Chapter 3: Things You Need

The very thought of pulling the cover off your computer and tinkering with its innards has given more than one tough hombre a case of the willies. The insides of a PC look like a prop left over from a Star Trek Borg episode. But we're here to tell you that performing hardware upgrades is something even the most timid earthling can do with a little thought and preparation.

A Proper Work Area

Before you start taking your computer apart, be prepared. Much of what we'll talk about in this section might seem obvious, but you'd be surprised how easy it is to overlook the obvious when fussing with computer hardware.

Before you even think of beginning an upgrade, give some serious thought to your work area.

Plain Speaking - It's All in the Cards

If you've never taken the cover off a computer and gazed at its internal workings, it can be downright intimidating the first time. All kinds of stuff is in there, wires are running this way and that way, and there are strange metal boxes. Don't panic. With a little guidance and experience, you'll be popping boards in and out with ease.

Here's the short course to get you started. A number of circuit boards are inside the computer case. These are the green, plastic-looking things with all the weird and shiny stuff sticking out of them. A circuit board is just a bunch of electronic flotsam and jetsam stuck together in a base of epoxy on one side and all connected together by spidery lines on the other. These lines are what makes the *circuit* in circuit board. Therefore, it's important not to scratch one of these lines or crack the epoxy of the board.

Each circuit board, also known as a *peripheral card* (or just *card*), performs a function, such as handling the graphics output to your monitor (graphics adapter card) or dealing with sending sound to your speakers (sound card). The board contains the electronics necessary to perform the function, relieving the motherboard of the need to have that function built into it.

Cards connect to the motherboard by plugging into a bus slot and communicate with the motherboard and the central processing unit through that connection. This design makes upgrading possible; you easily can change out one graphics card for another without having to replace the entire motherboard.

Remember to handle circuit boards carefully when removing and installing them, and always handle them by the edges. You don't want to twist or stress the boards themselves. Pretend they're old and valued photographs and you don't want to bend them or touch the actual photo part. Figure 3.1 shows an example of a typical circuit board.

The motherboard and various cards can be attached to other devices inside the case by

cables. Some cables are flat and range from narrow to several inches wide. Other cables are just a number of wires twisted together. Some cards don't connect to anything inside the case but have cables plugged into them where their connectors protrude from the back of the computer.

Don't let the complexity of all the junk inside your computer throw you. You don't need to know how to build a circuit board to remove one from a computer or pop in a new one.

Figure 3.1
Handle peripheral cards with care.

Moving the Computer

Don't pull the cover off a computer that's installed under a desk and start working on it in the dark, lying on your side with a flashlight clenched in your teeth. Please, we've tried this and are here to tell you that it does not save time in the long run even if all you want to do is swap out a sound card.

Take the time to move the PC to a real work area out of the way of pedestrian traffic, preferably up on a solid table (see Figure 3.2). This will go a long way toward saving both your back and your sanity. Getting the PC up off the carpet is a good idea because static electricity and computers do not go together. A good static buildup from rolling around on the carpet can arc from you to a delicate bit of silicon, rendering it useless.

Figure 3.2
An uncluttered work area is essential to a smooth upgrade.

Clearing the Clutter

If you're installing several new components (or setting up a new system from scratch), you'll be amazed how quickly you find yourself up to your elbows in empty boxes and packaging materials. Allow for this and figure out where you'll stack the boxes before you start unpacking. Uncrate one component at a time so you don't wind up with manuals, instructions, spec sheets, CDs, and the like scattered all around, causing you to get lost in the empty boxes and discarded packaging materials.

Save the Boxes

Open the component's box carefully with a minimum of collateral damage to the box and any Styrofoam packing blocks that might be inside. Save the original box, packing materials, internal plastic bags, twist ties, and related materials in case you have to repackage the component and return it to the seller. This is especially important when dealing with equipment purchased via mail order. Most vendors will always want the item returned in its original packaging.

Okay, that's easy enough for small boxes, but what about the giant monitor and system boxes? Granted, they're a pain to store, but you should save them, too—at least for a

month or so. If you have room in the garage, keeping the box for as long as the warranty runs is not a bad idea. Trust us, you won't be happy trying to box up a monitor for shipment without the original packaging.

