
Things to consider before purchasing a computer

Use

The first and most important question to ask before you purchase a new computer is, “what am I going to use it for?” If all you are going to use your computer for is surfing the web and sending email you don’t need a high-end computer. Or is the computer going to be used for extensive gaming? If so, you are going to want better 3-D graphics, separate speakers, and a good sound card. Is this going to be a business computer? You may want to consider a larger, LCD monitor. What are you going to store on it? Music? Movies? Then you’ll want a very large hard drive. To get the best value, spend your money on the components that best suit your needs.



Laptop vs. Desktop



Do you:

- Travel a lot?
- Need to take your computer with you when you leave the house?
- Want to use your computer in different rooms of the house?
- Have limited desk/office space?

These are all issues you may have to face when purchasing a computer. If you answered “yes” to any of them, you may want to consider buying a laptop (sometimes called a notebook PC). Laptops are portable, small, and good travel companions.

Laptops aren’t the answer to everything, though. There are some disadvantages. They aren’t easily upgraded. You have to replace most of the computer if you want more memory or a better processor. Most laptops have all of their interior parts integrated into one piece. Another downside is the fact that you can spend an average amount of money on high-end features on a desktop whereas on a laptop computer you will end up paying a lot more money for those same features. Small means more expensive.

Windows vs. Macintosh

Many people choose Windows because it's what they've always used. Apple's iBook will suit you if you're interested in photo editing, music, video, and other multimedia application. Apple computers are also less susceptible to most viruses and spyware than Windows-based computers. The Apple PowerBook is relatively expensive as laptops go, however.

\$ Money \$

The next question should be, "how much can I afford to spend?" Know your budget. If you set a maximum price that you are willing to pay and you can't find what you are looking for you might just have to wait for a sale or special rebate. Keep an eye on the ads. The computer stores are always putting certain systems on sale or having a store-wide special on all computers. Sometimes Circuit City has an online sale that doesn't apply to in-store computers. The smart thing to do is to figure out what you want first, then check all of the stores and wait for a good price.

Also, do you currently own a computer? Do you want to keep any parts of it? Is your monitor fairly new? Do you love your mouse? What about your keyboard? If you have all of the components of a computer, but merely need a new tower you could keep a lot of your old items by purchasing just the tower. Sometimes this is cheaper, and sometimes it isn't. A lot of good systems are sold at very low prices with everything included. You will have to shop around. Maybe you want to keep your old mouse and get rid of the one that came with your new purchase? It's up to you.

Hardware

Tower



Besides considering whether you should purchase a laptop or a desktop computer you should consider what type of layout you would prefer. Some computers have towers that are part of the monitor or attach to the back of the monitor. Some stand upright next to the monitor or on the floor. Others have the computer lying horizontally on a table or in a drawer. Some are even small enough that you can pick them up and carry them from place to place with a built-in handle.



Just remember that the smaller the tower, the less additional items you will be able to install on your own. For some people this isn't a problem at all. For others, they want a lot of extra room to add on.

The following page is an excerpt from CNet's Desktop Buying Guide.
http://reviews.cnet.com/4520-7963_7-5114565-2.html?tag=bnav

➔ **Small form factor (SFF)**

We've been surprised at the number of features desktop vendors have been able to cram into the ultra-SFF boxes, but what those ultrasmall cases can't accommodate is expansion cards. So for most gaming, digital video encoding, and other tasks normally aided by PCI and PCI Express cards, you'll need the bigger little box.



[WinBook Jiv Mini](#)

➔ **All-in-one**

Popularized by the iMac, the all-in-one PC is a desktop with a built-in monitor. The desktop components (processor, memory, hard drive, and such) may be in the base or hidden behind the flat-panel display itself. Like a SFF desktop, an all-in-one limits expansion, but many boast advanced features, such as DVD burners and TV tuners. Because the display and the computer itself are enclosed in a single box, they're generally more space efficient than a traditional tower-and-monitor combination. On the other hand, the PC components will become obsolete faster than the LCD, one drawback of having the two so tightly integrated. If you have a small space in which to setup your computer, an all-in-one can save the day.



[Sony VAIO VGC-LS1](#)

➔ **Living room-friendly case**

Your home theater looks like a cross between a sci-fi movie set and a Philippe Starck hotel lobby, so why destroy the vibe with a boxy desktop PC? A small percentage of dedicated Media Center PCs are built into low, wide cases, designed to fit in among the cable boxes, DVD players, and video game consoles in the typical home theater. Some call them "living room PCs," others "A/V-style" or "rack-mount systems," although very few are ever actually mounted in equipment racks, and you're likely to find extras such as LED displays and copious audio and video connections.



[VidaBox Slim](#)

➔ **Midtower case**

The box no longer has to be beige, but the basic design of the tried-and-true midtower case remains the same: several internal and external drive bays, PCI Express and regular PCI slots for expansion, and a long list of ports on the front and the back for connecting peripherals, such as digital cameras and printers. You'll still find the trusty midtower case under many desks.



[Dell XPS 410](#)

➔ **Full-tower case**

If you are a serious speed junkie, then this is your hot rod. The interior space allows for plenty of expansion room, with many internal and external bays for both optical drives and hard drives. It should also include an x16 PCI Express slot or two for high-end 3D gaming cards, as well as at least five PCI or x1 PCI Express slots.



[Alienware Area-51 7500](#)

Monitor

Most systems come with an LCD (Liquid Crystal Display) monitor these days. They are quickly replacing the old, CRT (Cathode Ray Tube) monitors. The LCD monitors are nice for a few reasons:



- They are only about an inch thick, not including the stand. They don't take up much room at all.
- They use less electricity than a CRT monitor. You can save on your electric bill.
- They also produce less heat than the CRTs so your room doesn't overheat.
- They have very crisp displays and are easier on the eyes.

However, there are a few minor disadvantages to LCD monitors:

- They are a little more expensive than the CRT monitors. As technology continues to advance the price difference becomes less and less every month, though. These days the price difference is only about \$30-\$50 for a basic monitor.
- LCD monitors are also more fragile. You can kick most CRT monitors in the glass and they won't even notice. Kick an LCD monitor on the display area, and it will crack and break like a mirror.
- The refresh rate of LCD monitors is not as high as in a CRT. Serious gamers might prefer a CRT monitor, although as technology advances this may not be an issue for long.



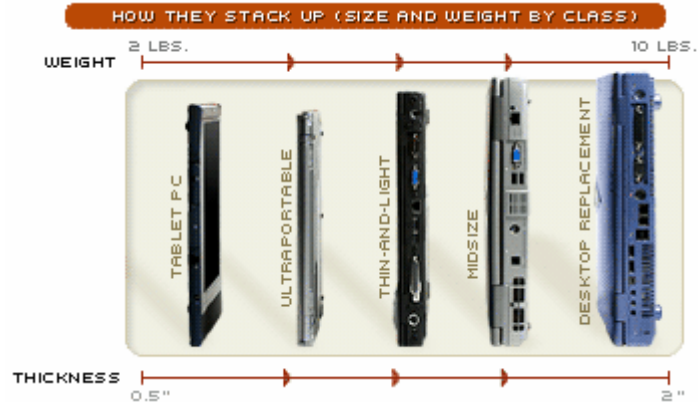
You should also consider space and money issues. Is your desk very small? Is there room for a CRT monitor? If you keep your current CRT monitor for monetary reasons will your desk continue to be cluttered? Will a new LCD monitor free up needed desk space?

If you are going to be looking at your monitor for extended periods of time or displaying large spreadsheet documents you may want to consider buying a monitor with a larger screen. Screens come in sizes from 15 inches all the way up to 24 inches.

Some systems don't come with a monitor, but they will come with a keyboard and mouse. Read the fine print and be aware if the monitor is sold separately.

Laptops

If you decide to go with a laptop you should be aware of the different types available. They have thin ones, portable ones, heavy ones, and even Tablet PCs. Whichever one you choose should depend upon your specific needs.



