If I don’t need to access any CDs and don’t need super-extended battery life, I just take out the component that’s currently installed and put a blank faceplate into the empty slot. Traveling with an empty bay makes my hefty laptop weigh a little bit less, and every little bit helps!

Most modular drives are truly hot-swappable, enabling you to remove and insert devices without any special software. Many still require you to use the Hardware Removal Tool (also known as Safely Remove Hardware) located in the System Tray (Figure 19-23). When in doubt, always remove modular devices using this tool. Figure 19-24 shows the Safely Remove Hardware dialog box. To remove a device, highlight it and click the Stop button. Windows will shut down the device and tell you when it's safe to remove the device.

**Figure 19-23**  
Hardware Removal  
Tool in System Tray



**Figure 19-24**  
Safely Remove  
Hardware dialog box



## Mobile NICs and Mini PCI

Every laptop made in the last few years comes with networking capabilities built in. Laptops have modems for dial-up and Ethernet ports for plugging into a wired network. Because they run Windows, OS X, or some Linux distro, laptops have all the networking software ready to go, just like their desk-bound cousins.



**NOTE** See Chapter 21 for the scoop on dial-up networking and Ethernet.

Many laptops now come with integrated wireless networking support by way of a built-in Wi-Fi adapter usually installed in a Mini PCI slot on the laptop motherboard. The *Mini PCI* bus is an adaptation of the standard PCI bus and was developed specifically for integrated communications peripherals such as modems and network adapters. Built-in networking support means you don't need an additional PC Card to provide a network adapter. The Mini PCI bus also provides support for other integrated devices such as Bluetooth, modems, audio, or hard drive controllers. One great aspect of Mini PCI is that if some new technology eclipses the current wireless technology or some other technology that uses the bus, you can upgrade by swapping a card.



**EXAM TIP** A typical reason to upgrade a Mini PCI Wi-Fi NIC is to gain access to improved security options such as better encryption.

Officially released in 1999, Mini PCI is a 32-bit, 33-MHz bus and is basically PCI v2.2 with a different form factor. Like PCI, it supports bus mastering and DMA. Mini PCI cards are about a quarter the size of a regular PCI card and can be as small as 2.75 inches by 1.81 inches by .22 inches. They can be found in small products such as laptops, printers, and set-top boxes.

To extend battery life, built-in communication devices such as Wi-Fi and Bluetooth adapters can be toggled on and off without powering down the computer. Many laptops come with a physical switch along the front or side edge allowing you to power on or off the communications adapter. Similarly, you can often use a keyboard shortcut for this, generally by pressing the Function (FN) key along with some other key. The FN key, when pressed, allows other keys to accomplish specific tasks. For example, on my laptop pressing FN-F2 toggles my Wi-Fi adapter on and off; pressing FN-F10 ejects my CD-ROM drive.



**NOTE** Chapter 21, “Local Area Networks,” covers wireless networking in great detail.

## Managing and Maintaining Portables

Most portable PCs come from the factory solidly built and configured. Manufacturers know that few techs outside their factories know enough to work on them, so they don't cut corners. From a tech's standpoint, your most common work on managing and maintaining portables involves taking care of the batteries and extending the battery life through proper power management, keeping the machine clean, and avoiding excessive heat.

Everything you normally do to maintain a PC applies to portable PCs. You need to keep current on Windows patches and Service Packs, and use stable, recent drivers. Run Check Disk with some frequency, and definitely defragment the hard drive. Disk Cleanup is a must if the laptop runs Windows XP. That said, let's look at issues specifically involving portables.

## Batteries

Manufacturers use three different types of batteries for portable PCs and each battery type has its own special needs and quirks. Once you've got a clear understanding of the quirks, you can *usually* spot and fix battery problems. The three types of batteries commonly used in mobile PCs are *Nickel-Cadmium (Ni-Cd)*, *Nickel-Metal Hydride (Ni-MH)*, and *Lithium-Ion (Li-Ion)* batteries. Manufacturers have also started working with fuel cell batteries, although most of that work is experimental at this writing.

