

Part 1

The Laptop Computer

Whatever you call it — laptop, notebook, portable, tablet, or AI — the concept behind its design is to squeeze 25 pounds of stuff into a 5-pound box. In this part, I tell you what's inside that sealed box and show you all the ways you can plug things into a device with more compartments, slots, and connectors per square inch than any other consumer device in your home or office.



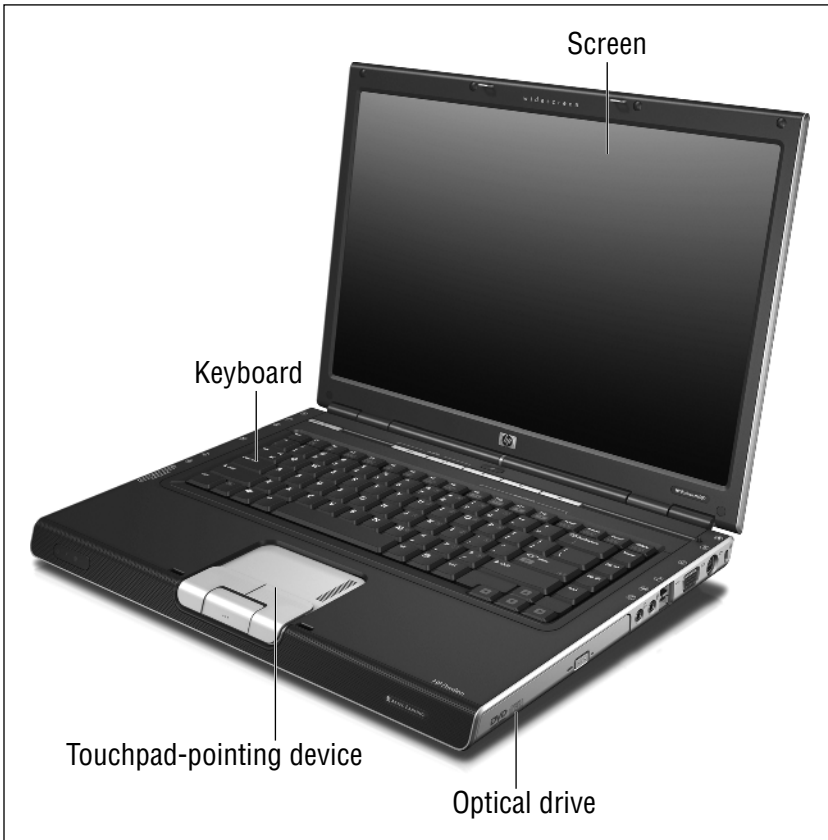
In this part . . .

- ✓ Adding hardware
- ✓ Investigating laptop models
- ✓ Going online
- ✓ Working with files and folders

Checking Out Basic Hardware

Your laptop is good to go all by itself. Okay, let me amend that slightly: You'll probably want to bring along an AC adapter to recharge the battery or run the machine off wall current. But other than that, when it comes to basic functions, it's all in the box. See Figure 1-1.

Figure 1-1



Courtesy of Hewlett-Packard Company

From the beginning of time, or at least laptop time, the box has been built in what designers call a *clamshell* — two main components with a hinge at the back and a latch at the front.

When you slide that latch and open that hinge, you have the following: the upper part, which is the screen (nearly always a variation of a liquid crystal display, better known as an *LCD*), and the lower part, which I call the . . . laptop

computer. The upper part may have a few indicator lights, LEDs, or a miniature LCD screen displaying information about its status, and some of the most current machines offer miniature video cameras in the top lip of the frame.

The lower part is where all the action is: the motherboard and its microprocessor, the memory, the hard disk, a CD or DVD drive (on most modern machines), or the latest: a Blu-ray drive (a high-capacity, high-resolution version of a DVD). And because a laptop is, at heart, an everything-in-one-box device, the lower part also includes components ordinarily separated from a standard home or office PC: the keyboard, a pointing device, and a set of tiny speakers.

Take a quick tour of the basic components:

- ✔ **Screen:** Your porthole into the computer. You can read the news, write the Great American Novel, juggle numbers in a spreadsheet or database, wield a digital paintbrush, or sit back and watch a movie, the news, or a baseball game. Virtually all modern laptops use an LCD of one design or another.
- ✔ **Keyboard:** The primary means for entering our own information into the computer, by hunt-and-peck or fast-as-the-wind speed typing. It's not the only way, of course: Many of us get information into our machines from the Internet, from e-mail, from CDs or DVDs, or over a wired or wireless network from another user.
- ✔ **Buttons, lights, and indicators:** What's the point of having all these bells and whistles if you don't have flashing or glowing lights and a passel of special-purpose buttons with unusual icons? There are some that are pretty obvious: on/off and a rotary volume control wheel or a pushbutton that electronically turns the sound up or down, for example. And there are some that must have made sense to some designer some time, but don't seem to have anything to do with any task you ever need to perform.

Here are some indicators you may find on a modern machine:

- ✔ **Power button:** On and off, of course, but also (on many machines) the pathway to Sleep or Standby modes. Many machines also provide one or more indicator lights that tell you whether the laptop is on or asleep, running on power supplied by the AC adapter or the battery, and deliver a report on the power level of the battery. On some machines, a little low-power-draw LCD screen delivers the same information in the form of an icon or text message.
- ✔ **WiFi on/off switch:** Controls the activation of the wireless transmitter and receiver hardware in a modern laptop. You'll also have to instruct the operating system to use the wireless facilities. On most laptops a little indicator light tells you when hardware is powered up.
- ✔ **Multimedia controls:** Yes, it's a serious business machine, even if you catch me watching a DVD of *Airplane* at 35,000 feet over the Atlantic. Many

modern machines offer a set of VCR-like buttons to directly control the playback of a video or audio disc in the CD or DVD player.