Tablet PCs are becoming more and more popular. They were first released over three years ago but did not have a very stable operating system. Since then, the manufacturers have made great strides in terms of stability and use. They are as good as any “normal” laptop on the market now.

Here is what CNET has to say about them:

“Usually comparable in size and weight to ultraportable or thin-and-light laptops, tablets let you take handwritten notes and navigate menus, documents, and Web pages using a stylus directly on the screen. The most common type is the *convertible* tablet, which looks much like traditional a laptop but has a display that swivels 180 degrees and folds flat over the keyboard.

(Some manufacturers are incorporating this type of tablet functionality into larger midsize and thin-and-light laptops.) *Slate* tablets, on the other hand, lack keyboards--they're all screen. The smallest tablets, *ultramobile PCs*, bridge the gap between PDA and ultraportable, with 7-inch touch-screen displays and enhanced media player features. Once only the tool of specialized industries, tablets are gaining a wider audience, thanks to their portability, flexibility, and wow factor.”



You should also keep in mind that the size of the laptop determines the size of the screen and keyboard. Small laptops will have small screen sizes and compressed keyboards. The buttons may not be in the same places that you are used to. Make sure you examine the display and keyboard features before you purchase one.



CNET’s complete Laptop Buying Guide is available at:
http://reviews.cnet.com/4520-7602_7-1016082-1.html?tag=dir.

Keyboard/Mouse

Most keyboards are very similar. However, you should be aware of what the keyboard looks like before you buy the system. If you need an ergonomic keyboard where the typing surface is split into two sections so that you don't hurt your wrists by forcing them into a position that fits the keyboard and not you, you will need to purchase one separately. Some people find them useful when you have to do a lot of typing. Others find them just plain annoying.



Mice are also pretty standardized on new computer packages. If you want an optical mouse rather than a mouse with a ball you will have to make sure that is what is being offered. Most come with an optical mouse since they don't have the problem of getting dirty like the ball mice. If you are using a clear glass area as your computer table you will want to make sure you either get a mouse with a ball or use a mouse pad as optical mice will not work on see-through glass tabletops.



A third mouse option is the trackball. Some people prefer moving a ball with their finger over moving their whole hand. This type of mouse takes some time to get used to, but it can be convenient if you don't have room on your desk area to move around a mouse.



Also, some systems come with a wireless keyboard and mouse. This is nice because you aren't tied to your computer and can use your computer from across the room. There are also less cords to deal with and see.

But be careful. If you are going to use a wireless mouse and keyboard make sure you purchase them together. Sometimes the signal from one object will interfere with the other, and your wireless items won't work properly. If they are sold together they will not interfere with each other. And there are rare instances where another wireless item in the room will interfere with your wireless mouse or keyboard. A cordless phone that sits next to the computer could possibly disrupt the signal of your items. The technology is always improving so there is less chance of this happening today, but it should not be ruled out.



If you are getting a laptop for everyday use you may want to purchase a separate keyboard and mouse because these two components on laptops are relatively small and take time to get used to. Laptop keyboards are often cramped and the buttons are not always in the same places as on a regular keyboard.

Laptops have a touchpad as a mouse replacement. The touchpad is a rectangular pad that sits below the keyboard. You touch the pad and move your finger around to move the pointer around. The faster you move your finger the farther the pointer moves. You click and double-click by tapping the pad with your finger. Just watch out for those blisters.

Printer/Scanner/Fax

There are two major types of printers: laser and inkjet/bubble jet. Laser printers operate similarly to photocopiers, providing high quality print and faster speeds than inkjets. They are also less expensive to operate at higher print volumes.



Inkjets provide color and acceptable print quality at a lower price than lasers. They can print a wide variety of documents such as letters, brochures, and cards. Higher-end inkjets offer faster print speeds, sharper images and the ability to print photos. If you plan on printing a lot of photos from your digital camera you will want to purchase a special photo printer.

See Appendix A (pages 21 through 27) at the end of this handout for a complete printer buying guide.



At one time scanners were considered a luxury for the average computer user. Prices have dropped sharply over the last few years with some models now under \$100. If what you want to do is scan pictures and photos for use on the web, these lower priced models are all you need. As you move up in price range you will find scanners that have the ability to capture higher resolutions and color depth, important for professional quality image editing.

See Appendix B (pages 28 through 34) of this handout for more information about purchasing a scanner.

Sometimes you can purchase a printer, scanner, and fax machine together as one unit. Some advantages of this include:

- It takes up less space
- It needs only one connector cable and one power outlet
- It can be cheaper than buying separate, stand-alone devices



One disadvantage is that if one component breaks down the whole device won't function. Meaning if your printer isn't working, neither is your fax or copier. Also keep in mind that you may not be able to upgrade individual components separately.

Game Controller

Game controllers are sold separately, but are nice if you plan on playing a lot of games. You can hook up a controller, joystick, or steering wheel to aid in your gaming experience so that you don't have to rely on the keyboard and mouse for movement.



Processor



Speed

The processor is the “engine” that drives the computer, the bigger and faster the processor, the better the performance – generally speaking.

The speed of a computer depends on the amount of data its processor can manipulate in a given period of time and the processor’s clock speed. The clock speed of a processor is measured by the number of electronic pulses it can produce in a second. Clock speed is built into the processor and is measured in gigahertz (Ghz). Since *giga* means billion and *hertz* means times (cycles) per second, 1.0 Ghz is 1 billion times per second.

If all you are doing is surfing the internet, using a few office programs, and checking email, you aren’t going to notice much of a difference when it comes to processor speeds. However, if you are planning on using a lot of taxing, high-end/expensive programs or games you will want to splurge a little on a better processor. You don’t want to spend most of your day waiting for an application to open or respond to you. However, you also don’t need the top-of-the-line model unless you plan on doing some serious computing.

As far as processor brands and types go, see CNET’s Desktop Buying Guide for complete details: http://reviews.cnet.com/4520-7963_7-5114565-3.html?tag=bnav.

Cache

Cache is a term you will commonly see listed in the specs of a computer. The cache in a computer is used to store information temporarily so that the computer doesn’t have to search around for it the next time that it is needed. In addition, it also includes information adjacent to the accessed information that is likely to be accessed. This reduces the time that it takes to read and/or write information to the hard drive.

There are two levels of cache memory and these are referred to by their location and degree of accessibility to the processor. The Level 1 cache (referred to as L1 or primary cache) is located on the same chip as the processor. This close proximity to the processor makes the L1 cache very fast. The Level 2 cache (referred to as L2 or secondary cache) is a separate chip on the computer’s motherboard. Although it takes longer for the processor to retrieve information from the L2 cache than the L1 cache, the L2 cache is much faster than the computer’s main (RAM) memory. The next time the processor needs to execute an instruction or load information that it has previously used, the memory cache supplies the data. If the information is not found in the L2 cache, the processor moves on to the computer’s RAM memory.

As with the processor speed, in general, the faster the L2 cache, the faster your computer will run.

Memory

Random Access Memory (RAM) is considered the muscle of the computer. It is the place where the operating system, programs, and data in current use are kept, ready to be accessed by the processor. The more RAM you have, the quicker and more powerful your computer is.



If you're faced with a choice between buying a faster processor without much memory or buying a slightly slower processor with more memory you should take the memory. Having extra RAM will provide a much bigger boost to system performance than a few extra GHz of processing speed.

All computers come with at least 512MB of DDR SDRAM (Double Data Rate Synchronous Dynamic Random Access Memory). This is the level needed to run a basic computer for word processing, internet, and email functions on Vista Home Basic. You will notice a huge boost in response time if you go up to 1 or 2GB of RAM. If you are going for a higher Vista level you will need at least 1GB of memory. DDR2 SDRAM is the newer version of RAM and is the higher end model.

Storage/Drives

Hard Drive

While RAM stores information for a limited period of time for instant access to the processor, the hard drive is the place where data is stored on a more permanent basis. All software, from operating systems to work processors, has grown tremendously in size over the last few years. Media files such as MP3 and digital photos are big and require a lot of disk space. This has led to a corresponding need for high capacity hard drives where all this data can be kept.