### Nickel-Cadmium

Ni-Cds were the first batteries commonly used in mobile PCs, which means the technology was full of little problems. Probably most irritating was a little thing called *battery memory*, or the tendency of a Ni-Cd battery to lose a significant amount of its re-chargeability if it was charged repeatedly without being totally discharged. A battery that originally kept a laptop running for two hours would eventually only keep that same laptop going for 30 minutes or less. Figure 19-25 shows a typical Ni-Cd battery.

**Figure 19-25**  
Ni-Cd battery



To prevent memory problems, a Ni-Cd battery had to be discharged completely before each recharging. Recharging was tricky as well, because Ni-Cd batteries disliked being overcharged. Unfortunately, there was no way to verify when a battery was fully charged without an expensive charging machine, which none of us had. As a result, most Ni-Cd batteries lasted an extremely short time and had to be replaced. A quick fix was to purchase a *conditioning charger*. These chargers would first totally discharge the Ni-Cd battery, and then generate a special “reverse” current that, in a way, “cleaned” internal parts of the battery so that it could be recharged more often and would run longer on each recharge. Ni-Cd batteries would, at best, last for 1,000 charges, and far fewer with poor treatment. Ni-Cds were extremely susceptible to heat and would self-discharge over time if not used. Leaving a Ni-Cd in the car in the summer was guaranteed to result in a fully discharged battery in next to no time!



But Ni-Cd batteries didn't stop causing trouble after they died. The highly toxic metals inside the battery made it unacceptable simply to throw them in the trash. Ni-Cd batteries should be disposed of via specialized disposal companies. This is very important! Even though Ni-Cd batteries aren't used in PCs very often anymore, many devices, such as cellular and cordless phones, still use Ni-Cd batteries. Don't trash the environment by tossing Ni-Cds in a landfill. Turn them in at the closest special disposal site; most recycling centers are glad to take them. Also, many battery manufacturers/distributors will take them. The environment you help preserve just might be yours—or your kids'!



**EXAM TIP** You *must* use disposal companies or battery recycling services to dispose of the highly toxic Ni-Cd batteries.

## Nickel-Metal Hydride

Ni-MH batteries were the next generation of mobile PC batteries and are still quite common today. Basically, Ni-MH batteries are Ni-Cd batteries without most of the headaches. Ni-MH batteries are much less susceptible to memory problems, can better tolerate overcharging, can take more recharging, and last longer between rechargings. Like Ni-Cds, Ni-MH batteries are still susceptible to heat, but at least they are considered less toxic to the environment. It's still a good idea to do a special disposal. Unlike a Ni-Cd, it's usually better to recharge a Ni-MH with shallow recharges as opposed to a complete discharge/recharge. Ni-MH is a popular replacement battery for Ni-Cd systems (Figure 19-26).

**Figure 19-26**  
Ni-MH battery





## Lithium Ion

The most common type battery used today is Li-Ion. Li-Ion batteries are very powerful, completely immune to memory problems, and last at least twice as long as comparable Ni-MH batteries on one charge. Sadly, they can't handle as many charges as Ni-MHs, but today's users are usually more than glad to give up total battery lifespan in return for longer periods between charges. Li-Ion batteries will explode if they are overcharged, so all Li-Ion batteries sold with PCs have built-in circuitry to prevent accidental overcharging. Lithium batteries can only be used on systems designed to use them. They can't be used as replacement batteries (Figure 19-27).

**Figure 19-27**  
Li-Ion battery



## Other Portable Power Sources

In an attempt to provide better maintenance for laptop batteries, manufacturers have developed a new type of battery called the *smart battery*. Smart batteries tell the computer when they need to be charged, conditioned, or replaced.

Portable computer manufacturers are also looking at other potential power sources, especially ones that don't have the shortcomings of current batteries. The most promising of these new technologies are *fuel cells*. The technology behind fuel cells is very complex, but to summarize, fuel cells produce electrical power as a result of a chemical reaction between the hydrogen and oxygen contained in the fuel cell. It is estimated that a small fuel cell could power a laptop for up to 40 hours before it needs to be replaced or refilled. This technology is still a year or two from making it to the consumer market, but it's an exciting trend!