- ✔ **Pointing device:** Here's how to give your computer a hand, essentially reaching into the screen to identify, choose, or move text or graphics. On a desktop machine, you might generically call this a mouse, but on a laptop you'll usually find one of the following miniaturized equivalents that don't require additional desk space: a touchpad that responds to the movement of your finger on its surface, a pointing stick embedded in the keyboard that works like a joystick, or a trackball that moves the cursor as you push its suspended marble. (You can also attach a tiny portable mouse to a port on your laptop if you've got the room to use it.)
- ✔ **Speakers, headphones, and microphones:** Your laptop can talk or sing, or listen to what you have to say. Some models are more oriented toward multimedia than others, but because laptops are often used to make presentations (using PowerPoint, spreadsheet, or graphics programs), nearly all current machines offer capable audio features. The headphone jack, by the way, not only serves to protect the guy in the next seat from having to listen to your soundtrack or the details of your corporate marketing presentation; on most models it can output the sound to a larger, room-sized amplifier and set of speakers.
- ✔ **Optical drive:** This is a technical way to refer to CD, DVD, and Blu-ray drives, each of which read information by shining a laser onto a spinning disk and detecting tiny dark or light spots, which are converted by the electronics into the 0s and 1s that the computer can work with. Today, optical drives can write discs with your own information, and the most advanced can read, write, and rewrite (erasing old information in the process).
- ✔ **Expansion and enhancement bays and slots:** As the internal parts of laptops have gotten smaller and smaller, designers have given back some of that space in the form of bays and slots and other forms of pockets that can hold miniaturized expansions of the machine. Nearly every laptop offers the ability to add one or more additional modules of *random access memory (RAM)*. And most allow use of credit-card-size *ExpressCards* or *PC Cards* (an earlier version of the same sort of technology) that can add functions to the machine. Some units include an extra bay that can hold a second battery or a second hard drive.
- ✔ **Power supply and battery:** The only essential components of a laptop that aren't permanently attached or enclosed in the sealed box are the power supply and the battery. An *AC (alternating current)* power supply takes wall current (modern systems can work with either 110 or 220 volts) and transforms it to *DC (direct current)* and reduces it to somewhere in the range of 12 to 20 volts, depending on the machine. That power can be used to directly operate the laptop, which is fine when you're sitting at a desk in an office or your hotel room, but a bit inconvenient if you're flying or driving

or sitting out in the woods. The power supply's other use is to charge and recharge a battery that installs in a bay on the side or bottom of the laptop. (You can also run many laptops using a special power adapter that plugs into an automobile's DC output — what used to be called the cigarette lighter — or into a power source offered by some airlines. And some current-model automobiles now offer a 110-volt AC outlet for use with electronic devices.)

- ✔ **Security lock slot:** Most current laptops include a small attachment point — connected to the internal metal or heavy-duty plastic shell of the machine — for a locking cable. The good news about laptops is that they're easy to move around. The bad news is that bad people out there know this. You can purchase a cable to loop around a pipe or other fixed object; a special lock (keyed or combination) fits into the slot.
- ✔ **Cooling vents:** The flow of electrons through tiny wires within your laptop is not perfectly free and easy. The friction of the electricity in the pipes generates heat, and the faster the flow, the hotter the temperature. And of course, today's laptops are very fast. Heat within a laptop is exhausted to the outside through the use of vents and one or more fans.

Cornering Input and Output

I was thinking about calling this section Ports Aplenty, which isn't really a technical term, but nevertheless a pretty appropriate way to think about a laptop. Since the machine's essentially a sealed box meant to travel the globe, clever designers have come up with all sorts of ways to allow you to attach external devices or communicate through wires, networks, pulses of light, or radio waves.

Current I/O options

As technology marches along, ports may come and ports may go. For example, the versatile USB port has taken over the role formerly played by a number of older means of connection. Designers have ensured that nearly every piece of external equipment, no matter how old, can find a way to communicate with even the most modern machine.

First, consider the ports that are now common on current laptops:

- ✔ **RGB (monitor) port:** This is an output of the same image seen on the LCD screen, converted to a signal that can display on a standard computer monitor, or on a wall if you use an external video projector.
- ✔ **S-video port:** This port sends a relatively high-resolution video output to modern TV sets that have a matching input. The picture quality is generally not quite as good as what you see on a computer monitor, but TVs are usually larger than monitors.

- ✔ **USB port:** This high-speed, highly adaptable port (some laptops offer two or even three of them) can be used for almost any type of device, from printers to external keyboards to various forms of add-on storage. A USB port provides both data and electrical power to attached devices, although some high-demand devices may require their own AC or battery power source. And if you need to plug in more devices than you have USB ports, you can add a *hub* that splits the signal and provides more connecting points.
- ✔ **eSATA port:** Designers promise to extend the high-speed internal Serial ATA bus from inside the laptop to work with devices outside. Hence the acronym that adds *e* for external. The specification, in its eSATA 3.0 Gbps version, delivers (wait for it) . . . 3.0 Gbps of data transfer, which is very fast—speedier than USB 2.0. In theory, an external hard drive or DVD drive connected this way operates no slower than an internal device. The port also delivers electrical power.
- ✔ **Ethernet port:** This connects a network interface within the laptop and a wired network of other computers or devices. It can also directly connect to a high-speed broadband modem, such as one that uses a cable television, DSL, or fiber-optics network. The connector, which looks like an oversized telephone jack, is technically called an *RJ45*.
- ✔ **Modem port:** If the laptop has a built-in telephone modem, this port accepts a cable (with an RJ-11 connector) that attaches to the phone network.
- ✔ **Headphone/speakers jack:** The tiny connector can provide stereo audio to a set of headphones, send a signal to a set of external speakers, or connect to the sound circuitry of a television set, video projector, or stereo amplifier and speaker system. You can purchase adapters that allow just about any audio device to plug into and use the signal from this jack.
- ✔ **Microphone jack:** Attaching a microphone to this jack permits recording of voice or live music, or provides an input to speech-recognition software for dictation or verbal commands to the computer. The jack isn't intended for use with amplified line signals, such as those that come from a stereo system or an iPod.
- ✔ **Line-in jack:** This connection, common only on laptops marketed as multi-media devices, allows connection of an external source of audio such as the output of a receiver, a VCR, or a stereo system. If your machine does not have a line-in jack and you want to record amplified sound, your best bet is to purchase a USB adapter that adds an external sound card and additional jacks.
- ✔ **iLink/FireWire port:** You can call it iLink or you can call it FireWire or you can refer to it by its technical specification, IEEE 1394. Just call it fast. This is a competitive technology to the USB port that Sony (under the iLink designation) has adopted for audiovisual devices including digital video

cameras, by Apple (marketing it as FireWire) for a broad range of devices, and by the 1394 Trade Association for anything and anyone.