If you are going to be buying a computer for the whole family, you're going to want to go for the biggest hard drive you can afford. All those MP3 and video files that people like to download can quickly fill a smaller hard drive. The less need you have to accommodate large media files and games, the safer you can feel going with a smaller hard drive. For typical office use, the minimum you can purchase today is sufficient. Computers usually don't come with less than 60GB, which is more than enough space.

Also, the faster the drive spins, the higher the data transfer rate will be. It is recommended that you go no lower than 5400 RPM. 7200 RPM and higher is standard now in desktops whereas the laptop standard is around 5400 RPM. If you are tired of slow computers, splurge on the RAM and RPM speed. You won't regret it.

External hard drives can be purchased if you feel your computer doesn't come with enough space. These are nice in that you can pick them up, take them with you, and plug them in to any computer you need to use.

CD/DVD Drive (or Optical Drive)



It is becoming the industry standard for computers to come with a combination CD/DVD drive. The lower end systems will be able to read and write to CDs, and only read DVDs. You can store 700MB of data on a CD, whereas you can store 4.7GB of data on a DVD. Burning information onto DVDs (and not just movies) looks like it is going to become more of a primary way information is stored, replacing CDs since they hold so much more information. If you want to be able to watch DVDs on your computer, make sure you get one with a DVD drive.

The x-factor of a drive refers to its transfer rate. The higher the number, the faster the drive function. A 1x speed on a CD drive stands for a transfer rate of 150 Kbytes/second. A DVD drive transfers data 9 times faster than a CD drive, so a 1x DVD drive transfers data at the same rate as a 9x CD drive. Most systems for sale today will have sufficient read/write speeds where you shouldn't have to worry about functionality. Just remember that the best drives out there have the highest speeds.

There are a few letters that appear after CD or DVD that you should be aware of. *ROM* (Read Only Memory) refers to a drive that merely reads information. *R* refers to a drive that can write to one-time writable discs. *RW* refers to the ability of the drive to write to rewritable discs.

DVD+R DL (Double Layer) drives can write to DVD+R DL discs. These discs employ two recordable dye layers, each capable of storing nearly the 4.7 GB capacity of a single-layer disc, almost doubling the total disc capacity to 8.55 GB.

Floppy Drive

The floppy disk is a form of storage similar to a hard drive, but able to hold much, much less data. The standard floppy disk holds 1.44 MB of information. The standard hard drive today stores about 100,000 MB of information. A CD can hold 700 MB of data and a DVD can hold 4.7 GB of data. The amount of data that can be stored on a floppy drive is so small that it is being phased out very quickly.



You will be hard pressed to find a computer for sale today with a floppy drive installed. You can purchase a drive and install it into your machine if you really need one. Most desktop computers come equipped with the internal support and wiring to hook a drive up. Or you could purchase an external floppy drive that hooks up to your computer through a USB port.

USB

An alternative to floppy drives is the USB or thumb drive. These small devices work the same as a floppy disk in the way they store information. They hold much more information, though. Most drives are anywhere from 512 MB to 2 GB. You can get some that hold much more, and they are small enough to stick in your pocket or on your keychain. If your computer doesn't have a floppy drive you can purchase a USB or thumb drive to take the place of your entire floppy disk collection.

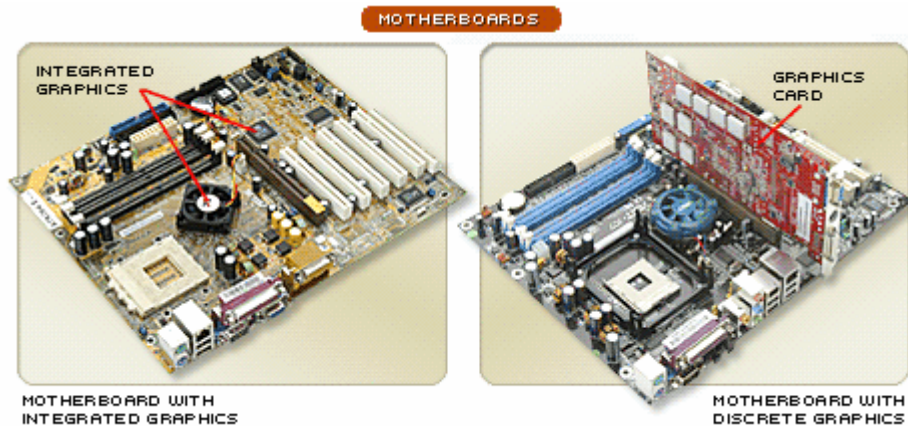


Audio/Visual

Video Card

The video card controls what you see on your monitor. The memory on the card is used to store the images that you see on the screen. An integrated chipset will have the card installed directly onto the motherboard, and doesn't perform as well as a separate chip. If the system you are looking at says "shared memory" or "integrated" this is an indication that the chip is built into the motherboard.

For most users, integrated video will work just fine. If you are going to be playing extensive video games, however, you might want to look into getting a system with a separate chip.



Audio

Like the video card, the sound card is either separate or built into your PC's motherboard. Its job is to control the quality of audio in and out of the computer. There should be input jacks for speakers, headphones, and a microphone.

All systems these days come with sufficient audio for the every-day user. If your audio requirements are more advanced or you play a lot of games, you should consider a PCI sound card with a wider range of features. Positional, or 3D audio, is offered by higher-end sound cards and can make games and music come alive. For example, when an enemy is about to attack, you can detect which direction he's coming from by the sound of his footsteps. To get the best sound card available you will need to purchase it separately and have it installed.

Every computer you purchase will either come with external speakers or have internal ones installed. These are perfectly good speakers for every-day use. However, speakers powered by the sound card are incapable of producing rich and dynamic audio. Gamers and serious audiophiles will want at least 30 Watts of power with a separate subwoofer for ample bass reproduction. You will need to purchase these separately, also.



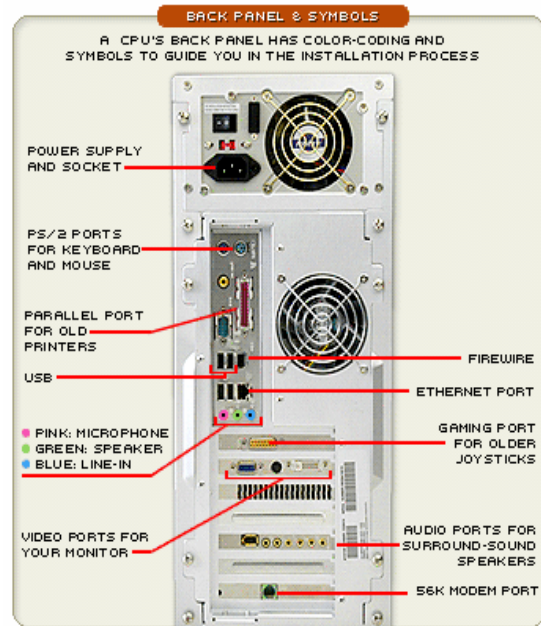
If you want to talk into your PC to record your great singing or to make phone calls over the Internet, you'll need a microphone unless your computer states that it comes with one. Also, Windows has accessibility features for people with disabilities built into it that requires a microphone. They aren't more than \$20, so you may want to purchase one to be prepared for possible use in the future.



Ports

Every computer comes with ports where you can plug a variety of items into it. The standard system comes with places to plug in a microphone, headphones, speakers, and a multitude of other items through USB (Universal Serial Bus) ports. If you would like to hook your computer up to a TV make sure it comes with an S-Video port.

Connection ports may not seem like a big deal, but if you are only planning on purchasing a computer tower and using your existing home monitor, keyboard, mouse, and printer to save money, ports can be a major hassle. The industry standard these days is for everything to connect via a USB port. It is difficult to find a new system that has the old parallel (printer), VGA external connector (monitor), or PS/2 (keyboard, and mouse) ports like the image on the right. Connection adapters can be purchased if you are overly attached to your old printer, mouse, monitor, etc., so do not despair. But these purchases can quickly add to the bottom line cost. If you are purchasing an entirely new system you should have no problems with all of the components connecting. Check your home equipment's connectivity before you go out and buy anything if you plan on keeping some components.