## The Care and Feeding of Batteries

In general, keep in mind the following basics. First, always store batteries in a cool place. Although a freezer is in concept an excellent storage place, the moisture, metal racks, and food make it a bad idea. Second, condition your Ni-Cd and Ni-MH batteries by using a charger that also conditions the battery; they'll last longer. Third, keep battery contacts clean with a little alcohol or just a dry cloth. Fourth, *never* handle a battery that has ruptured or broken; battery chemicals are very dangerous. Finally, always recycle old batteries.



**NOTE** Got an old portable PC battery lying around? Well, you've got to get rid of it, and since there are some pretty nasty chemicals in that battery, you can't just throw it in the trash. Sometimes, you can take old laptop batteries to an auto parts store that disposes of old car batteries—I know it sounds odd, but it's true! See if you can find one in your area that will do this. Many cities offer a hazardous materials disposal or recycling service. Check to see if and how your local government will help you dispose of your old batteries.

## Power Management

Many different parts are included in the typical laptop, and each part uses power. The problem with early laptops was that every one of these parts used power continuously, whether or not the system needed that device at that time. For example, the hard drive would continue to spin whether or not it was being accessed, and the LCD panel would continue to display, even when the user walked away from the machine.

The optimal situation would be a system where the user could instruct the PC to shut down unused devices selectively, preferably by defining a maximum period of inactivity that, when reached, would trigger the PC to shut down the inactive device. Longer periods of inactivity would eventually enable the entire system to shut itself down, leaving critical information loaded in RAM, ready to restart if a wake-up event (such as moving the mouse or pressing a key) would tell the system to restart. The system would have to be sensitive to potential hazards, such as shutting down in the middle of writing to a drive, and so on. Also, this feature could not add significantly to the cost of the PC. Clearly, a machine that could perform these functions would need specialized hardware, BIOS, and operating system to operate properly. This process of cooperation among the hardware, the BIOS, and the OS to reduce power use is known generically as *power management*.

## System Management Mode (SMM)

Intel began the process of power management with a series of new features built into the 386SX CPU. These new features enabled the CPU to slow down or stop its clock without erasing the register information, as well as enabling power saving in peripherals. These features were collectively called *System Management Mode (SMM)*. All modern CPUs have SMM. Although a power-saving CPU was okay, power management was relegated to special "sleep" or "doze" buttons that would stop the CPU and all of the peripherals on the laptop. To take real advantage of SMM, the system needed a specialized BIOS and OS to go with the SMM CPU. To this end, Intel put forward the *Advanced Power Management (APM)* specification in 1992 and the *Advanced Configuration and Power Interface (ACPI)* standard in 1996.

## Requirements for APM/ACPI

APM and ACPI require a number of items in order to function fully. First is an SMM-capable CPU. As virtually all CPUs are SMM-capable, this is easy. Second is an APM-compliant BIOS, which enables the CPU to shut off the peripherals when desired. The third requirement is devices that will accept being shut off. These devices are usually

called “Energy Star” devices, which signals their compliance with the EPA’s Energy Star standard. To be an Energy Star device, a peripheral must have the ability to shut down without actually turning off and show that they use much less power than the non-Energy Star equivalent. Last, the system’s OS must know how to request that a particular device be shut down, and the CPU’s clock must be slowed down or stopped.

ACPI goes beyond the APM standard by supplying support for hot-swappable devices—always a huge problem with APM. This feature aside, it is a challenge to tell the difference between an APM system and an ACPI system at first glance.



**NOTE** Don’t limit your perception of APM, ACPI, and Energy Star just to laptops! Virtually all desktop systems also use the power management functions.