While we're on the topic of clutter, be sure you set up a NEAT box (if you don't already have one) for the system on which you're working. NEAT stands for New computer Emergency catchAll Trunk and can be anything from an old shoebox to a large plastic trash bag. We, however, highly recommend you purchase a Rubbermaid (or similar brand) plastic box that's approximately 12' wide, 16" long, and 8" deep (see Figure 3.3). Add to your NEAT box everything that accompanies each component—manuals, install disks, specification sheets, instructions, CD-ROMs, licenses, invoices, packing slips, spare parts, screws, twist ties, cables, connectors, and so on. A NEAT box ensures that you have to search for things in only one place. Everything that relates to a given system should be stored in its NEAT box. If you have more than one computer, set up a separate NEAT box for each of them.

Figure 3.3
A NEAT box contains everything related to a particular PC.

Importance of Good Lighting and Ventilation

When picking out and setting up your work area, don't overlook adequate lighting. Some cables are color-coded, meaning you need to see the colors to know which side is which. Some of the parts you'll be working with are small and have smaller jumper blocks on them. In addition, they have tiny letters written next to the jumpers so you can identify them, so get as much light as you can. However, you'll still need a good flashlight and possibly a magnifying glass in your toolkit.

Ventilation is a good idea, too, because no matter how well you clean out your system prior to working on it (as we'll discuss shortly), some dust will still be inside the case.

Disconnecting the PC

Most people have a natural reluctance to moving the computer from where it is to the work area. Unplugging all the cables from the system and hauling it out from under the desk can be a hassle. Older computer chassis force you to unplug everything from the back before you can open the case, but more recent designs let you pop the side off the system with everything still connected. Resist the temptation. Instead, disconnect everything and move the system to your work area.

If you're nervous about getting everything hooked back up correctly when you put the system back, don't be. Use a marker to label each connection on the back of your PC and then tape a tag to each cable and label them accordingly. When you are ready to reconnect the system, you just match the cable tags to the connections on the system and plug them in. If you don't want to mark up your computer chassis with a marker, you can tape a piece of paper to the back of the chassis near the connectors and label them that way (see Figure 3.4).

Figure 3.4
Labeling each cable and connection port makes it easy to reconnect everything after you've finished your upgrade.

When you're disconnecting a system, be sure to first power down the computer and then unplug the

power cord. This is important because some systems are designed so that power is still going to the motherboard even though the switch is off. You can damage your computer, to say nothing of yourself fussing around with a PC that still has the power cord attached. Unplug the cord!

Cleaning the PC

If you've never pulled the cover off your system, you might be amazed at all the dust and dirt that has accumulated inside.

Computer power supplies have fans that suck the air out of the system chassis. This causes air to flow into the system wherever it can. This air is then expelled, creating a current of air flowing over and around the components inside the case. This serves to cool down the electrical components that generate a lot of heat.

Cool Off First!

Keep in mind that cool is used here as a relative term; the insides of your computer get hot, so don't ever work on a system until it has been powered down and had time to cool to room temperature.

Dust, dirt, hair, and anything else that can be found on the floor around the system gets drawn in as well, and stays there.

Off the Wall - Clean Is Cool

Your computer needs to be cleaned from time to time, not just when you open the case up for an upgrade. Once a quarter, open up the system case and blow out all the dust bunnies. If you're working in an exceptionally clean environment, you probably could get away with twice a year. It's not that we're neat freaks; dust is a real problem because it's a great insulator. Dust builds up on the chips and boards inside your computer and similar to a cozy wool blanket holds in heat, which is the primary enemy of your computer. Heat shortens the life of electronic components and can exacerbate the problem of thermal distortion. When you heat things, they expand. Conversely, when you cool them, they shrink. This happens to everything inside your computer. The more expanding that occurs when things are hot, the more shrinking that occurs when you shut down your system. Things work loose, crack, warp, and so on—all of which are bad for your computer. Keeping your system free of dust helps the cooling efforts of the system fan and increases the life of the system.

After disconnecting your system and before performing the upgrade, take the computer outside and blow it out with compressed air. Most computer supply stores sell cans of compressed air in various sizes. You definitely want to do this outside if at all possible because billowing clouds of dust will result.

Make sure the entire system has cooled to room temperature before you blow it out because the compressed air chills whatever you spray it at (the air spray can itself actually gets so cold it might become uncomfortable to hold). Hitting something that is hot with an icy blast of cold air causes it to contract suddenly, and that can damage the circuit boards and electrical parts in your system.