A FireWire port (sometimes called an IEEE 1394 port) is used to connect a camcorder to your PC. If you plan on downloading footage from your video camera you should make sure your new computer comes with a FireWire port.



A docking station or port replicator may be useful if you purchase a laptop. Docking stations and port replicators are accessories that you keep at your desk. Your laptop fits snugly into them and receives additional functionality, making it more like a desktop computer when it's used at your desk. Most full-size/desktop replacement laptops today come with enough ports so that you don't need these things.

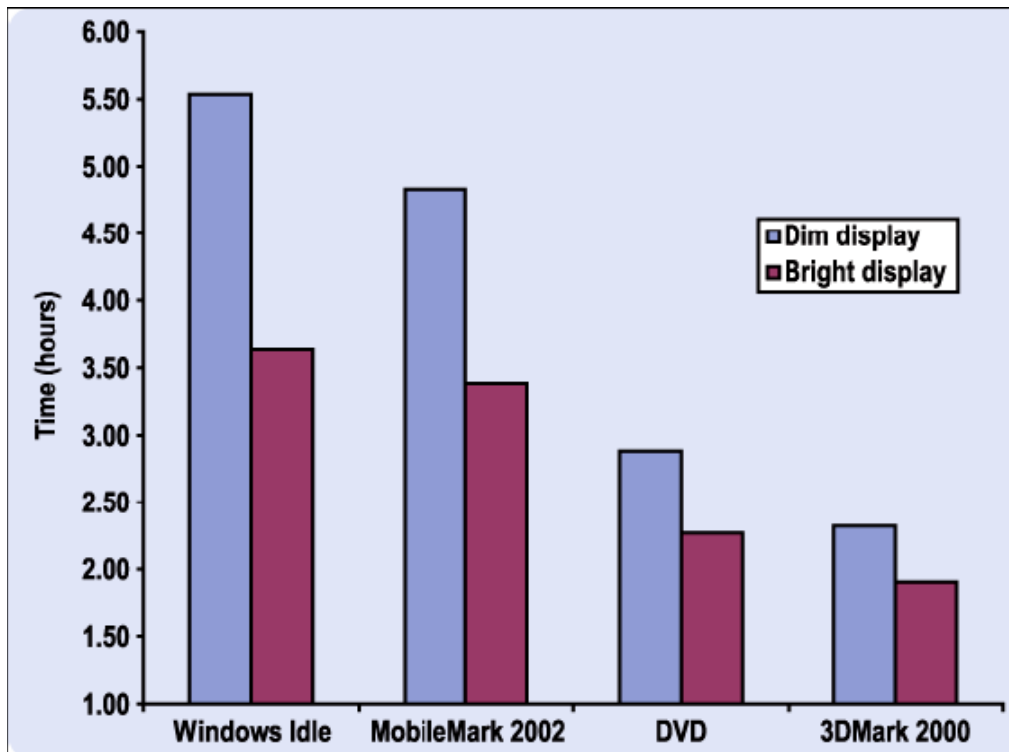
More on Laptops

Looking down at your laptop screen may not be very comfortable for your neck. You can prop it up higher, but then you won't be able to reach the attached keyboard as easily. To get around this problem you can either attach a separate keyboard and place your laptop on top of another object or you can place it on a stand. Laptop stands aren't economical for large amounts of typing since the stand is at such a steep incline. Other stands cover up the keyboard completely, making you rely on a separate keyboard. You will have to decide which option is best for you.



Many factors affect the amount of time that a portable computer battery can deliver power before it must be recharged. These factors include the types of applications being run and display brightness. Most companies that sell portable computers report battery life estimates for their computers. In addition, industry trade magazines and websites such as PC Magazine and www.zdnet.com provide battery life estimates. These estimates are usually based on well-known battery life benchmarks that attempt to replicate the way that portable computers are used in typical environments. Despite continuous improvements in these benchmarks, the estimated battery life figures they yield can differ from actual battery life experienced by users.

This table shows an example of battery life times:



Note: These benchmarks were run on a Dell Latitude C600 portable computer with an Intel Pentium III processor running at 700 MHz.



If you plan on traveling a lot it may be wise to purchase an additional battery. They range from \$100 to \$300. Many notebooks allow you to swap them into the main media bay. Other secondary batteries clip on to the back of the notebook or attach via a cable. However, if you rarely travel with your notebook and your laptop is pretty much always plugged in, don't bother with a second battery.

Another option is to purchase an airline/car adapter. When the adapter is used in a car, the adapter simply plugs into a cigarette lighter. In newer aircraft, there are connectors available to plug your notebook into.

You definitely want a carrying case for your laptop if you ever plan on taking it out of the house. If you don't get one, you'll quickly have a beat-up laptop. Depending upon the amount of traveling you plan on doing with your laptop, you have some options when it comes to carrying cases. Basic bags are handy for transporting your laptop around, but they often lack a shoulder strap or internal pockets. The best ones have padded shoulder straps, reinforced corners, and specialized compartments designed to hold the AC adapter, the extra batteries, and so on.



Internet/Networking

Before we get into the various types of services, a few definitions are in order. First off, the speed of an Internet connection or the data transfer rate, is measured in bits per second (bps). Modems will list their connection speed as Kbps (Kilo = thousand, bits per second).



A modem (**modulator/demodulator**) connects your computer to the Internet by modulating the digital signal from the computer to a carrier signal (audio). This audio signal is then sent (via the modem) over your existing telephone line to your ISP (Internet Service Provider). Your ISP will have a modem that your modem is dialed into that demodulates the signal back to the digital, giving your computer the ability to connect to the Internet. The data transfer rate of a modem is limited by the telephone company's bandwidth which is about 3,000 Hz.

DSL refers to **Digital Subscriber Line**. It uses your existing telephone line but is able to significantly increase the bandwidth over the lines between your home and the telephone company. DSL gives you 24 hour access to the Internet and does not interfere with incoming and outgoing telephone calls like a dial-up connection would.

A cable modem uses your existing cable TV cable by allowing you to connect your computer (using a network interface card) to the box that connects your TV to the cable.

The home user is typically faced with three options for getting on the Internet. A 56K modem through a dial-up phone connection, a high-speed DSL line, or a cable service. The biggest benefit of the DSL line and cable modem is the speed at which you can download large files (MP3's, pictures, demo software, movies, etc.) and view streaming media (radio, video, concerts, etc.). This extra speed comes at a cost, however. On average you'll have to pay double what you would for dial-up. So if you use the Internet for email and the occasional web surfing, high-speed access is probably not worth the price. For a broadband connection computers require an Ethernet card which is then connected to a specialized modem, normally supplied by the service provider.

If you have more than one computer at your home and you want all of them to be able to connect to the Internet you will need to network them. (This does not work for dial-up.) Networks are also useful if your computers need to share a printer or send files between them.

There are two basic types of network set-ups: wired, and Wi-Fi. A switch is used to connect computers together using network cable. Each computer plugs into the switch, and the switch is what connects to the modem. This set-up is simple and doesn't require older computers to have a wireless card installed.



Wi-Fi is sometimes called a wireless Ethernet. Wi-Fi is suited for setting up networks since it is a fast connection and has increased security. Wi-Fi is popular among the computing world. Virtually all new laptop computers come with Wi-Fi built in, and all desktop computers are able to be adapted to have a Wi-Fi connection. Recently, a few new cell phones have come out with Wi-Fi.

You should determine which set-up you are going to go with before you purchase your computer so that you can acquire any separate components before you get home. Most laptops will come with the capability for wired and wireless connections, and all desktops have a preinstalled card for wired connections. If you are positive that you will be working with one system or another make sure your new computer is capable of connecting in that way. For a wired connection your computer should come with an internal modem or Ethernet card. For a wireless connection your computer will specify that it can perform wirelessly.