## APM/ACPI Levels

APM defines four different power-usage operating levels for a system. These levels are intentionally fuzzy to give manufacturers considerable leeway in their use; the only real difference among them is the amount of time each takes to return to normal usage. These levels are as follows:

- **Full On** Everything in the system is running at full power. There is no power management.
- **APM Enabled** CPU and RAM are running at full power. Power management is enabled. An unused device may or may not be shut down.
- **APM Standby** CPU is stopped. RAM still stores all programs. All peripherals are shut down, although configuration options are still stored. (In other words, to get back to APM Enabled, you won’t have to reinitialize the devices.)
- **APM Suspend** Everything in the PC is shut down or at its lowest power-consumption setting. Many systems use a special type of Suspend called *hibernation*, where critical configuration information is written to the hard drive. Upon a wake-up event, the system is reinitialized, and the data is read from the drive to return the system to the APM Enabled mode. Clearly, the recovery time between Suspend and Enabled will be much longer than the time between Standby and Enabled.

ACPI handles all these levels plus a few more, such as “soft power on/off,” which enables you to define the function of the power button.

## Configuration of APM/ACPI

You configure APM/ACPI via CMOS settings or through Windows. Windows settings will override CMOS settings. Although the APM/ACPI standards permit a great deal of flexibility, which can create some confusion among different implementations, certain settings apply generally to CMOS configuration. First is the ability to initialize power management; this enables the system to enter the APM Enabled mode. Often CMOS will then present time frames for entering Standby and Suspend mode, as well as set-

tings to determine which events take place in each of these modes. Also, many CMOS versions will present settings to determine wake-up events, such as directing the system to monitor a modem or a particular IRQ (Figure 19-28). A true ACPI-compliant CMOS provides an ACPI setup option. Figure 19-29 shows a typical modern BIOS that provides this setting.

| Phoenix - AwardBIOS CMOS Utility                                     |               |                      |
|----------------------------------------------------------------------|---------------|----------------------|
| Power                                                                |               |                      |
| APM Configuration                                                    |               | Select Menu          |
| Restore on AC Power Loss                                             | [Power-Off]   | Item Specific Help▶▶ |
| PWR Button < 4 secs                                                  | [Instant-Off] | Set the Data, Time   |
| Power Up On PCI/PCIE Devices                                         | [Disabled]    | resume by Alarm.     |
| USB Resume from S5                                                   | [Disabled]    |                      |
| Power On By RTC Alarm                                                | [Enabled]     |                      |
| Date(of Month) Alarm                                                 | [ 5]          |                      |
| Alarm Time(hh:mm)                                                    | 2 : 9 : 5     |                      |
| Power Up By PS/2 Mouse                                               | [Disabled]    |                      |
| Power Up By PS/2 Keyboard                                            | [Disabled]    |                      |
| F1:Help    ↑↓:Select Item    ~/+/: Change Value    F5:Setup Defaults |               | F10:Save and Exit    |
| ESC:Exit    ▶◀:Select Menu    Enter: Select SubMenu                  |               |                      |

Figure 19-28 Setting a wake-up event in CMOS

| Phoenix - Award BIOS CMOS Setup Utility                                                 |                     |                                                                      |
|-----------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------|
| Power Management Setup                                                                  |                     |                                                                      |
| ACPI Suspend Type                                                                       | S3 (Suspend-To-RAM) | Item Help                                                            |
| -USB Resume from S3                                                                     | Enabled             | Menu Level ▶                                                         |
| Power Button Function                                                                   | Delay 4 Sec         |                                                                      |
| Wakeup by PME# of PCI                                                                   | Disabled            |                                                                      |
| Wakeup by Ring                                                                          | Disabled            |                                                                      |
| Wakeup by OnChip LAN                                                                    | Enabled             |                                                                      |
| Wakeup by Alarm                                                                         | Disabled            |                                                                      |
| x - Day of Month Alarm                                                                  | 0                   |                                                                      |
| x - Time (hh:mm:ss) Alarm                                                               | 0 : 0 : 0           |                                                                      |
| AMD K8 Cool'n'Quiet control                                                             | Auto                |                                                                      |
| Power On Function                                                                       | Button Only         |                                                                      |
| x - KB Power On Password                                                                | Enter               |                                                                      |
| x - Hot Key Power On                                                                    | Ctrl-F1             |                                                                      |
| Restore on AC Power Loss                                                                | Power Off           |                                                                      |
| ▲▼▶◀:Move    Enter:Select    +/~/PU/PD:Value    F10:Save    ESC:Exit    F1:General Help |                     | F5:Previous Values    F6:Fail-Safe Defaults    F7:Optimized Defaults |