You might be tempted to break out the trusty household vacuum cleaner to get dust out of your computer and avoid having to move it outside for cleaning. However, two problems exist with this method.

First, the business end of a vacuum cleaner is hard metal (or a hard plastic attachment) and too large for the purpose, thereby increasing the chance you'll whack something delicate inside the case that should remain whack-free. Second, even if you have a mini-vac designed for this type of work, it simply can't do as effective a job as a can of compressed air. Air cans come with small pipettes (little plastic tubes) that fit the nozzle and enable you to direct the air stream between circuit boards and in very tight places where dust and debris accumulate.

Note, Map, and Label

The first time you remove something from your computer chassis can be unsettling or even frightening. How can you, an unqualified technician, be expected to get everything put back when you're finished? Did this cable-thingy plug in here or over there? Did the whatsit plug in like this or like that? And what about this plug that doesn't plug into anything? Was it like that when I started or did I forget to hook something back up?

Don't get scared; get cautious. Caution is your friend.

Mapping the Layout

Take a moment (and a pad of paper) and sketch out the area of your system on which you'll be working. This might be just a relatively small area of the system (for example, if you're performing a RAM upgrade) or it might be the entire system (if you're pulling out and replacing the motherboard).

Deciphering the Layout

The manual that came with your motherboard probably has a schematic drawing that labels the major components of the motherboard. This can be very helpful when you're trying to determine things such as which IDE connector is the primary and which is the secondary or where the DIMM slots are.

Draw a map of the internals. On your map, note the position of the drives, which device plugs into what, where the cables run (what they go over or around), which slot each card is plugged into, and everything you see so you know how it all goes back together again. You might not know that the twisted red and blue wires are for the hard drive activity light, but if you know it connects to the two pins "over there" on the map, you'll be able to hook it back up correctly.Figure 3.5 shows a typical motherboard in a newer PC and the slots and connectors to which you connect the processor, RAM,

sound cards, video cards, network cards, drives, and power supply. Your motherboard might vary somewhat, especially if you have an older system. But if you carefully note the location of each connection before disassembly, you'll be able to reassemble it. Also, before disconnecting each of the power plugs that connect your motherboard and drives to the power supply, be careful to note the position of the connectors. If any of the cables has a colored stripe (usually red) along one edge, be sure to note this when making your map so you can properly plug these back in when you are finished.

Figure 3.5
Creating a road map of your system's cabling can give you confidence that you haven't overlooked anything.

Noting All Connections

With some yellow stickies and ordinary cellophane tape, you can label and tag your computer's cards and cables as necessary while you work. Be sure to remove them all when you're done, though. Then, when you reassemble your system, you'll know that wire "A" connects to card "B" in the upper-right corner.

Tag each thing you unplug even if it's unrelated to what you're upgrading. Remember, space can be very cramped inside your system. For example, you might need to unplug the power connection and the controller cable for something such as the CD-ROM to get at the drive installed just above it in the chassis. Experience has taught us that it's easy to forget about things you disconnect while trying to get at the thing on which you want to work and on which you have your attention focused. If you forget to reconnect it, you'll power up your system after the upgrade only to find that something that was working before now appears broken. A yellow sticky on a loose power connector would have reminded you to reconnect the item.

Writing Down the Steps

Here's a trick that you should definitely use until you gain some experience with a particular hardware upgrade. Write down each thing you do, step by step. Say you're upgrading your old CD-ROM drive to a new CD-R/RW (Recordable/ ReWritable) drive. If this is your first attempt at upgrading this particular component, take the time to write down each step as you complete it.

Roadmap to Your Upgrade

1. Disconnect power lead to CD drive. Label A.

2. Disconnect ribbon cable to CD. Red stripe on cable toward open side of case. Label B. Usually a thin wire is running from the CD drive to the sound card. Disconnect from the CD. Label C.

3. Remove four screws (two on each side) of drive bay bracket holding CD drive in case.

4. Slide CD drive out through front of case.

Now you've got a road map of the upgrade procedure. When you install the new CD-R/RW drive, you can simply check off the steps in reverse order (as appropriate). This can be a lifesaver, so you should take the necessary additional time to do this whenever you are performing an upgrade you're

unfamiliar with or when working on a system that's new to you. Don't assume that every chassis is laid out the same way.