- ✔ **Specialized memory slot:** Many modern laptops can directly read from tiny memory cards used in products including digital cameras, music players, PDAs, and cell phones. There is a dizzying array of these cards, including Memory Stick, Secure Digital, SmartMedia, xD Picture Cards, and CompactFlash. For example, Toshiba offers a slot capable of working with many memory devices, calling it a Bridge Media slot; Dell has an 8-in-1 card reader and a 13-in-2 card reader that pretty much cover the waterfront.
- ✔ **Infrared and WiFi ports:** Technically, these aren't ports since nothing plugs into them from the exterior of the laptop. Instead, these high-speed *transceivers* (transmitter/receiver devices) connect to similarly equipped devices, including standalone printers and keyboards to wireless networks that bring together other laptops, desktops, and Internet gateways.
- ✔ **Bluetooth and Wireless USB:** Not yet common, these forms of wireless communication are aimed at short-range cord-free communication. Many cell phones use Bluetooth to upload and download address books, digital photographs, ringtones, and other snippets of portable data. Wireless USB transmits data from a laptop to devices including printers, pointing devices, and digital cameras.

Legacy I/O options

As I've noted, the computer world is constantly changing, adding new technologies and improving on old ones. A bit of overlap is always there: The devices you used last week don't suddenly become unusable this week just because a new and improved way of doing things has been introduced. The industry even has coined terms to deal with this. If a new technology encompasses an older one without making it obsolete, that is called a *downward compatible* specification. (A term that means the same thing, but is not often used by image-conscious marketers is *backward compatible*.)

As an example, USB 2.0, the current specification for that high-speed means of communication, is downwardly compatible with earlier USB 1.1 and 1.0 devices. The older equipment works just as it always did (at the slower original speed), while newer equipment designed for the newer specification performs faster and with new features.

Yet another term is *legacy technologies*. These devices and specifications have been made obsolete by new replacements; in most cases manufacturers continue offering support for these legacy devices for a few years, but eventually that ends. Examples of legacy devices include floppy disk drives, parallel ports, standard serial ports, and dedicated ports for external keyboards and mice. My older laptops still have built-in floppy disk drives and individual mouse, serial, and parallel ports; my newer laptops dispense with all of these connection

points, instead advising users to attach old-style devices to the multipurpose USB port or to purchase a special cable that converts a USB signal to a parallel or standard serial connection.

You may find these legacy ports on a laptop:

- ✔ **Parallel port:** Direct connection to older printers and certain other devices that require this sort of cabling in which 16 bits of information march along next to each other in separate wires instead of one behind each other in a serial connection. (Parallel used to be faster than serial, but modern technologies have reversed that trend.)
- ✔ **Serial port:** The original form of computer communication, used mostly for early telephone modems and some printers. Now completely replaced by USB circuitry; if your laptop does not offer this port and you need to emulate an older, slower form of communication, you can purchase a converter than uses the USB port.
- ✔ **Keyboard/mouse port:** The small, circular port used by desktop machines to connect keyboards and mice was also available on some older laptops. There may have been one port for each device, or a single port able to work with either device. Why would you want an external mouse or keyboard when your laptop comes equipped with one of each already? First of all, an external device is usually larger and easier to use. Secondly, you can choose to install a specialty pointing device or keyboard — a board with European accent characters, the slightly different arrangement of keys you find in some parts of the world, or a more precise trackball or optical mouse instead of the pressure-sensitive touchpad or stick used by most laptops. And finally, an external port allows you, in a pinch, to work around the failure of your laptop's keyboard or pointing device.
- ✔ **Docking station/expansion port:** Older machines often were designed with a large connector at the rear that extended the computer's internal bus to an external docking station on a desktop. This was intended to allow addition of more ports, an external mouse or keyboard, external hard disk drives, and other devices. The docking station connector was usually a proprietary design that worked only with a particular manufacturer's combination of laptop and expansion module. Docking stations were not much used by most laptop owners, and have been replaced by the multifunction USB port and by WiFi and wired networks.

Delving into Basic Software

Okay, here's a metaphysical question: Is a computer a collection of hardware that exists to run software, or is software a set of instructions that is created to make use of the hardware?

And does it really matter?

The second question is the easy one. When it comes down to it, it's the software that gives your computer its personality and the tools you use to do your work. The hardware is very important, but it is just apparatus.

Let me put it another way: If you're buying a new laptop, you should determine what kinds of programs you intend to run on it and then go out and buy hardware that works well with that software.

The software in your laptop includes the following:

- ✓ **The System BIOS:** I've no sooner switched the subject from hardware to software before I must take a half-step back. The *System BIOS* is specialized software that exists in your machine's hardware; its initial purpose is to bring the inanimate chips and circuits and other doodads to life when you press the On button. That is called *booting* the machine, as in "lifting yourself up by your own bootstraps." Its second purpose is to operate the lowest level of the interface between hardware and software: interpreting keystrokes on a keyboard, receiving and moving along clicks from a mouse, and that sort of thing.
- ✓ **The operating system:** This is the all-encompassing personality of the machine, determining the look and response of programs and the way they interact with each other. The most common operating system is one of another version of Microsoft's Windows; as this book goes to press most laptops are delivered with one of the various versions of Windows Vista.

