The Beginner's Guide To Computing:

Demystifying The PC

By David Muller

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This guide is meant for educational purposes only. I take no responsibility for anything bad that you or anyone else does.

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All information researched March 2006

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Preface

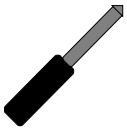
Have you ever felt lost in the silicon sea of computing? With all of the standards, options, synonyms, and acronyms floating around between homes, offices, and electronics stores, it's easier than ever to become confused by computers. However, I plan to help you navigate through the terms, concepts, dangers, and hype surrounding many aspects of both desktop and laptop technology. This guide is best suited to those who have only a minimal knowledge of computing and have been waiting for clear, concise explanations of the many aspects of computing. To this end, this guide contains tables, photographs, icons, and a detailed glossary. You can read this guide from start to finish for a solid overview of computing or use it as a reference for quick computing information. However you read it, please enjoy *The Beginner's Guide To Computing: Demystifying The PC*.

Icons:

The Warning icon warns you of potential problems.

The Tip icon calls attention to extra advice.

The Dollar Sign icon highlights expenditures (and savings) of money.



The Screwdriver icon points out installation procedures.

The Electricity icon signifies a danger of electric shock. This guide is not meant as a safety manual – be cautious at all times.

The Chassis

The chassis, or case, is like an empty office building: it doesn't do anything on its own, but it provides a place for work to be done.

Every case is meant to house a particular type of motherboard (covered below), including ATX, Micro ATX, Extended ATX, and BTX. The most common standard by far is ATX, so you usually won't have to worry about your ordinary motherboard fitting into an ordinary case.

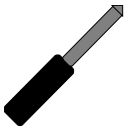
The motherboard and all drives are anchored to the case in one way or another. All chassis have these common features: 1) the motherboard provides direct input to a very primitive speaker built into the case, and 2) the motherboard provides direct input to the indicator LEDs (for power and drive access) on the chassis.

There are several brands to choose from when purchasing a chassis, including:

- Antec,
- Aopen,
- Lian-Li,
- Sunbeam,
- and Thermaltake.

A low-end case will range from $40-$70 dollars, and the higher-end models usually cost from $150-$220.

Make sure the case you choose has enough room for expansions you plan on making.



To set up your case, all you really have to do is to plug in the power cord. Plug the male end into the wall and the female end into your computer. All other installations are covered in the sections of their specific components.

The Motherboard

One of the largest internal components of a computer is the motherboard, or mainboard. Most other parts are installed directly onto the motherboard, which is anchored securely to the case.

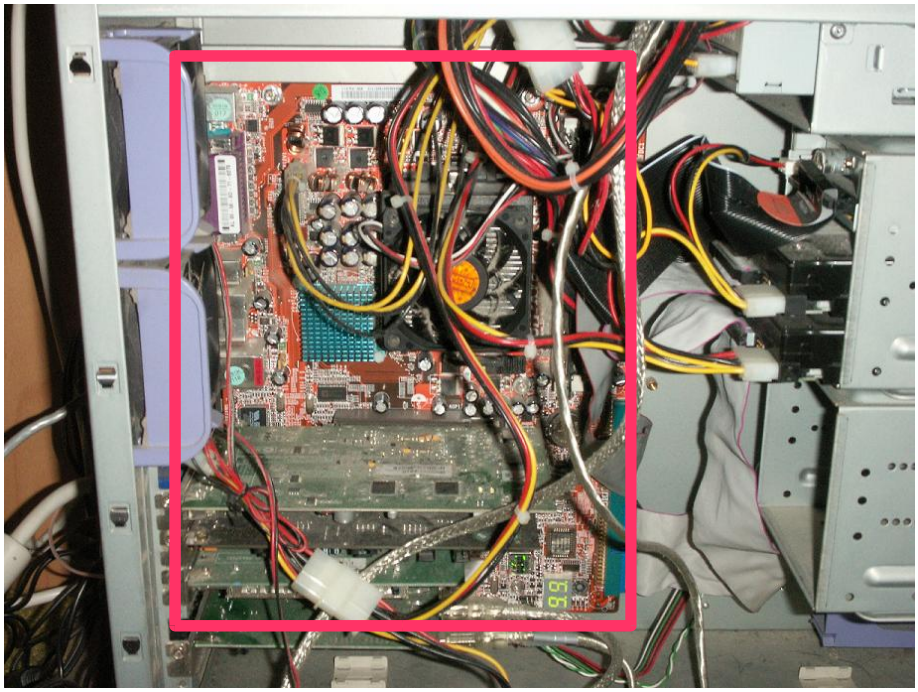


Figure 1: The half-hidden orange object in the red border is the motherboard.

Some motherboards take care of many things, including audio, video, and Internet connectivity. All motherboards provide a starting point for the computer, called the BIOS, before the operating system has loaded.

Motherboards conform to any of a set of dimensional and locational standards which includes:

- ATX (the most common),
- Micro ATX,
- Extended ATX,
- and BTX.

As stated above, any given new motherboard will most likey be ATX. However, there are several other aspects to think about when choosing a motherboard.

Of major importance are types of components a motherboard will accept, such as CPU, RAM, video cards, drives, and expansion cards. All modern motherboards will have UDMA ports for drives, and newer boards will

also have SATA ports for faster drive connections. Today's motherboards have either a single AGP (Accelerated Graphics Port) slot or one or two PCI-Express slots for graphics cards. All modern motherboards also have from one to several PCI slots for connecting various expansion cards, such as sound cards or PVR cards. On the edge of a motherboard will be the array of I/O ports that usually end up at the rear of your computer.