Working Inside the System Case

As we mentioned earlier (and will mention again), never work on an open computer chassis without first disconnecting the power cable from the system. Unplug it completely; don't just rely on switching off the power. The following sections discuss some other things you should keep in mind when working inside your computer.

No Jewelry

Take off any jewelry, including rings, watches, and bracelets. Don't wear loose clothing or dangling items such as ties or necklaces that can hang down or catch inside the case. Almost everything mounted on a circuit board has a sharp edge that can snag clothing or jewelry, not to mention the edges of the boards themselves.

Keep Track of Parts

This is a must—you have to keep track of every screw you remove from your system. Every screw. Keep count, just like medical surgeons do with sponges, so you know you've accounted for them all at the end of the operation, er, upgrade.

First, you must screw back whatever you take out. We've worked on computers that had the hard drive hanging by one lone remaining screw because the others had been lost at one time or another. Second, you don't want to have loose metal screws rolling around inside the computer chassis where they might become lodged across things that have current running through them. You also don't want them getting stuck in heat sink fans.

As you remove screws during an upgrade, place them in an ash tray, on a piece of doubled masking tape (which keeps them from rolling away), or in a small plastic film canister. The small boxes you get from the bank with a batch of checks make great containers for small parts, too.

If you do drop something into your system, be sure to retrieve it. But don't start fishing around inside the case with a magnet trying to remove a dropped screw. Magnets and computers are a huge incompatibility. You want to get a parts grabber (also known as a parts retriever or holder), which looks similar to a pencil. You push one end and a set of small wire claws pops out of the other end, enabling you to carefully snatch a small object out of the inner recesses of your system (see Figure 3.6).

Figure 3.6
Picking up a fallen screw from an inaccessible cranny of your computer's insides is a snap with a parts retriever.

Auto parts stores have longer articulated versions of these parts grabbers, but this is overkill for most computer users.

No Food or Drinks

Don’t eat lunch while you’re up to your elbows in the system case. If you need a cup of coffee, step away from your work area or leave the room entirely to avoid the temptation (and possible disaster). Ditto while you finish that ham on rye. You don’t want to drop crumbs or liquid inside your computer case under any circumstances.

No Fast Moves

The working space inside your computer’s chassis is very limited. The electronics parts are somewhat fragile, and sharp protrusions abound. Move around inside the case slowly and deliberately. Don’t apply force—for example, to loosen a too-tight screw—unless you're properly balanced and can apply the force in a manner that won't cause a disaster if the screwdriver slips. A screwdriver scraping across your motherboard can ruin it in a heartbeat. Barking your knuckles on a drive cage is not much fun, either.

Don't force things in general, especially circuit boards. Some substantial pressure might be required to pop a board into or out of its slot, but be very careful not to twist the board or to apply pressure unevenly. It's important that you not crack the board you're installing or the motherboard that supports the slot into which you're plugging it. A circuit board is made of an epoxy material (which is somewhat brittle) to which various electrical gizmos are attached. These gizmos are all wired to each other by traces on the board. These traces look like spidery silver lines on some boards. If you crack a board by bending it, you can sever one of these traces and thus ruin the board.

Static Electricity and What to Do About It

Everyone's familiar with static electricity; you reach for a doorknob and just before you touch it, a spark leaps from you to the metal knob and you feel a small zap. This is called an electrostatic discharge (ESD). An ESD is caused by your acquiring a surplus of electrons. Given a chance, nature likes to keep things balanced, so those electrons will leave you if they can by jumping to something else. Something conductive such as the doorknob or a computer circuit board or chip is attractive to the surplus electrons. Zap, indeed.

Off the Wall - Clearing the Static

We once worked in a high-rise office building that caused ESD outbursts that were positively painful. It got to where you hated to open a door because you knew you were going to be shocked. We learned that if we laid the palm of our hand on the door for a moment before opening it, the door would gently draw off enough electrons so that we did not get shocked when we touched the doorknob.

You must be grounded to not have a negative electrical charge when you work on your computer. When you're working on a computer, avoid those leather wingtips and don't shuffle your feet on the carpet. Try a pair of sneakers instead. Touch something that's grounded, but not the chassis of the computer on which you're working because after you unplug its power cable, it is no longer grounded.