Although Microsoft would prefer otherwise, the older Windows XP operating system is still very common and popular. As this book goes to press, Microsoft intends to discontinue support for Windows XP effective April 2009. That does not mean that XP will automatically stop working on that date or that you won't find troubleshooting solutions on the Microsoft web site; it does mean that Microsoft will not create new solutions to new problems that may crop up after that time.

Nipping away in distant third place is the Linux operating system; Linux has a small piece of the server market, a smaller chunk of the desktop pie, and just a few crumbs of laptop cake. (On Apple Macintosh machines, the official operating system is Apple's own Mac OS X Leopard, although most current laptops from Apple can also run Windows as a primary or secondary OS.)

- ✓ **The applications:** Here's where the work gets done.
 - The most popular programs for laptop users include the basic office functions that are part of the Microsoft Office suite of word processing, spreadsheets, and databases. If you're going to make presentations, Microsoft PowerPoint is the tool of choice.

- You need an Internet browser, which can be the nearly ubiquitous Microsoft Internet Explorer or one of several competitors such as Firefox (from Mozilla) or Safari (from Apple).
 - Finally, you want an e-mail client and here the choices begin with Microsoft's Outlook Express or Windows Live Mail, or third-party products such as Thunderbird.
- ✔ **The utilities:** Problems happen. Your hard disk can become fragmented or corrupted. Your machine can catch a virus from a nasty e-mail or an infected piece of software. An unfriendly web site can send a spy to your machine. Windows can become clouded by broken pieces. There's nothing like having the right tool for a repair job, and nothing nearly as annoying as its lack.

Diving into Laptop Types and Models

All laptops are essentially the same:

- ✔ On the outside, a screen, a keyboard, and a pointing device
- ✔ On the inside, a processor, a set of memory chips, and storage (hard drive, CD, DVD, and the like)
- ✔ In between, a set of ways to get information in and out of the box

The design and the particular combination of very-nice-but-not-always-essential bells and whistles distinguish one laptop from another. If you're looking for an analogy — and who isn't in these troubled days — consider cars. All automobiles have the same basic components: a set of wheels, brakes, steering mechanism, a couple of seats, and an engine to pull (or push, depending on how you want to look at it) the box along the road.

I just checked product listings and reviews on a web site. If I were looking for the least expensive gasoline-powered putt-putt for runs to the grocery store I might consider the oh-so-cute Smart Car *fortwo* model with a list price of about \$11,590; it includes in its tiny front end a 70-horsepower three-cylinder engine with seats for a driver and a passenger. In back is just enough space for three or four bags of kettle-cooked salt and vinegar potato chips and a 12-pack of India Pale Ale.

On the other hand, I could dip into petty cash and pick up a pulsating yellow Lamborghini *Murcielago* Roadster, which is anything but cute. Its suggested price is a mere \$345,000 but the engine is a bit more robust: a 632-horsepower 12-cylinder gas guzzler. It also has just enough room for a driver and a passenger, plus those chips and ale.

You could put either car on a race track, although one engine will scream as it powers you from 0 to 60 mph in 13.3 seconds and the other will purr to the same speed in 3.4 seconds. Can you guess which one has the giddy-up? More importantly, both cars will get you through heavy traffic to the supermarket in exactly the same amount of time.

Okay, enough about cars. Back to laptops. For basic jobs like word processing, browsing the Internet, and playing solitaire, any current machine will do just fine, from a \$600 bargain special to a \$3,000 luxury model. If you're planning on doing a moderate amount of basic graphics or audio editing, or if you need to prepare and then deliver complex PowerPoint presentations, then you need a machine with a bit more horsepower (in the form of a faster processor and more memory). And if you've got to do some very demanding work and have special needs like an extra-large screen or some extraordinary multimedia assignments you may need to buy a Lamborghini . . . I mean a top-of-the-line luxury model laptop equipped with above-the-ordinary graphics and audio capabilities.

No industry standards consistently divide laptop models into classes, so I've come up with some of my own. Feel free to modify them to meet your particular needs, update them as changes occur in the industry, and use them to make your own decisions on purchasing, upgrading, or holding on to your laptop.

The prices and configurations I am using are common in 2008. Throughout the history of personal computers, the trend has always been this: Prices go down and you get more and more for your money over time. But there will always be a price and performance difference between the latest and greatest, and the relatively oldest and least. Be careful out there.

Basic laptop

This is the perfect machine to use as an extension of your desktop computer when you go out on the road or head off to class. It will process words, churn a spreadsheet, or communicate with the Internet just about as well as any other machine. In 2008, the low end of the market would have been considered near the top of the pyramid a few years ago. You could pay somewhere in the vicinity of \$550 and receive the following:

- ✓ An Intel Celeron or equivalent CPU, running at about 1.8GHz in speed
- ✓ A set of capable but basic graphics chips built directly into the motherboard (*integrated*, as the techies like to say) and sharing the system memory (which means the total amount of RAM available to the CPU is reduced by the amount required by the graphics processor)
- ✓ A glossy, widescreen LCD of about 15.4 inches
- ✓ 1GB or so of RAM, shared with the graphics processor
- ✓ A combination CD-R and DVD player

- ✔ A large (but not huge) hard drive, perhaps about 80GB in capacity
- ✔ Basic I/O facilities including two or three USB ports, an ExpressCard slot, a built-in Ethernet port, and a built-in modem
- ✔ Built-in WiFi transceiver for wireless communication
- ✔ A 1.5"-thick box that weighs about 5.9 lbs

In less than two years since this book's first edition, the typical price for this basic machine has dropped about \$100, the screen has grown over an inch, the hard disk drive has doubled, the standard memory has quadrupled, and WiFi has gone from optional to standard.