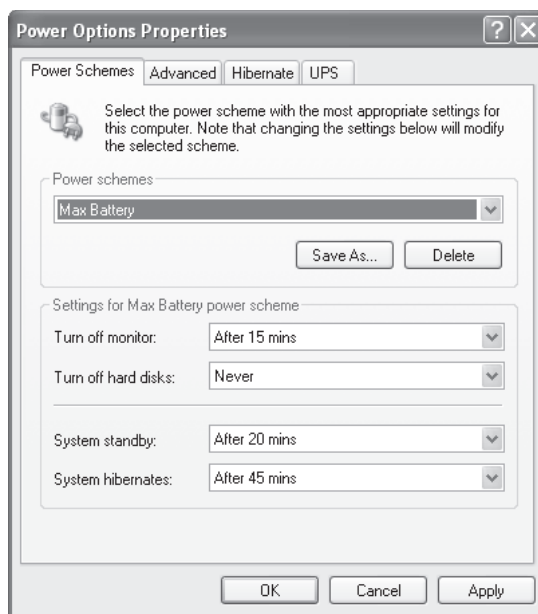
Figure 19-29 CMOS with ACPI setup option

APM/ACPI settings can be found in the Windows 2000/XP control panel applet Power Options. The Power Options applet has several built-in *power schemes* such as Home/Office and Max Battery that put the system into standby or suspend after a certain interval (Figure 19-30). You can also require the system to go into standby after a set period of time or turn off the monitor or hard drive after a time, thus creating your own custom power scheme.



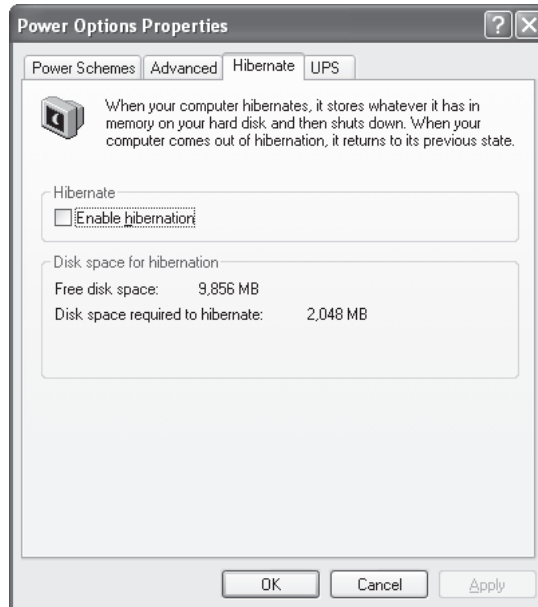
**NOTE** You may also access your Power Options by right-clicking on the Desktop and selecting Properties | Screensavers, and then clicking the Power button in the Monitor Power section of the Screensavers tab.

**Figure 19-30**  
Power Options  
Properties



Another feature, Hibernate mode, takes everything in active memory and stores it on the hard drive just before the system powers down. When the PC comes out of hibernation, Windows reloads all the files and applications into RAM. Figure 19-31 shows the Power Options Properties applet in Windows XP.

**Figure 19-31**  
Power Options  
Properties



## Cleaning

Most portable PCs take substantially more abuse than a corresponding desktop model. Constant handling, travel, airport food on the run, and so on can radically shorten the life of a portable if you don't take action. One of the most important things you should do is clean the laptop regularly. Use an appropriate screen cleaner (not a glass cleaner!) to remove fingerprints and dust from the fragile LCD panel. (Refer to Chapter 17 for specifics.)

If you've had the laptop in a smoky or dusty environment where the air quality alone causes problems, try compressed air for cleaning. Compressed air works great for blowing out the dust and crumbs from the keyboard and for keeping PC Card sockets clear. Don't use water on your keyboard! Even a minor amount of moisture inside the portable can toast a component.