Another Fine Mess - Danger, High Voltage

You acquire electrons by touching things. Dry atmospheric conditions increase your chance of acquiring electrons. Leather-soled shoes shuffling across a carpet are notorious for this, and you can produce quite a spark when you touch a conductive surface. It's best that this conductive surface *not* be inside your computer. That little static electricity zap you feel is caused by high-voltage electricity. No fooling, very high-voltage electricity. Several thousand volts is common; even the smallest spark requires 500 volts or so, which can ruin the delicate silicon chips found everywhere inside your PC. Rub a balloon on your head to the point where your hair starts standing on end and you'll be carrying a charge of tens of thousands of volts. This is not to be taken lightly when dealing with electronic components.

An electrostatic discharge wrist strap is a handy thing to have if static electricity is a problem (see Figure 3.7). It consists of an attachment that makes contact with your wrist (with a conductor wire) and a cord you attach to something grounded. This enables any static buildup to flow from your wrist to ground. The problem, of course, is finding a ground near to where you're working. Remember, the computer on which you're working isn't grounded after you unplug the power cable so it is not a candidate as a ground. We mention this again because it's a common mistake.

Figure 3.7
An ESD wrist strap is a sensible precaution against static electricity when working on your computer.

The best (albeit not cheap) solution we've come across is a receptacle analyzer carried by some electronics industry tool supply companies. It's a small gizmo that plugs into a three-prong wall outlet and lets you know whether you have a good ground. You plug your wrist strap into the analyzer, which is in turn plugged into the wall. It can feel a bit scary the first time you plug this wire hooked to your arm into something that's plugged into your wall outlet.

Tecra Tools sells a number of static defense tools, including the Stat Gard Receptacle Analyzer, wrist straps, static dissipating mats, and more. Their Web site is http://www.tecratools.com/.

If you think you'll be inside your machine enough to justify the $40–$50 expense, this is a good option. Otherwise, be very mindful about static, try to work in an uncarpeted area, and ground yourself to something before you even begin unpacking your upgrade components.

Required Tools

The good news is that unlike many do-it-yourself projects, you don't need to invest a fortune in tools to work on a computer. We'll discuss the types of tools you need in this section and conclude this chapter with a checklist of everything you'll need to tackle your upgrade tasks.

The System Journal

Here's a tool that is often overlooked but that can really come in handy. The system journal is simply a spiral notebook you keep next to your computer. You should write down everything out of the

ordinary that happens to this computer. If Windows crashes, note the date, time, and what you were doing when it went kaput! If you hear a funny noise, note that too.

PlainSpeaking - The Right Tool for the Job

Only a few hand tools are needed to completely disassemble a computer right down to the bare metal chassis. Opening up the system case, which used to be a tiring undertaking, doesn't require any tools on many newer models. Although you don't need a garage full of tools, the tools you do need must be good ones (don't get a rusty, beat-up, old screwdriver from the kitchen junk drawer to tinker inside your system).

Your tools should be clean and sized appropriately for the task at hand. The screws that hold your computer together are small; larger screwdrivers, or worn screwdrivers with rounded edges, can slip unexpectedly and damage your system or even your hand.

By recording every crash, glitch, odd noise, and "hmmm, that was odd" incident all in one notebook, you can start to see patterns in the problems. Seeing the pattern is the first step toward solving a problem. You also can get a better warning of impending doom if the frequency of a given problem is increasing. This in turn helps you plan your upgrades and equipment replacements.

Also, you should use the journal to record every time you open the case, clean the computer, or upgrade a component. Note what you did to the system, when you did it, any problems you encountered, and how you resolved them. This can save you time on later upgrades by preventing you from having to figure out the same trick each time.

Screwdrivers

Your screwdrivers should have nice sharp edges so they'll grip the screw tightly. You'll need both Phillips and the regular slotted type. Make sure they fit the small screws that hold your system together—not too large, not too small. You don't want the screwdriver to slip and damage anything nearby. For the Phillips type, you should have a size #0 and a #1 and for the slotted type, a 1/8" and 3/16" will do.