Fully equipped road warrior

This is a model for travelers who need to do real work while they are away from their real desk, and it also has the facilities you need to create and display presentations on its own big screen or connect to a projector if you need to live really large. Expect to pay at least \$1,500 and as much as \$2,000 for something like this:

- ✔ An Intel Core 2 Duo processor or equivalent CPU with a pair of processors running at 2.0 to 2.6GHz
- ✔ A separate, high-end graphics card within the case with its own block of memory, adding more colors, higher resolution, and speed
- ✔ A separate audio sound card that delivers full sound production and capture facilities, well beyond the basic capabilities of built-in audio chips on the motherboard
- ✔ A high-resolution glossy widescreen LCD of about 15.4 inches, or for about \$100 more, a 17-inch screen
- ✔ 3GB to 4GB of shared RAM, or dedicated memory for the exclusive use of the CPU
- ✔ A DVD read/write device that also works with CDs. The next great thing is a Blu-ray drive, which can also handle DVDs and CDs; prices are beginning to decline for the advanced drive but you can expect to pay a premium to go blue for a while.
- ✔ A larger, faster hard drive, perhaps about 200GB to 300GB in capacity, spinning at 7200 RPM
- ✔ A full complement of I/O facilities including as many as six USB ports, a FireWire port, S-video output, an infrared port, a PC Card slot, a built-in Ethernet port, and a built-in modem
- ✔ A built-in webcam mounted in the upper frame of the LCD, plus a microphone and speakers

- ✓ A fingerprint reader to add a highly personalized form of security to the login process
- ✓ A larger battery for extended usage
- ✓ A 1½"-thick box that weighs about 6 pounds

Since this book's first edition, the price of this highly capable road warrior has remained about the same, but has improved in many important ways. The CPU now has two processors and they're faster than ever; the installed RAM has gone up six- or eightfold; the hard disk has doubled or tripled in size; and bells and whistles include the webcam, the fingerprint reader, and a DVD burner. Oh, and the weight has dropped by a few pounds.

If you're determined to spend even more, you can pay as much as \$3,000 for an "extreme" machine that comes with the latest and fastest CPU, the most capable graphics and audio subsystems, extra RAM, a larger hard drive, and other tweaks, bells, and whistles.

Lightweight champ

For some users, you (or your laptop) can never be too light. And there's a lot to be said for such machines; just ask a chiropractor or physical therapist who's treated sore shoulders, stiff necks, and twisted knees from travelers. A few pounds can make a great deal of difference over the course of a week-long trip.

There has to be a tradeoff, of course, and it begins with a smaller screen and a lighter, slightly less capacious battery. Some users may also find the overall shrunken dimensions of a laptop are as small as they want to go; many light-weight models have reduced-size keyboards and pointing devices. Expect to pay about \$1,500 to \$2,000 for a little gem like this:

- ✓ An Intel Centrino Duo or equivalent CPU
- ✓ An integrated graphics chipset that shares the system memory
- ✓ A screen size of about 12 inches
- ✓ 1GB to 2GB of RAM
- ✓ A DVD read/write combination drive
- ✓ A mid-size hard drive, perhaps about 120GB to 200GB in capacity
- ✓ A good complement of I/O facilities including perhaps a pair of USB ports, a FireWire port, S-video output, an ExpressCard slot, a built-in Ethernet port, and a built-in WiFi transceiver
- ✓ A 1-inch box that weighs about 2.44 pounds

In 2008, Apple introduced a nifty little device called the MacBook Air, which shoehorns a 13.3-inch display, a keyboard, and a solid-state 64GB "drive" into a

box less than $\frac{3}{4}$ inch thick and weighing short of 3 pounds. The price? Well, early buyers could expect to pay somewhere between \$2,700 and \$3,000, but some people can never be too rich or too thin.

Entering the Box

I describe the laptop as a sealed box, and for the vast majority of people, that's the way it will always be. This is very different from a desktop PC, which is readily opened and is built with the expectation that it will be adapted, changed, or expanded.

The main reason the laptop box is sealed is that its internal parts are so tightly and intricately packed that it's not easy for an untrained amateur — no matter how experienced at fix-it projects — to reassemble it. The case is engineered to be tough but light, sealed against the elements but still able to exhaust heat. In addition to holding all of the pieces in a relatively secure box, it also is assigned the task of guarding against radio frequency radiation, which might interfere with other pieces of electronics. And finally, the parts within the case are mostly proprietary to a particular manufacturer — these aren't the same sort of components you can buy off the shelf at your nearby super-duper-computer center.

I won't ask you to pick up a screwdriver or a specialized tool to open the case of a laptop. That task is better left to a professional repair shop. Later on, though, I discuss those parts of the machine that are open to you, including memory slots and plug-in expansion bays. But just so you can say you do know what lies within, here are the major components inside the sealed box:

Motherboard

A *motherboard* is the place that holds the principal electronics of the computer, with tiny etched wires (called *traces*) that connect attached components or sockets that hold removable chips. Branching off the motherboard are connectors to various types of memory, storage, and input/output.

In the original design for personal computers, what was called the mainboard started to be expanded through the use of smaller, attached boards of circuits and chips. The mainboard became the motherboard and the smaller collections of electronics the daughterboards.

Motherboards are very closely linked to the case that holds them; the mainboard from one maker's machine is unlikely to fit into the case sold by another, and only slightly less unlikely to move within the various models sold by the same manufacturer.

CPU

The *central processing unit (CPU)*, or *microprocessor*, is the brain, or at least the manager, of all the data and instructions that pass back and forth within the machine. Most modern laptops use a modified version of the same microprocessor employed by desktop computers; designers have come up with many ways to reduce the amount of power that processors demand, which helps extend battery life and also reduces heat buildup (which also cuts down on power use by the fan).

Some of the most current microprocessors, including the Intel Centrino M, can adjust their speed and power use depending on the task they're performing. The Centrino technology includes a CPU, a supporting chipset, and a wireless transceiver. The chip itself is the Pentium M. If the computer includes all three parts, the manufacturer can call it a Centrino system; if it lacks the WiFi circuitry, then the laptop is called a Pentium M system.