## Heat

To manage and maintain a healthy portable PC, you need to deal with issues of heat. Every portable has a stack of electronic components crammed into a very small space. Unlike their desktop brethren, portables don't have lots of freely-moving air space that enables fans to cool everything down. Even with lots of low-power-consumption devices inside, portable PCs still crank out a good deal of heat. Excessive heat can cause system lockups and hardware failures, so you should handle the issue wisely. Try this as a starter guide.

- Use power management, even if you're plugged into the AC outlet. This is especially important if you're working in a warm (more than 80 degrees Fahrenheit) room.

- Keep air space between the bottom of the laptop and the surface on which it rests. Putting a laptop on a soft surface like a pillow on your lap, for example, creates a great heat retention system—not a good thing! Always use a hard, flat surface!
- Don't use a keyboard protector for extended amounts of time.
- Listen to your fan, assuming the laptop has one. If it's often running very fast—you can tell by the high-pitched whirring sound—examine your power management settings and your environment and change whatever is causing heat retention.
- Speaking of fans, be alert to a fan that suddenly goes silent. Fans do fail on laptops, causing overheating and failure. All laptop fans can be replaced easily.

## Protect the Machine

While prices continue to drop for basic laptops, a fully loaded system is still pricey. To protect your investment, you'll want to adhere to certain best practices. You've already read tips in this chapter to deal with cleaning and heat, so let's look at the "portable" part of portable computers.

### Tripping

Pay attention to where you run the power cord when you plug in a laptop. One of the primary causes of laptop destruction is people tripping over the power cord and knocking the laptop off a desk. This is especially true if you plug in at a public place such as a café or airport. Remember, the life you save could be your portable PC's!

### Storage

If your laptop or PDA isn't going to be used for a while, storing it safely will go a long way toward keeping it operable when you do power it up again. It's worth the extra few dollars to invest in a quality case also—preferably one with ample padding. Smaller devices such as PDAs are well protected inside small shock-resistant aluminum cases that clip on to your belt while laptops do fine in well-padded cases or backpacks. Not only will this protect your system on a daily basis when transporting it from home to office, but it will keep dust and pet hair away as well. Lastly, remove the battery if you'll be storing your device for an extended period of time to protect from battery leakage.

### Travel

If traveling with a laptop, take care to protect yourself from theft. If possible, use a case that doesn't look like a computer case. A well-padded backpack makes a great travel bag for a laptop and appears less tempting to would-be thieves. Don't forget to pack any accessories you might need, like modular devices, spare batteries, and AC adapters. Make sure to remove any disks, such as CD/DVD or floppies, from their drives. Most importantly—back up any important data before you leave!



Make sure to have at least a little battery power available. Heightened security at airports means you might have to power on your system to prove it's really a computer and not a transport case for questionable materials. And never let your laptop out of your sight. If going through an x-ray machine, request a manual search. The x-ray won't harm your computer like a metal detector will, but if the laptop gets through the line at security before you do, someone else might walk away with it. If flying, keep your laptop out of the overhead bins and under the seat in front of you where you can keep an eye on it.

If you travel to a foreign country, be very careful about the electricity. North America uses ~115-V power outlets, but the rest of the world uses ~230-V outlets. Many portable computers have *auto-switching power supplies*, meaning they detect the voltage at the outlet and adjust accordingly. For these portables, a simple plug converter will do the trick. Other portable computers, however, have *fixed-input power supplies*, which means they run only on ~115-V or ~230-V power. For these portables, you need a full-blown electricity converting device, either a step-down or step-up *transformer*. You can find converters and transformers at electrical-parts stores, such as Radio Shack in the U.S.

## Shipping

Much of the storage and travel advice can be applied to shipping. Remove batteries and CD/DVD/floppies from their drives. Pack it well and disguise the container as best you can. Back up any data and verify the warranty coverage. Ship with a reputable carrier and always request a tracking number and, if possible, delivery signature. It's also worth the extra couple of bucks to pay for the shipping insurance. And when the clerk asks what's in the box, it's safer to say "electronics" rather than "a new 20-inch laptop computer."

## Security

The fact is, if someone really wants to steal your laptop, they'll find a way. There are, however, some things you can do to make yourself, and your equipment, a less desirable target. As you've already learned, disguise is a good idea. While you don't need to camouflage your laptop or carry it in a brown grocery bag on a daily basis, an inconspicuous carrying case will draw less attention.