We should mention a special type of screwdriver called a Torx, which has a tip in the shape of a six-pointed star (see Figure 3.8). Way back in the early days of the personal computer age, Compaq thought it would be a great idea if their systems used Torx screws, which made it nearly impossible for the average person to even open up the chassis without buying a special tool. What were they thinking? The good news is that it's uncommon nowadays to come across a situation in which a Torx driver is required (although it does happen from time to time). If you find you need a Torx and your local hardware store doesn't carry them, try an auto supply store.

Figure 3.8
Three types of screwdrivers are used when working on computers—the Phillips, the slotted, and the less common Torx.

Nutdrivers

Many of the metal machine screws in your system have hexagonal heads on them with a slot for screwdriver use. The hex head of the screw enables you to use a nutdriver instead of a screwdriver to rotate the screw (see Figure 3.9).

Figure 3.9
The nutdriver provides a solid grip and prevents the accidents that can occur when using a screwdriver.

Another Fine Mess - The Only Thing Magnetic Should Be Your Personality

Stay away from screwdrivers with magnetic tips. Yes, they are handy, but the risk of having magnetic fields moving around inside your computer is not worth the convenience. You risk damaging chips and data media, such as floppy disks, and your hard drive.

A nutdriver is similar to the socket from a socket wrench that has been welded onto the end of a screwdriver handle. The nutdriver generally gives you a much better grip on the screw, especially if the slots in the screw are worn. You'll need a 3/16' and a 1/4" nutdriver in your toolkit.

Flashlight

Even if you heed our advice and work on your system up on a table with good lighting, you'll still need a bright flashlight. A good flashlight will provide directed light on the depths of the chassis.

Cable Ties

Computer cables (both internal and external) come in three types: too long, too short, and missing. If a cable is missing, the replacement will invariably be one of the other two types. It seems you're doomed to eventually wind up with most of your cables in the too long category.

Is a rat's nest of cables lurking behind your PC or PCs? If there is, here's how you can keep those cables organized and make it easier to connect, disconnect, access, and reposition your equipment.

Cable ties can help you here. You can get plastic-coated wire ties, but we prefer the Velcro or self-locking nylon cable ties (after they lock, they're locked forever) available for about 10 cents apiece in a variety of lengths and colors. You can find these at most computer and hardware stores.

After you've cinched the self-locking nylon ties tight, you'll have to snip them off with scissors or wire cutters. Still, they are the preferred method to keep your excess cables neatly organized inside your system. We also like them for tying off cable coils. On the other hand, Velcro ties are better for bundling several cables together (see Figure 3.10).

Figure 3.10
Nylon zip, Velcro, and plain twist ties can all help you deal with cable clutter.

For keeping your cables neat and out from underfoot along the baseboard of your workspace, the ideal solution is a device that wraps the cables up but can also be easily opened and closed. Curtis cable organizers to the rescue.

Curtis makes a locking cable clip (part no. CO2) you can use to create a virtual conduit along the baseboard and perhaps at a few strategic locations on the back of a desk. Each clip has a one-inch, square, plastic plate mounted with a very strong self-adhesive so you can just peel and stick them. Position each clip properly the first time because they don't come off easily, and that's good! The front side of the plate sports a ratcheted ring you quickly can pop open, lock closed, loosen, or tighten. The ring diameter is slightly less than one inch. They come five in a box at $2.99 per box. We suggest you mount them twelve inches apart, closer in corners to minimize the tension on any given clip (see Figure 3.11). Keep extra cable neatly coiled and tied off at each end.

Figure 3.11
Putting Curtis wall-mounted locking cable clips to good use in one of our offices.

Check out these and other accessories at the Curtis Web site (http://www.curtis.com/).

PC Toolkits

For less than $20 you can pick up a basic computer toolkit at most of the computer superstores, such as CompUSA (see Figure 3.12). These usually come in a vinyl zipper case and contain the necessary sizes of Phillips and slotted screwdrivers, two nutdrivers, a pair of tweezers suitable for pulling jumper blocks and fishing loose screws out of the computer case, and so on.

Figure 3.12
Even a basic kit contains the tools in the sizes you'll need for most upgrades.

However, the toolkit might not have a three-claw parts grabber, which is so handy that we recommend you either keep shopping until you find a kit that has one or purchase one separately (refer to Figure 3.7). As mentioned earlier, you can find parts grabbers at your local auto parts store.