Other Intel chips used in laptops include mobile versions of the Core 2 Duo processors, sometimes identified as Mobile Core 2 Duo, and the slightly less capable Core Duo processors.

Advanced Micro Devices, the only significant Intel competition in the laptop CPU marketplace, has its own series of highly capable microprocessors. Current chips include the Mobile AMD Sempron and the AMD Turion 64 X2 Dual-Core Mobile Technology.

Memory (also known as RAM)

Memory is the place where the computer gets its work done. This is the scratchpad, the assembly place for your words, numbers, pictures, and sounds before you manipulate, display, print, or file them away in storage for future reference. Memory is more properly referred to as *random access memory (RAM)*, because the computer can reach directly into the chip to find a piece of information without having to go through everything else in front of it.

Another important thing to remember about RAM is that it's *volatile*, or temporary; it requires a near-continuous source of electrical power and regular refreshing of its contents. Let me put it another way: Turn off the laptop and RAM loses its memory.

And finally, more memory is generally better than less memory. Your processor works faster if it can work on data in RAM instead of having to retrieve it from storage (a hard disk, for example). The downside to more memory in a laptop is that the chips require power and also generate more heat, which fans must remove. Therefore, a battery's working time in a system with a lot of RAM is shorter than in a system with less memory.

Chipset

If the CPU is the brain or the manager, then the chipset is the loyal, handpicked, and highly skilled support staff. The devices in the *chipset*, which must be carefully matched to the CPU by the laptop's designers, are in charge of executing the instructions put forth by the processor and determine the personality of the hardware side of the hardware/software equation. In almost every design, laptop processors and chipsets come from the same manufacturer; once again, the biggest maker of both is Intel.

Input/Output

Where the motherboard stops, its *input/output (I/O)* ports and connectors begin. Modern laptops offer faster and more flexible means of communication than ever before, led by USB and WiFi.

Foraging for Hardware

You buy into a tradeoff with the purchase of a laptop: It's unreasonable to plan on opening the box to make changes or add parts. Everything has to be done from the outside.

The good news, though, is that there is a huge selection of external enhancements. I will divide those improvements into two classes: plug-ins and attachments. Those two may sound like they're the same, and they're very similar. But here's the difference:

- ✔ *Plug-ins* slide into pockets, bays, and enclosed slots and travel with the laptop. In most cases they're locked into place with a latch or a screw. (They're still external to the innards of the case despite residing in their own plastic cocoon.)
- ✔ *Attachments* hook up to connectors, ports, or make electronic communion with wireless points of access including WiFi and infrared circuitry. Most must be disconnected and put in your carrying case or suitcase (or left behind) when you set out to travel.

Plug-ins

Modern laptops typically come with one or more bays to allow easy interchange, replacement, or upgrade of certain components. They include the following:

- ✔ **Memory compartment:** Most machines come with a basic block of RAM and let you install one or more additional modules into connectors, which you access from the bottom of the case. (Most motherboard designs balance memory into an even number of *banks*, which is why a design with

two or four slots is common.) These modules are usually industry-standard sizes and shapes; you don't ordinarily have to buy memory that bears the logo of the manufacturer of your laptop. Be sure, though, to exactly follow the required specifications.

- ✔ **Battery compartment:** Your laptop comes with a battery, and depending on your patterns of use, it may last for a year or two and sometimes longer before it fails or no longer holds a charge long enough to make it useful. You can purchase a replacement battery from your laptop manufacturer or a third party. Some users go to the trouble of buying and charging a second battery to take with them on long airline trips or for other situations where they might not be able to recharge the device or run the laptop from AC current.
- ✔ **Hard drive compartment:** Many laptop makers now attach their storage disks to quick-connect, quick-remove pockets or bays. This allows easy upgrading or replacement of a failed unit. As with other components, you may be able to obtain a replacement drive from sources other than the laptop manufacturer. Be sure to follow all instructions about removal and installation procedures; in almost every machine, you should never remove the hard drive while the laptop is powered up. The drive is usually locked in place with one or two small screws.
- ✔ **Optical drive compartment:** Some manufacturers make it easy for you to remove and replace the CD or DVD drive. You may be limited in your options for replacement here because of nonstandard carriers or connectors used by some makers, and you also must have the proper software driver to work with the machine. The drive is almost always held in place by several small screws.
- ✔ **WiFi module compartment:** You may find access to a small compartment that holds a matchbook-size circuit board that serves as a transmitter and receiver for wireless communication. Most manufacturers advise users against even opening the compartment because of regulations set by the FCC meant to limit spurious radio frequency emissions. Check instructions carefully before you consider removing or replacing this circuit board.
- ✔ **ExpressCard slot:** Most laptops can accept one or two credit-card-size enhancements here. The range of devices you can install here include WiFi transceivers for laptops that don't have built-in facilities, tiny hard drives, modems, Ethernet network interfaces, and many other devices. The older size and design for such plug-ins was called a PC Card; the newer and more flexible system is known as the ExpressCard.

Attachments

The Swiss Army knife of the modern laptop is the USB port, and you may find one or as many as six ports. For many users the USB and the wired Ethernet or wireless ports are all you need to work with just about any external device or network.

Most — but not all — external devices require a separate power source and are generally used when the laptop is at a desk with an AC power supply.