Another physical deterrent is a laptop lock. Similar to a steel bicycle cable, there is a loop on one end and a lock on the other. The idea is to loop the cable around a solid object, like a bed frame, and secure the lock to the small security hole on the side of the laptop. Again, if someone really wants to steal your computer, they'll find a way. They'll dismantle the bed frame if they're desperate. The best protection is to be vigilant and not let the computer out of your sight.

An alternative to physically securing a laptop with a lock is to use a software tracking system. Software makers, such as Computer Security Products, Inc. at [www.computersecurity.com](http://www.computersecurity.com), offer tracking software that transmits a signal to a central office if stolen and connected to a phone line or the Internet. The location of the stolen PC can be tracked, and sensitive files can even be deleted automatically with the aid of the stealth signal.

## Troubleshooting Portable Computers

Many of the troubleshooting techniques you learned about with desktop systems can be applied to laptops. Additionally, there are some laptop-specific procedures to try.

### Laptop Won't Power On

- Verify AC power by plugging another electronic device into the wall outlet. If the other device receives power, the outlet is good.
- If the outlet is good, connect the laptop to the wall outlet and try to power on. If no LEDs light up, you may have a bad AC adapter. Swap it out with a known-good power adapter.
- A faulty peripheral device might keep the laptop from powering up. Remove any peripherals such as USB or Firewire devices.

### Screen Doesn't Come On Properly

- If the laptop is booting (you hear the beeps and the drives), first make sure the display is on. Press the FN key and the key to activate the screen a number of times until the laptop display comes on.
- If the laptop display is very dim, you may have lost an inverter. The clue here is that inverters never go quietly. They can make a nasty hum as they are about to die and an equally nasty popping noise when they actually fail. Failure often occurs when you plug in the laptop's AC adapter, as the inverters take power directly from the AC adapter.

### Wireless Networking Doesn't Work

- Check for a physical switch along the front, rear, or side edges of the laptop that toggles the internal wireless adapter on and off.
- Try the special key combination for your laptop to toggle the wireless adapter. You usually press the FN key in combination with another key.
- You might simply be out of range. Physically walk the laptop over to the wireless router or access point to ensure there are no "out of range" issues.

### Handwriting Is Not Recognized

- If your PDA or tablet PC no longer recognizes your handwriting or stylus, you may need to retrain the digitizer. Look for an option in your PDA OS settings to "align the screen." On Windows tablet PCs, you will find a similar option under Start | Settings | Control Panel.

## Keypad Doesn't Work

- If none of the keys work on your laptop, there's a good chance you've unseated the keypad connector. These connectors are quite fragile and are prone to unseating from any physical stress on the laptop. Check the manufacturer's disassembly procedures to locate and reseat the keypad.
- If you're getting numbers when you're expecting to get letters, the number lock (NUMLOCK) function key is turned on. Turn it off.

## Touchpad Doesn't Work

- A shot of compressed air does wonders for cleaning pet hair out of the touchpad sensors. You'll get a cleaner shot if you remove the keyboard before using the compressed air. Remember to be gentle when lifting off the keyboard and make sure to follow the manufacturer's instructions.
- The touchpad driver might need to be reconfigured. Try the various options in the Control Panel | Mouse applet.

## Beyond A+

### Centrino Technology

As mentioned previously in this chapter, consumers have always, and will always, demand better performance, more features, and longer battery life from their portable PCs. Intel, for example, promotes a combination of three components—extremely low-power, yet speedy, CPUs; integrated wireless networking technology; and an Intel chip-set—that, when combined, produce portable PCs that not only are exceptionally powerful, but also boast an extremely long battery life!

### Origami—Ultra-Mobile PCs

Microsoft started pushing the Ultra-Mobile PC (UMPC) standard in 2005 and has started to get some traction in the industry. UMPCs are a small form-factor tablet PC, designed to fill the spot between PDAs and tablet PCs. Most of the versions use a 7-inch widescreen, touch-enabled LCD (although at least one model on the market has a 4.3-inch widescreen LCD) and feature everything you would expect to find in their bigger cousins, with the exception of optical drives. They have internal 30–80 GB hard drives, 512 MB to 1

GB of RAM, built-in Wi-Fi and Bluetooth for connectivity, and more. Some even have USB and FireWire ports! All weigh under 2 pounds and come in at under 1 inch thick.