If you are connecting your computers to a network, you will have to purchase the switch (wired) or router (wireless) separately and the CAT 5 (or 6) cable to connect the switch to your computers if you are connecting with a wire. The hardware for the Internet connection will come from the company you purchase your service through. You may need to purchase a phone cord to connect your computer to the phone line if you are going with dial-up.



Bluetooth is a short-range way to connect electronic equipment, similar to Wi-Fi. It is used in a variety of new products such as phones, printers, modems, and headsets to name a few. Bluetooth is acceptable for situations when two or more devices are in close proximity with each other and doesn't require high bandwidth. Bluetooth is most commonly used with cell phones, either using a Bluetooth headset or transferring files from phones to computers. Because Bluetooth uses short range radio frequencies it is not as effective for setting up networks that can be accessed from remote locations. Wi-Fi technology is better suited for this purpose. However, if you plan on connecting cell phones or other wireless devices like a PDA to your computer without a cable you will want to make sure your new computer is capable of Bluetooth technology.

Software

Computers are all loaded with software when you purchase them unless you are building the computer, yourself, from scratch. A typical, middle-of-the-road set-up includes:

Windows Vista Home Premium
Works 8
Office Student and Teacher Edition 2007 (60-day trial)
Norton® Internet Security 2007 (with 60 days of live updates)
HP Photosmart Essential
Roxio Creator and MyDVD Basic
Muvee autoProducer
Adobe® Reader® 7

Cheaper systems will offer less. Notice that some of the programs only offer trial periods. This is intentional. The companies are trying to get you used to using their software so that you will want to purchase the full license when your trial runs out. If you intend to use Microsoft Office or a Virus protection program long-term make sure you figure that amount into your budget.

Warranty

Possibly the most important part of a computer is the warranty. Make sure you get a 3-year warranty. The industry-average desktop warranty lasts one year for both parts and labor. Not all one-year warranties are created equal, however. Some companies will dispatch a repair person to your home if a problem can't be fixed over the phone or online; others offer only depot service, which means you must drop it off at a local service center or ship it directly to the company itself. If the warranty offers the latter, be sure to find out who pays for shipping. Also, check whether you need to save the original boxes for shipping; some warranties require this.

Many companies will offer extensions up to three additional years for an added cost. Whether it's worth it to tack on another year or two depends on your comfort level with making repairs yourself (or letting a friend or relative inside the case) and how much you spent on the system. For an experienced user buying a budget system, an additional \$149 for a second year of coverage probably isn't money well spent.

Purchasing

One of the best sources for information is your friends and family members. See if any of them have a system similar to what you want to buy. Check to see if they have had any trouble with their system or have ever tried to get technical support from the system's manufacturer.

Also, check the ads. Pay attention to the special sales or rebates available. If you find exactly what you are looking for and it's on sale, go for it!

Another good place to check for information is the Internet. The websites of computer retailers are designed to give you information on these topics. You get more information from the site than you do in the actual store.

www.circuitcity.com

www.compusa.com

www.bestbuy.com

www.dell.com

www.gateway.com

Gateway does not sell their own systems anymore. They distribute them to other retailers, but their site still has a lot of useful information about individual computers.

Dell's site is nice in that you can specify the exact system you would like to purchase rather than picking from complete ones at a store. They will recommend a certain set of components, but you can add additional memory or a separate sound card right from the site, with the price being updated in real time with each change. Then when it is delivered your computer is fully assembled and ready to plug in.

Web Resources

Information Sites:

www.cnet.com

www.consumerreports.org

www.en.wikipedia.org

www.gateway.com

www.geek.com

www.microsoft.com/windowsvista

www.pcmag.com

www.viewz.com

www.zdnet.com

Places to purchase:

www.bestbuy.com

www.circuitcity.com

www.compusa.com

www.dell.com

References

Bluetooth. Wikipedia: The Free Encyclopedia. <http://en.wikipedia.org/wiki/Bluetooth>

Buying Advice: Laptop Computers. http://www.consumerreports.org/cro/electronics-computers/laptop-desktop-computers/laptop_desktop_sub/how-to-choose-laptops/index.htm

Computer Buying Guide. Viewz. 2006
<http://www.viewz.com/shoppingguide/compbuy.shtml>

Dave's Guide to Buying a Home Computer. 2004. <http://www.css.msu.edu/PC-Guide/>

Dave's Guide to Buying a Notebook. 2004. <http://www.css.msu.edu/PC-Guide/>

Desktop Buying Guide. CNet.com.
http://reviews.cnet.com/Desktop_buying_guide/4520-7963_7-5114565-1.html?tag=dir

DVD+R DL. Wikipedia: The Free Encyclopedia.
http://en.wikipedia.org/wiki/DVD%2BR_DL

Laptop Buyer's Guide. Geek.com. 2003. <http://www.geek.com/htbc/glanlap.htm>

Laptop Buying Guide. CNet.com. http://reviews.cnet.com/4520-7602_7-1016082-1.html?tag=dir

PC Buyer's Guide. Geek.com. 2002. <http://www.geek.com/htbc/glanbuy.htm>

Printer Buying Guide. Viewz. <http://www.viewz.com/shoppingguide/printer.shtml>

Scanner Buying Guide. Viewz. <http://www.viewz.com/shoppingguide/scanner.shtml>

Verdun, Gary. Understanding Battery Life In Portable Computers. White Paper. Dell Inc. 2005. http://www.dell.com/downloads/global/vectors/2005_batterylife.pdf

Appendix A



<http://www.viewz.com/shoppingguide/printer.shtml>

Printer Buying Guide

Remember when everyone predicted the computer would eliminate the need for printed documents - boy, were they wrong! Paper is piling up as fast as ever. So you're entering the marketplace for a printer, the first thing on your mind has to be what am I going to use this printer for?

Everyday folk need a printer for personal use or for their business/home office. The type of printer you choose depends on what you want to print -- be it text, graphics or photos in black & white or color. If you know that text will make up the bulk of your printing then a monochrome printer will suit your needs. But for most graphics and photos you'll want color which means an inkjet printer or possibly a color laser.

In addition to personal printers, small business owners should investigate a multifunction printer, laser or portable printer for business on the go. Whatever your needs, there's a printer with your name on it, it just takes a little homework to find the perfect match.

Inkjets and Color Lasers

Inkjet printers function by spraying tiny dots of ink onto a page of paper. This process can produce black and white or color images and in some cases photo quality images. However, inkjets can have trouble with sharp lines so text can vary from adequate to good depending on how fast the printer runs.

The most basic inkjets will have only three colors cyan, magenta and yellow (CMY) which are combined to produce a composite black. This eats up a lot of ink, and more often than not, composite black looks bluish or greenish which is less than ideal for text. For true black, you need an inkjet that holds at least two cartridges: one for the CMY cartridge and another for just black (K). The best configuration is a printer with a separate cartridge for each color, that way you only replace the color you need.

Decent photos require a CMYK printer, and for professional quality photos you'll want a six color printer which adds a light cyan and a light magenta. These dedicated photo inkjets are great for photos but lousy for text. Keep in mind that to get those high quality images, inkjets go through a lot of ink and often print best on special stock so cartridge and paper cost are important factors to consider.

<http://www.viewz.com/shoppingguide/printer.shtml>

Inkjets aren't the roadrunners of the printer world. Speed is 2-6 pages per minute (ppm) for text and about 2-3 minutes for graphics. Naturally, speed increases with price. Overall, inkjets will fit a reasonable budget. An all around personal inkjet can start around \$150; at the high end of the scale are the graphic oriented inkjets that can go as high as \$1500.

The more expensive option for color printing is the color laser which uses CMYK toner to produce images. They create high quality color graphics and photos, as well as sharp text, all at significantly faster rates: 6-8 ppm for text and 1 ppm for graphics. There's a hefty price attached to that increased efficiency since color lasers start at around \$2000. In the long term colored toner is less expensive per page than inkjets, but this will only offset the higher printer price if you're in need of high volume, color printing.