Some of the more expensive kits come with a wrist strap that grounds you against ESD. Don't buy an expensive 150-piece toolkit just to get a wrist strap, though. You can purchase ESD straps separately from any electronics supply store.

Splitters and Converters

We keep a number of miscellaneous but indispensable items in our tool bags. If all you're doing is swapping a sound card, you probably won't need any of these, but if you embark on upgrades of a more ambitious nature, chances are you'll need them. It's also a good bet that the nearest computer supply store will have closed five minutes before you realize you need one of these items.

A Y-splitter connects to one of the power cables inside your computer, effectively giving you an extra power connection. We've opened up computers, counted the unused power connectors, and found one available for our need—only to discover that particular unused cable was too short to reach the new hard drive. In such a case, you might be able to use a Y-splitter on one of the power cables closer to where you want power, thereby giving you an extra connector in the right place (see Figure 3.13).

Figure 3.13
Use a Y-splitter power connector to give yourself an extra power plug inside your PC.

Another common snafu occurs when you want to plug a serial device into your computer's serial port. This shouldn't be a problem, except that the device has a cable that ends in a 25-pin D-Shell connector. The serial port on your computer is a 9-pin D-Shell receptacle. Argh! Converter plugs enable you to convert a 25-pin serial connector to a 9-pin serial connection or vice versa. Converters also exist to switch a 5-pin DIN keyboard plug into a smaller PS/2 connector. If you need to use an extension cable, you might run into a situation in which you need a gender changer to make a male plug into a female socket. You can get all these at computer or electronics supply stores (see Figure 3.14).

Figure 3.14
Various cable converters can come in quite handy when performing system upgrades.

Where's an Extension Cord When You Need One?

If you fuss around with computers much, you probably have extra power cords lying around. They plug into a standard three-prong electrical outlet on one end and into a computer power connection at the other end. Said another way, one end of the cable is a male three-prong plug and the other end of the cable is a female three-prong plug. You need a converter that consists of a 6- to 8-inch length of cord that converts a power cable into an extension cord.

Tools Checklist

The following is a list of the things we recommend you have handy before you start upgrading your PC:

- Flashlight
- Nutdrivers (3/16" and 1/4")
- Screwdrivers (Phillips and slotted without magnetic tips)
- Tweezers (larger types suitable for picking up and holding machine screws, not the smaller type found in the medicine cabinet)
- ESD wrist strap or comparable ESD equipment (antistatic mat, sprays, and so on)
- Magnifying glass
- Cable ties
- Suitable container for holding screws and other small parts

- Electrical extension cord (three-prong)
- Extra PC power cable (and power cord–to–extension cord converter)
- An assortment of splitters and connectors depending on the upgrade project you're about to tackle
- The computer's system journal and NEAT box

Breaking Down Your Computer

If you've never worked on a computer before, it can be a bit intimidating the first time. The following are the basic steps you should perform (we're assuming here that this is your first time performing an upgrade):

First Timers

1. Label all the cables coming out of the back of your computer.
2. Label all the connectors to correspond to the attached cables.
3. Turn off the power.
4. Disconnect all cables plugged into your computer.
5. Move the system to an area where you can blow out the chassis. Remove the case cover and use a can of compressed air to thoroughly blow out the system.
6. Move the system to your prepared work area. You can move most systems with the cover off, but you must be very careful about bumping into things because all the delicate internal electronic components are exposed and unprotected. Replace the cover before moving the system if you are uneasy about this.

Finding the Right Jack -

As long as you're labeling things, here's a hot tip: The sound card on your system has several mini-plug connectors—one for your speakers, one for a microphone, and probably a line in and a line out. They might or might not be marked with cryptic icons or actual words etched in the shiny metal of the bracket end of the peripheral card, and these might be readable (in a strong light, with a magnifying glass, up on your work table). However, after you install the system and you have a handful of cables snaking this way and that, chances are good you'll be unable to read these default labels. Save yourself some headaches down the road and mark the back of your chassis (or the top or the side) and pencil in which connector is which. Then, when you're trying to plug in a microphone or headset, you'll know that the first plug on the left is the speaker, the second is the line in, the third is the microphone, and so on.

You're now ready to work on your upgrade. You should have a clean, uncluttered work area with adequate light and ventilation. When your upgrade is complete, replace the system and plug all the cables back in.