In the list that follows, I've marked the ones that usually require independent power with an asterisk. You can attach these devices to a laptop:

- ✔ **Network**: If you need to upgrade an old machine or work around a failure, you can plug in the circuitry to exchange information with other computers or share devices, including a broadband modem for use of the Internet, or a printer attached to any other computer that's a member of the workgroup on the network. The common specification is called *Ethernet*, and it can use either a wired or a wireless (WiFi) connection to other devices.
- ✔ **Printer***: A printer can be directly connected to a laptop using the USB port. You shouldn't have to carry your own printer around with you; almost any USB printer can be attached and recognized by a current laptop running Windows. Older laptops and printers may want to communicate using a parallel port and connection; either the laptop or the printer can use a converter cable that changes parallel data to serial information (or the other way around).
- ✔ **Broadband modem***: You can directly connect to a high-speed cable or DSL modem to use the Internet. Most of these devices connect to a laptop through an Ethernet or USB port.
- ✔ **Scanner***: This useful device can import digital images of pictures or text; that information can be kept as graphics, or the text can be put through an *optical character recognition (OCR)* software program to convert it to editable data for use in a word processor. Scanners require a broad pipe to convey a great deal of information; most current models use (you guessed it, right?) a USB port. Some older scanners require a SCSI port, which isn't commonly offered on laptops, although once again some converters can stand between the scanner and the . . . USB port.
- ✔ **External hard drives***: You can easily add more storage with a plug-in drive; external drives can be as small and light as a videotape and attach to a USB or an eSATA port.
- ✔ **External optical drive***: Plugging in an attached CD reader or burner, or a DVD player or burner, is easier than installing a new one in your laptop. Once again: You'll make the connection through the USB or eSATA port.
- ✔ **Digital still or video camera**: Film? We don't use no film around here no more. Digital cameras have almost completely replaced film; in almost every situation, they're used in conjunction with a computer for storage, editing, printing, and transmission of the pictures. Almost all current cameras can output their files to a laptop using a cable to either the USB or the iLink/FireWire port.

- ✓ **Memory card reader:** An alternative to directly downloading using a cable from a digital camera is to use a card reader that plugs into a . . . say it with me . . . USB port on the laptop. Some readers are specific to a particular type of memory media, such as CompactFlash or SmartMedia, and some offer four to six slots intended to work with most of the common designs.

Going Through Windows

It would be hard to find a computer user who hasn't been exposed to Windows — the operating system for PCs and PC-based laptops. (A small slice of the computer world uses Linux, which is the same idea, differently expressed; Apple users use that company's equivalent.)

But relatively few users understand the real purpose of the operating system and its interrelation with the hardware and software that sit (in logical terms) below and above it. Let me try to explain. The job of Windows is to

- ✓ **Manage the hardware.** Windows sits between the hardware and your applications with hooks into each. When a piece of software — a word processor, for example — wants to load a file into memory for editing, Windows receives the request and translates it into a command that the hardware can fulfill. Hardware must fit within certain specifications in order to work with PC motherboards and processors, but various components have differing capabilities; manufacturers develop a small piece of code called a *driver* that identifies hardware to the operating system.
- ✓ **Manage the software.** Similarly, software developers have a fairly wide latitude in the sort of tasks they can assign to their programs. However, there has to be a way for a single piece of software to interact uniformly with the nearly infinite combinations of hardware that exist within computers. The job of Windows is to adapt the software commands to what it knows about the capabilities of the hardware. Windows also allocates the use of the computer's memory and processor time so that various programs can coexist without conflicts and crashes. (Do I hear a guffaw out there? I'm with you . . . but it's true that with each successive release and update of Windows, the number of system crashes and other failures has gone down. May we all live to celebrate the extermination of the final bug.)
- ✓ **Manage the files.** If you have a hard time this morning remembering where you put your keys, consider the fact that a typical computer has to remember the location of tens or hundreds of thousands of programs, snippets of information, and complete files. (On my main work machine, my antivirus checking program most recently found something like 450,000 files worth checking . . . and half a dozen pieces of spyware it recommended for obliteration.) Windows oversees the creation and management

of a set of interlocked tables and indexes of files. It's all invisible to you, but oh so important.

- ✔ **Show a pretty (and simpler) face.** For most users, this is what it's all about: Putting lipstick on an electronic pig. Those of us old enough to have used computers before the introduction of Windows (or Apple's Macintosh operating system) remember that the screen was harsh and black. The machine sat there stubbornly presenting nothing more than a command prompt, a flashing dash that demanded that you, the user, tell it what to do. It was your job to type in the proper command to launch a program, format a disk, or copy or rename a file. The arrival of Windows put a *GUI* (pronounced *goeey*) on the screen: a *graphical user interface*. A mouse or other pointing device was presented and allowed to click here, pick up and move something there, and even draw on the screen. Beneath that GUI, Windows translates it all into commands to the hardware and software.

Hitting the Internet

When laptops (and desktop computers before them) were developed, they were thought of as independent islands. A *personal* computer was meant to be one person's tool. But just as human beings are by nature social creatures, so too have PCs evolved into interconnected members of a worldwide web of machines. In fact, what once began as a sidelight — the interchange of electronic mail and the ability to visit a collection of information at a "site" — has for many users become the computer's main purpose.

Laptop users have especially benefited from this evolution. As you go out on the road, you can now take your home or business office with you; you can exist in *cyberspace* and no one has to know where you are when you send or receive files, information, or mail. Think of what cell phones have done in an even shorter period of time: If I'm not at my desk when someone calls my office, the call is forwarded to my cell phone and I can answer almost anywhere in the world.

Laptop users can gain access to the Internet in several ways: by using a dial-up modem in connection to the *plain old telephone system (POTS)*; by WiFi interchange with a wireless point of access to a high-speed modem; or by connecting (via wire or wirelessly) to an office or home network that includes a high-speed cable or DSL modem.

Where exactly is this place called *cyberspace*? The best definition I know of is based around a technology more than 125 years old: If you and I were to speak on the telephone, our conversation doesn't take place where I am or where you are. Our words, and the business we conduct, take place in a virtual world that has no physical foundation: *cyberspace*. (The word itself was coined by novelist William Gibson in his 1984 book, *Neuromancer*, and it referred to a vast network

of interconnected human and computer minds.) Today we call that place the *Internet*, and here's what it encompasses.

The World Wide Web

The best-known part of the Internet isn't a thing, and it isn't owned or directly managed by any individual, company, or government agency. That's mostly a good thing, although sometimes a world without limits can be taken over by bandits, vandals, and other evildoers. The Internet is a *web* of interconnections between huge commercial, educational, and government systems and individual outposts like your personal laptop.