Monochrome Lasers

Laser printers work on the same electrostatic concept as photocopiers which accounts for their speed. A monochrome laser produces sharp text fast at roughly 6-8 ppm (pages per minute) as well as black & white graphics at around 2 ppm. Lasers are best at reproducing text, especially if you need to print fonts that are larger or smaller than the usual 10 to 12 point sizes. A laser printer offers a lower cost per page since monochrome toner is comparatively cheap and regular paper does the job.

Laser printers also tend to have better paper handling options. For example, they can hold more paper or make it easier to attach an extra tray for different paper sizes. These features make monochrome lasers a great choice for a home office. Prices begin around \$300 and go up from there.

Multifunction Devices

In a small business setting, a printer is just one of several useful machines like copiers, scanners and fax machines. With this in mind, multifunction devices (MFDs) were created, combining printing, scanning, copying and often faxing all in one. MFDs are cheaper than buying separate stand-alone devices, take up less space and need only one connector cable and one power outlet.

Great, this is the best of all possible worlds, you're thinking - not exactly. One disadvantage is that if one component breaks down the whole device won't function. Meaning if your printer isn't working, neither is your fax or copier. Also keep in mind that you may not be able to upgrade individual components separately.

An MFD is somewhat like trying to choose a movie with three other friends. It will always mean compromises and trade-offs. For instance, you might want a model with a monochrome laser printer but then it doesn't have the color scanning capability you require. Identify what is the most important function for you and get a model that is strong in that area.

The software for all these functions can be complex and possibly confusing. Check out the manufacturer's website to get a sense for how easy the device is to operate and program. Depending on the model, MFDs can perform various functions like faxing or copying without the computer being turned on. Check out the machine's hardware control panel and choose one with buttons for your preferred functions.

So what will one of these all-in-one wonders cost? A MDF aimed at the personal user will range between \$350-1000, more for workgroup models.

Portable Printers

Printing on the road can be essential to a mobile business person. Portable printers aim to be compact enough to fit in a briefcase (imagine the size of two aluminum foil boxes stuck together), weigh less than five pounds and run on battery power. These printers usually employ inkjets or thermal transfer ribbons. The latter works somewhat like a typewriter ribbon which is impregnated with dye. By applying pressure and heat to the ribbon the image gets transferred to the page.

Thermal transfer models tend to be smaller than inkjets but with lower image quality, slower print times and significantly higher cost per page. Both monochrome and color printing are possible depending on what kind of cartridge/ribbon you buy. In general, the cost per page for both text and color will be higher for portables because their small cartridges cannot print that many pages. The cost for a portable printer will range between \$150-\$500.

Since portables run on battery power, battery life is a key consideration if you need to print more than a few pages at a time. A standard Nickel-Cadium (NiCad) battery can print around 90 pages on one charge and can be recharged without removing it from the printer. A less common kind of battery is the Nickel Metal Hydride (NiMH) which lasts longer but takes longer to recharge. Not all printers include the battery in the price so be aware of that when comparison shopping.

Also investigate what features the portable offers. Those printing several pages at once will want a sheet feeder so you don't have to manually feed each sheet. Feeders can handle 5-80 pages, and some also handle transparencies and envelopes. Some printers also support an optional scanner cartridge which replaces the ink cartridge and turns your printer into a scanner. Another nice feature is an IR (Infrared) port which allows you to send commands to the printer without it being connected by cable to your computer, assuming your computer has an IR port.

It's All in the Specs

Resolution

Once you know what type of printer you need, there are a number of technical criteria that are worth consideration. Firstly, the printer's resolution tells you how many dots per inch (dpi) can be printed. Simply, the higher the resolution the better the image quality. Resolutions are quoted for both the horizontal and vertical (ie. 300x600). The standard resolution to aim for is 600x600. You won't need anything as high as 1200 dpi unless you want top photographic quality. Of course, the ultimate test is to view sample sheets.

Speed

How fast do you want to go? Printer speeds vary a lot with lasers being faster than inkjets and monochrome text printing faster than color graphics. Most personal users can get a snack if printing is slow, but you might not want to wait around in an office setting. The page per minute (ppm) quotes in the printer specs measure how fast the engine can turn out blank paper. This is not the actual printing time since it fails to take into account processing time. Raw engine speed does give an indication of true printing time, but it's wiser to read printer reviews that quote actual ppm.

Paper Handling

Paper is obviously a crucial part of printing. For text, most printers do well on ordinary stock, but color printers often require specialized stock for optimal results. Factor in the extra cost for this paper when you evaluate cost per page. As far as page size goes, most lasers and inkjets can handle letter and legal sizes, but expect to pay more for a printer that can handle tabloid sized (11x17) pages. Some printers can also print on heavy stock, envelopes, transparencies and labels. Make sure the printer can handle the types of paper you need. If you want to print on a variety of papers, you should also consider multiple paper trays. The capacity of the trays may be a factor depending on your expected printing volume.

Compatibility

Don't lose sight of the computer at the other end of the printer. Not every printer is compatible with both Apple and Windows computers -- specs will tell you what operating systems are supported. A lot depends on the printer language which consists of computer commands that tell a printer how to format a document. The de facto standards are PCL (Hewlett-Packard Printer Command Language) and Adobe Postscript. Windows GDI (Graphical Device Interface) can cause trouble if you're printing from DOS programs so check if the printer also uses another language like PCL. Postscript is the best at retaining the original formatting if you're swapping files with others.

Interface

Another issue between your computer and printer is the interface. The parallel port is fine for personal use or in a small office where users are sharing one printer. But larger workgroups will require a network connection. There are many choices for network connectors so they are often considered extra accessories and not included in a printer's cost. Recently, a third connecting option appeared on the market, the USB (Universal Serial Bus). USB offers higher data transfer rates and the option to daisy chain many devices together.

Memory

Just like a computer, a printer needs memory to hold a document. Often manufacturers reduce printer prices by including just enough memory for low resolution printing. So be certain the printer has sufficient memory to print at the resolutions you want. Find out how much extra memory costs in case you want to upgrade later to increase the printer's efficiency. Also find out if you can upgrade with cheaper generic memory or if you have to use the manufacturer's brand.

Consumables

Up front you're buying a printer, but the hidden costs of ink or toner cartridges, paper and parts can add up. All these items are called consumables, and this is where manufacturers produce a large chunk of their profit. By dividing the total cost of consumables by the number of pages produced from those consumables, you can calculate a cost per page.

For inkjets, the price for color printing is around 20-30 cents a page with text at 3-6 cents a page. Color lasers run about 3-8 cents a page, and monochrome lasers are roughly 3-5 cents a page. These figures do not include the price of paper which varies according to the type of printer. Laser printers usually use plain paper, whereas inkjets need special stock for optimal results. Coated paper is 10 cents a page and glossy stock is about \$1.50 a sheet.

Sometimes it's hard to know how manufacturers calculate their cost per page so don't take their quotes too literally. Manufacturers will say a given cartridge will print "X" pages at "Y" percent coverage; the average page of text has 4-5% of the paper covered in ink. This figure will be different for color printing so always make note of what percent coverage the manufacturer is assuming to calculate cost per page.

In addition to toner, laser printers have a number of components that periodically need to be changed. A toner cartridge has inside of it an OPC (Organic Photoconductor) drum, developer unit, ozone filter and fuser wand which explains why cartridges can be so expensive. Some printers allow you to change each of these components separately so you'll need to tally up the individual replacement prices plus toner to arrive at a figure that is equivalent to cartridge price.

Not all the consumables in cartridges wear out when the toner is finished so you can save money and recycle the cartridge. A recycler can simply refill the cartridge with toner or remanufacture the cartridge by replacing the drum and a few other components with new ones. The recycled cartridge is usually quality tested too. Buying recycled cartridges can save you between 25-50%, and help the environment.

Some inkjet printers use ink cartridges that you can refill yourself. If you're deft with your fingers and don't mind a few stains you can buy kits for refilling these cartridges. This allows you to refill just the colors you need and cuts down on printing costs.