**NOTE** Microsoft initially called the UMPC project “Origami.” The name has stuck, even though Microsoft has since shifted over to the more generic UMPC name.

The feature that most distinguishes UMPCs from PDAs is that the former runs a fully featured version of Windows XP, just like your desktop and laptop PCs. Most UMPCs run Windows Tablet PC edition, although a few devices run Windows XP Home or Windows Vista. (A few über geeks have even installed versions of Linux on UMPCs!) Figure 19-32 shows a Sony VAIO UX UMPC.

**Figure 19-32**  
Sony VAIO UX  
(photo courtesy of  
Sony Electronics)



## Chapter Review Questions

1. What is the name of the lower level of software drivers that support PC Cards?
  - A. PCMCIA services
  - B. Socket services
  - C. Card services
  - D. I/O services

2. How many Type III cards can typically fit into a laptop at one time?
  - A. 1
  - B. 2
  - C. 3
  - D. 4
3. Parallel PC Cards come in \_\_\_\_-bit and \_\_\_\_-bit versions. The latter is called CardBus.
  - A. 8, 16
  - B. 16, 32
  - C. 32, 64
  - D. 64, 128
4. What is the typical use for Type II PC cards?
  - A. Additional RAM
  - B. Hard drives
  - C. Flash memory
  - D. I/O devices such as modems and NICs
5. Which of the following are good ideas when it comes to smart batteries? (Choose all that apply.)
  - A. Keep the contacts clean by using alcohol and a soft cloth.
  - B. Store them in the freezer if they will not be used for a long period of time.
  - C. Toss them in the garbage when they wear out.
  - D. Store them in a cool, dry place.
6. What's the typical input device for a PDA?
  - A. Keyboard
  - B. Mouse
  - C. Stylus
  - D. Voice
7. Tablet PCs come in which of the following form factors? (Select all that apply.)
  - A. Convertible
  - B. Desktop
  - C. Secure Digital
  - D. Slate

8. ExpressCards connect to which buses? (Select all that apply.)
  - A. ISA
  - B. PCI
  - C. PCIe
  - D. Hi-Speed USB
9. Clara's laptop has a DVI connector to which she has connected a projector. As she prepares to make her presentation, however, nothing comes on the projector screen. The laptop shows the presentation and the projector appears to be functional, with a bright white bulb making a blank image on the screen. What's most likely the problem?
  - A. She needs to plug in the projector.
  - B. She's running the laptop on batteries. You need to plug in laptops to use the DVI connector.
  - C. She needs to update her PC Card services to support projectors.
  - D. She needs to press the Function key combination on her keyboard to cycle through monitor modes.
10. What is the primary benefit to adding more RAM to a laptop that uses shared memory? (Select the best answer.)
  - A. Improved battery life
  - B. Improved system performance
  - C. Improved video performance
  - D. None. Adding more RAM is pointless with systems that use shared memory.

## Answers

1. B. The lower level of software drivers for PC Cards is known as socket services.
2. A. Due to their thickness, only one Type III PCMCIA card can fit into a laptop at a time.
3. B. Parallel PC Cards come in 16-bit and 32-bit varieties.
4. D. The typical use for Type II PC cards is for I/O devices such as modems and NICs.
5. A, D. Keeping a battery in the freezer is a good idea in theory, but not in practice. All batteries contain toxic chemicals and should *never* be treated like regular trash.

6. C. PDAs (and tablet PCs) use a stylus for input.
7. A, D. Tablet PCs come in convertible and slate form factors.
8. C, D. ExpressCards connect to either the PCI Express or Hi-Speed USB buses.
9. D. Clara needs to press the Function key combination on her keyboard to cycle through monitor modes.
10. B. Improved overall system performance is the primary benefit to adding more RAM to a laptop that uses shared memory.