Becoming a citizen of cyberspace is as simple as obtaining access to the Internet. Bits and pieces of the web are managed by communication companies, *Internet service providers (ISPs)*, and an international organization that oversees the issuance of *Internet protocol (IP)* addresses and domains.

I don't have time or space to name all of the things you can do on the Internet, but I list a few in a moment. I can confidently say, as a journalist who's been involved with personal computers since their birth more than a quarter-century ago, that almost none of these were even imagined back then: buying a car, selling a house, watching a movie, reading a book in a library 10,000 miles away, finding a recipe, consulting a doctor . . . get the idea?

Electronic mail

For many people, electronic mail has all but replaced the neighborhood postal carrier for most of the essential letters. We receive bills, mash notes, credit-card statements, and even that most cherished of all postal items: junk mail.

E-mail is essentially a store-and-forward system. Here's what that means: You can send a message anytime and the recipient can pick it up whenever he is online. Messages travel from your computer to a server at an ISP or a web site, and is then routed from there to the server associated with the person you're addressing and on to its destination. The message moves at electronic speed, minus the generally insignificant time it takes to navigate through traffic jams at various routing sites. For that reason, physical distance makes little difference; when I send a message or a file by e-mail to a co-worker at her desk 10 feet away from me, my message (broken up into small packets that travel on their own and are reassembled at the recipient) takes a couple of dozen hops up and a couple of dozen hops down before it arrives.

(Just for giggles, I decided to use one of the many *trace* utilities you can find on the Internet to see the path from my office in Massachusetts to the location of the computer that holds www.hudsondreams.com, one of the web sites I own. The report showed that there were 30 different handoffs that began near my office, eventually going through New York City, Washington, D.C., Dallas, Kansas City, and eventually arriving in Wayne, Pennsylvania. Total time: 71ms, or just shy of a tenth of a second from here to there.)

Instant messaging

If that's not quite fast enough for you, you can employ another technology that wasn't in the plans when personal computers were introduced. *Instant messages (IMs)* are intended for use in situations when both the sender and the recipient are at their computers and connected to the Internet; both parties make a connection to a central server, which routes messages between the computers at near-instant speed. The leaders include AOL Instant Messaging (AIM), Yahoo! Messenger, MSN Messenger, ICQ, and other services, including Google Talk and Jabber.

Voice over Internet Protocol

And then you've come full circle, to the use of the computer and the Internet as a substitute for the telephone. You plug a phone or an entire housefull of phones into a special telephone adapter, which is connected to a broadband modem and through it to the Internet. The telephone adapter converts the analog rising and falling waves of a voice signal into digital packets that can travel over the Internet. Calls from computer to computer can be as cheap as free (although you do have to pay for Internet service); calls from regular phone to phone, using the Internet's facilities, are often included in the flat rate for *Voice over Internet Protocol (VoIP)* service.

Organizing Files, Extensions, and Folders

One other important function of a computer — laptop, desktop, or mainframe — is as a place to keep your stuff. Although we're nowhere near the promised paradise of the paperless workplace, it's also true that computers are a great improvement over a filing cabinet (or in my case, piles of important papers on the desktop, stuffed into bookshelves, or arranged in dusty clumps on the floor).

For the convenience of humans (not the machine) Windows follows an electronic metaphor. Information of any sort, from word-processing documents to spreadsheets to graphic images, is stored as *files*. So too are programs, drivers, and settings.

Some files created by programs or the operating system have predetermined names; other files may be named by the program as they're created, and others, when you save a file that you've created, give you the chance to give it a meaningful name. (If you don't name it yourself, some programs apply generic titles like FILE001 or IMG001 or the like; just a little bit better are programs that attempt to name files based on the first line of text in the file, something that may or may not be meaningful to you.)

The operating system stores other information along with the name, including the date and time the file was last stored. Some other programs record additional information including the original date of the file's creation, the number of revisions, and other details. And many programs automatically create a backup version of an existing file when you open it for revisions; in case of catastrophe (or if you decide that changes you have made since the last time the file was saved are not worth keeping) you can open the backup file and save it under a new name.

There are no right or wrong names for files, except for two things:

- ✓ **Have a scheme that makes sense to you.** The more consistent and logical you are in choosing names, the easier it is to search and find files if you forget where you placed them on the hard disk.
- ✓ **Avoid using certain characters reserved for the computer.** You're somewhat protected here because the operating system will flat-out refuse to save a file that contains an "illegal" character. Just make sure to read the messages on the screen and don't assume that a file has been saved until you see the action performed.

Filenames under current versions of Windows can be as long as 255 characters and include any letter of the alphabet and any number, plus spaces, and special characters including \$ % ^ _ @ ~ ! () ^ # & + , ; = [] .

That said, I recommend keeping filenames simple and relatively short. (By the way, the filename's maximum length includes the *path* to where the file is stored. If your files are deeply buried in a place like C:\windows\mydocuments\corey\dummies\laptops\quickreference\secondedition, you're starting in a hole 73 characters deep including the drive designation.)

The computer also does two things to help you find and work with files: assigns a filename extension that identifies a file as being of a certain type (a word-processing document, a music file, a photo or drawing, and so on) and because Windows is a GUI, it also gives files an icon. Some programs come equipped with their own icons, while others leave it up to Windows to find an appropriate or generic picture.

Filename extensions and icons serve two very important purposes: They make it easy to quickly identify files of a particular type, and they make it easy for the operating system to associate a file with the program needed to use it. Because of this feature, Windows allows you to double-click a filename and open it within the proper program.

The final component of managing your stuff is to use folders. Think of them as file folders, filing cabinets, or boxes on the floor: Their purpose is to help you organize your stuff. Windows tries to help out by offering a folder called My Documents, but that's only one level removed from just piling everything on the desktop.