Some manufacturers say that optimal results can only be achieved with their consumables. Using recycled cartridges will not automatically invalidate a printer's warranty. But if your printer breaks down and it turns out the problem was caused by a third-party cartridge then your warranty won't cover the expenses. Buy consumables from a reputable source that will stand behind their products.

Shopping Tips

One of the best ways to get information about printers is online. Some manufacturer sites have solution advisors that allow you to select criteria like price, interface and type of printer, then search for models that match your specifications. Often you can view several sets of printer specs side-by-side for easy comparison. Other sites also provide ratings for printers. Reviews are also a significant source of information, providing analysis on price, speed, print quality and usability.

Some of the best advice can be found in articles listing the top picks for a certain printer type. There are also sites where you can read buyer reviews or post on discussion boards to get advice. Don't forget to ask friends or colleagues for their recommendations too.

When you're ready to lay down your money it's recommended you use a credit card. In the event that something does go wrong with your purchase, damage during shipping for instance, the best way to enforce your consumer rights is with the might of a credit card company behind you. Many credit cards also offer special insurance on big purchases against theft, loss or breakage of an item. Always read the fine print before committing your dollar, that way you won't be ambushed by unexpected shipping or restocking fees.

Warranty

Hopefully your printer will live a long life and need little repair. But if it does break down, you have to be prepared. Warranties can vary considerably in their coverage so make sure you get a written explanation of the printer's warranty that spells out what's covered. You want a warranty that will cover parts and labor on all components of your printer. It's also good to have access to onsite support if you need it. Ask your dealer who provides service, under what conditions onsite service is offered and at what cost.

Lastly, it's better to get a more comprehensive warranty for a shorter period of time than a weaker one that lasts longer.

Soon after buying your new printer make sure you thoroughly test all its features and modes of operation. If there are problems they will normally appear right away and can be looked after under warranty.

Wrap Up

A printer is one of the most important peripherals you'll buy. There's a wide selection of models on the market - color, black and white, laser and inkjet. Each of them is suited to different types of printing. Once you understand your printing needs, you'll be able to find a printer that satisfies them and your budget. Acquiring a little online education makes printer shopping that much easier. The web is full of useful sites, advice and reviews which will point you in the direction of the perfect printer.

Appendix B



<http://www.viewz.com/shoppingguide/scanner.shtml>

Scanner Buying Guide

What do you think of when you hear the word "scanners"? If the first thing that pops to mind is a vision of people's heads exploding then you're looking for a David Cronenberg website, sorry. The rest of you are probably looking to scan your vacation snaps or pictures for the web. Knowing what you want to use your scanner for will simplify your search for the right model.

The average person wants a color scanner for photos or graphics. A small business owner might be looking for a portable scanner for business trips or a black & white scanner to read documents and translate them into editable text. Graphic artists or desktop publishers might be looking for a specialized photo or slide scanner. Armed with the proper information, you'll be able to find a scanner that does just what you ask.

How A Scanner Works

So what is a scanner anyway? A scanner is an imaging device with an array of photosensitive cells or "eyes" that detect light reflected off or transmitted through the object being scanned. This array of light receptors is a long thin line of charged-couple devices (CCD). A CCD measures light intensity then converts it into electrical charge. Another bit of technology called an analogue to digital converter (ADC) is required to digitize the information, putting into a form your computer can understand. Each CCD in the array of thousands creates one pixel, and for each pixel a certain number of bits is stored. The more bits of information assigned to each pixel the better the image quality.

Most scanners use CCDs but some newer scanners use CIS (Contact Image Sensor) technology. With a CCD scanner, the light reflected from the original document passes through a system of mirrors and lenses which redirect the light to the CCD array. In a CIS scanner, the array of image sensors lies just under the document to be scanned so the sensors catch the reflected light directly. Since CIS scanners don't need a complex optical system they are cheaper to manufacture, smaller and more durable. They are well suited to cramped desktops and make useful portable scanners.

The sensors in a CIS array contain on-board logic for producing digital images and consume less power than CCDs. However, this on-board logic uses space that would normally be used for light sensing. This results in lower quality scans so most people forgo the slight savings of CIS and buy CCD scanners.

Types of Scanners

Flatbed Scanners

Flatbed scanners are constructed with a flat glass plate over the photosensitive array and a cover to go over the glass. You can place paper or objects like open books on top of the glass. Light emitted from under the glass reflects off the object being scanned and is picked up by the moving CCD array in the scan head. Flatbeds are a popular and flexible type of scanner that come in both monochrome and color. Their only draw back is that they hog a lot of desktop space. Prices for general purpose models can start below \$150, for higher image quality the range is \$375-\$1200.

Sheetfed Scanners

Unlike a flatbed scanner, the photosensitive array in a sheetfed scanner is stationary, and the page being scanned is moved over the array. This is a good type of scanner for someone who intends to scan a lot of documents to produce editable text. If you combine a sheetfed scanner with an automatic document feeder (ADF), you don't need to feed in each sheet by hand.

Sheetfeds are available in both monochrome and colour. Although you can feed pictures or small pages into the scanner, the scanned images can get warped so flatbeds are still more flexible. Sheetfed scanners are nicely compact so they're good for limited spaces. You can pick up one of these scanners for under \$150. Rapid, high volume business models can get into the thousands.

Handheld Scanners

Handheld scanners have scan heads 4-5 inches wide which makes them very portable. They plug into your parallel port so they're easy to share among people and can be a good addition to your laptop. The down side is that you will have to make several passes over a regular sized document to scan the whole thing. Usually, software is provided that will put the small scans back together, like stitching a patch-work quilt, but this is often time consuming. Moreover, unless you have the slow steady hands of a surgeon, your scans can turn out unevenly.

You can get cheap handhelds for under \$150, but their declining popularity might make them hard to find. High-end wireless models with superior image quality and stitching software are available for around \$750. Another kind of handheld scanner is the pen scanner. You drag a pen scanner over a line of print like a highlighter. The built-in optical recognition software turns the scan into text which can be downloaded to a computer via serial or USB port. Pen scanners can hold hundreds of text pages and cost around \$200.

Portable scanners are like mini versions of sheet-fed or flatbed scanners that are compact enough to fit in a briefcase. Portable sheet-fed scanners are about the size of a three-hole punch while flatbed models are smaller than a hardcover book. These types of scanners plug into a PC Card or USB port and can scan in color or black and white. Expect to pay about \$250. Portable and handheld scanners have weaker light sources so their image quality isn't close to a full-fledged scanner.

Slide, Film, and Transparency Scanners

The typical person won't be scanning slides or transparencies, but people in the graphics or publishing industry often do. Slides, film, negatives and transparencies have to be scanned so that light transmitted through them is picked up by the photosensitive array. Most scanners have the light source and the scan head on the same side so they can't accommodate these types of images. Since slides and film are so small you need very high resolution scanners to do the job.

There are a few options if you need to scan slides. Some flatbed scanners support a transparency adapter (TPA or TPU) which costs between \$150-\$525. This is a backlight that you attach instead of the scanner cover. These adaptable flatbeds sometimes have a special section on the glass bed that is magnified especially for slides.

Other kinds of flatbeds come with a pull out drawer where you can place slides, but they are fairly pricey starting at about \$1200. The last option is to get a dedicated slide scanner. These scanners have small scanning areas 4"x5", high resolution and high bit depth (see the criteria section) which makes them much more expensive. The cheapest start at \$750 and can go as high as a few thousand.

What To Look For

Bit Depth

As with any sophisticated piece of technology, there are a few technical aspects of scanners you'll want to understand before you go shopping. One term you're bound to bump into is bit depth. For each pixel in an image, the scanner can remember a certain number of bits which is known as bit depth. The higher the bit depth, the better the scanner is at distinguishing between really close shades of the same color. This results in higher image quality.

The minimum bit depth for decent image quality is 24. So for each pixel, the scanner remembers 8 bits of information for each of three color levels (red, blue and green). Overall, this means the scanner can theoretically represent around 16.8 million colors. Inherent in the scanning process is a certain loss or distortion of information which is caused by a number of factors. This is commonly referred to as "noise." In practice, noise cuts 24 bit depth down to around 18 which decreases the number of colors represented. As a result, scanned photos will lose some image quality in the highlights

and shadows. But the average user with a regular printer should find 24 bits adequate for most documents and web graphics.

The next couple of steps up in bit depth are 30, 32, 36, 42 and 48. If you plan on getting a scanner for slides, negatives or transparencies you need at least 30 bits, and 36 bits would be preferable. Now you might be wondering what happens if you get a scanner with 30 bits, but your monitor or printer can only handle 24 bits of color data. The extra information at higher bit depth will still produce smoother color gradations and better overall image reproduction.

Resolution

There are two types of resolution, optical and interpolated; the first is the most important. The optical resolution of a scanner is measured in dots or pixels per inch (dpi or ppi). More pixels mean better resolution and sharper image quality. The number of pixels a scanner can generate is based on how many CCDs are arranged horizontally and vertically in the scan head. Remember one CCD produces one pixel. Resolution is quoted both horizontally and vertically (eg. 600x300). When comparing resolutions always use the smaller number. If you need to pick up fine details, small fonts or complex lines or edges you'll want more optical resolution.

The interpolated resolution for a scanner is always higher than its optical resolution. To get interpolated resolution the scanner takes the information from two true pixels and using mathematical algorithms fills in a third pixel between them. Since more pixels are being mathematically generated the interpolated resolution is higher. Optical resolution is a more reliable indicator of image quality so don't be fooled into mistaking interpolated resolution for optical resolution. Higher interpolated resolution will be sufficient if you just need to enlarge images.

An optical resolution of 300 dpi should be enough for the average user. It will produce an image that will look good on the web or printed out on an inkjet or laser printer. Graphic artists who want to scan line art or images with lots of detail will want to go up to 600 dpi. Only people who are looking to buy a scanner for slides, negatives or transparencies need 1200 dpi resolution. Such a high resolution is needed to compensate for the small size of the original.

Even if your printer has lower resolution than your scanner, scanning at higher resolutions will produce better image quality in the finished document. You want to scan at higher resolution than what you'll print at because the image quality degrades when you process the image with editing software like PhotoShop. A scanner with a higher resolution will also produce better images even at resolutions below the maximum. For example, a 150 dpi scan from a 600 dpi scanner looks better than the same scan from a 300 dpi scanner.

Dynamic Range or Optical Density

For those of you who need a good graphics scanner or want really high image quality, you need to consider dynamic range, also called optical density (OD). It is a measure of how well the scanner can capture the tonal range of an image, the gradations from bright highlights all the way to dark shadows. Dynamic range is measured on a logarithmic scale (like the Richter scale) from 0-4 with zero as pure white and four as pure black. Dynamic range is the difference between the darkest and brightest optical densities a scanner can capture. The bigger the difference the larger the dynamic range.

Most flatbed scanners have an OD around 2.8-3.0 which is fine for the tonal range of photographs. To scan slides, negatives and transparencies which have broader tonal ranges you need a higher OD. For slides and transparencies aim for 3.2, a bit higher at 3.4 for negatives. When comparing scanners with the same bit depth, choosing one with a higher dynamic range will give you better image reproduction. However, many scanners aimed at the average user do not report dynamic range so don't be surprised if you can't find it in the specs.

Speed

Most people buying a scanner for personal use won't be too concerned with speed. But you don't want to get stuck with a scanner that barely crawls along. Remember that speed depends on the scanning resolution, the higher the resolution the longer you'll wait. An efficient time for a 600 dpi color scan is about 100 seconds but only 30 seconds for a monochrome 300 dpi scan. Reviews will usually rate a scanner for speed.

Software

When you buy a scanner you're also paying for the software that's bundled with it. The bundle will probably contain a driver program, color calibration software, image-editing software and optical recognition software (OCR). For Windows the driver program is usually TWAIN compatible.

TWAIN isn't an acronym and doesn't have anything to do with new country. A TWAIN driver allows imaging devices like scanners to be compatible with TWAIN-supported software. Since TWAIN is an industry standard most bundled software will operate off TWAIN. Color calibration software tries to maintain the original colors of the image throughout its processing. This means that what you see on the monitor and what you print out should be reasonably close to the colors of the original.

Image-editing Software

For image-editing software, more often than not, you'll be getting watered down or "lite" versions of graphics programs (ie. Adobe PhotoDeluxe or Ulead PhotoImpact).

Upgrading to the full version of a program will be worth the money if you really want all the cool effects that let you twiddle with images. More expensive scanners sometimes include full versions of software. Decide what you'll want to do with your scans and choose a software package that fits your needs.

Optical Recognition Software (OCR)

To produce editable text from a scanned document you need OCR software (ie. Caere OmniPage and Xerox TextBridge). While a scanned document can be read on a monitor, the computer sees it as a picture, not as editable text. You can't move the words around or type in new ones. Optical recognition programs examine the scanned image and convert it into a format that can be read by a word processor, spreadsheet or database.

Many scanners come with limited OCR software, but you're not going to get the sophisticated programs that can translate tables, charts and spreadsheets. If scanning for OCR is your main purpose for the scanner, you can get away with a black and white scanner.

Interface

Connecting a scanner to your computer can be done in a number of ways. Choose the one best suited to your needs. Plugging a scanner into the parallel port and configuring it is fairly easy. Most come with pass-through connectors to attach your printer to the scanner, just don't try to use both at once. Parallel ports tend to be the slowest way to connect, but the latest models can be almost as fast as the other two options, USB and SCSI.

The Universal Serial Bus (USB) is quickly becoming popular, offering straight-forward installation, flexible configuration and faster data transfer. Most high-end scanners, however, connect via a SCSI port. SCSI stands for Small Computer System Interface, but everyone just says "scuzzy". This type of connection is fast but can require more work to configure and install. Macs support SCSI connection but many PC's do not. Speed demons should also consider high-end scanners that support FireWire which is akin to USB but even faster.

Memory and Storage

To put it plainly, images can devour available hard disk space, especially if you need to store high quality versions. The common formats for saving images like JPEG and GIF compress files but lose information in the process. Graphic artists who need high image quality use TIFF or other formats to save files, but these can get quite large.

Keep in mind that storing all the photos from your European vacation may require additional hard-drive space or an external storage device.

A general rule is that whatever the size of the image file, you require twice the amount of memory to load it. To be on the safe side and ensure your computer doesn't get sluggish you should have three times the memory. For images of 8 MB or less, 32 MB of RAM is just fine. Consider investing in more memory to work with larger image files.

Shopping Tips

The most convenient way to gather information is via the web. Once you've decided what you're looking for in a scanner, there are matching engines that will filter through a catalogue of scanners and pick the ones that match your criteria. For instance, some engines let you specify the type of scanner, price, interface, scanning area and manufacturer.

When you've narrowed the search to a handful of models you can start reading reviews. Articles usually comment on image quality, price, speed, usability and software bundles. It's always a good idea to check out feedback from people who own the product, or ask friends and family what they recommend. Many sites have editor's picks or top 10 lists. Show me the plastic! Credit cards are a convenient way to buy plus some companies automatically insure your purchase against loss, theft or breakage. Before purchasing make sure you've read all the fine print about returns, restocking and shipping fees.

Warranty

Not all warranties are created equal. Most major manufacturers will stand behind their product but it's still a good idea to compare warranties before you buy. The best warranty will cover parts and labor on everything inside your scanner. If onsite service is available, find out what it will cost, who provides it and under what conditions it's offered. Also consider the length of a warranty. A more extensive warranty for a shorter term will serve you better than a watered down one that lasts longer.

Putting it all together

Gone are the days when you had to be a graphic artist to appreciate the merits of a scanner. With the advent of reliable OCR software, a scanner can process mountains of documents and turn them into editable text, reducing the tedium of typing in the office. At home, a scanner can be a lot of fun, allowing you to send pictures over the internet or update the photo gallery on your website. As a tool for productivity or pleasure, the scanner is an excellent addition to any computer system.