For many years, every motherboard allowed users to connect a keyboard, mouse and printer, each using a specialized, dedicated port. Since a few years ago, however, keyboards, mice, and printers all connect using USB, so many motherboard manufacturers have chosen to add extra features to this aspect of their products to set themselves apart. Many motherboards today now come with integrated audio, integrated video, built-in Ethernet connectivity, and more. This Swiss Army knife of capabilities greatly simplifies a computer and reduces hassles, as many individual components have now become redundant. This has the added effect of freeing up space for adding more specialized components, such as a PVR.

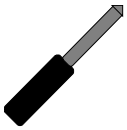
As a failed motherboard will always mean a dead computer, choosing a high quality brand is important. Some of the more well-known brands include:

- Abit,
- Asus,
- Gigabyte,
- Intel,
- and MSI (Micro-Star International).

The quality and reliability of a motherboard can mean the difference between a computer that experiences total failures every four months and a computer that gives the user loyal service for years.

When you buy a motherboard, choose one that will accommodate the CPU, RAM quantity and type, and video card/s you want and that will allow room for expansion in the future.

Motherboards range from one to several hundred dollars, with the majority of decent models falling between $150 and $200. When choosing your motherboard, select one that will fit the components you want and that will allow enough room for future expansion.



To install your motherboard, orient the I/O ports toward the cutouts at the rear of the computer, line up the

screwholes so that the motherboard fits snugly in the chassis with the I/O ports pressed tightly against the case's cutouts. To connect your motherboard to your case's basic speaker and indicator LEDs, consult the manuals for your motherboard and case for detailed instructions. You should find that all necessary wires are properly identified and labeled both in the manuals and in your computer.

The CPU

The CPU (the Central Processing Unit) carries out mathematical and logical operations, making it one of the most important parts of a computer. It can be thought of as the computer's brain.

A CPU will look like a flat square about one and a half inches to a side, with a gridlike array of pins on its underside that connect to the motherboard. A CPU's speed is measured in Hertz, or cycles per second. Older CPUs had speeds measured in MHz, or megahertz, meaning millions of cycles per second. Newer CPUs have speeds measured in GHz, or gigahertz, meaning billions of cycles per second. These CPUs range from around 1.6GHz at the slower end to over 3GHz or more for newer, expensive models. However, this Hertz measurement is not the only indication of the capability of a particular chip. There are many factors that influence the performance of a chip, making CPU choice a matter of personal preference or motherboard compatibility.

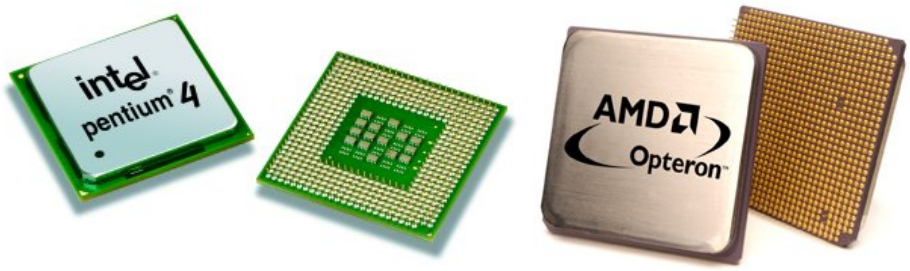


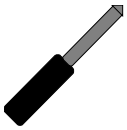
Figure 2: CPUs from Intel and AMD.

Different CPU families use different connectors to communicate with the motherboard, including:

- Socket A,
- Socket T,
- Socket 478,
- Socket 940,
- and Socket 939.

Most new Pentium 4 CPUs use Socket 478, and most new AMD Athlon CPUs use Socket 939. Double check your motherboard's CPU socket type to ensure that you will pick a compatible CPU.

$ There are two major manufacturers of CPUs: Intel and AMD. Older models of either brand will cost between $50 and $100, while the newest and fastest chips will cost upwards of $1000.



Installation of a CPU is simpler than it looks. First, lift the CPU latch next to the CPU socket. Next, simply drop the CPU into the socket pin-side down, making sure that it's oriented properly. Finally, return the CPU latch securely into its place. Remember to attach the proper heatsink and/or fan to your CPU to eliminate dangerous heat buildup.

The RAM

The RAM is the computer's Random Access Memory, which, continuing the analogy of the office, could be considered very similar to a worker's desk. More RAM, in MB, is like a larger desk: someone with bigger desk space can work on more projects simultaneously than someone with a smaller desk.

The amount of available RAM is a major consideration when purchasing a computer. Of much less consideration these days is the speed of the RAM, measured in MHz, which can be equated to being able to run faster between distant parts of the desk.

The majority of today's RAM modules are DDR SDRAM, which is Double Data Rate Synchronous Dynamic RAM. The biggest difference between types of available RAM are whether the RAM is single- or dual-channel. Single-channel RAM may be installed one module at a time, a great convenience in terms of cost savings and upgrade capability. Dual-channel RAM, while faster than single-channel, is sold in pairs of equal-capacity modules and can only be installed in these pairs. With this system, the desired quantity of RAM must be split into two smaller modules. When the time comes to upgrade, these smaller modules become useless and must both be replaced with larger modules. With single-channel RAM, a single, high-capacity module may be used, and when an upgrade is desired, all that is required is simply to insert one more module of any size. The speed (in MHz) of RAM must match the listed MHz rating of the motherboard in which it is installed. While RAM is available in many speeds, these days, 400MHz RAM is very popular and more than adequate for just about any purpose.

The amount of installed RAM is limited by the physical slots on the motherboard and the inherent 32-bit limit, as well as factors such as need and price.

Slots Filled:	Min./Max. RAM:	Possible Configurations:
1	128/1024	4
2	256/2048	8
3	384/3072	16
4	512/4096	32

Table 1: Motherboards will either have two or four RAM slots, which will accept modules in sizes of 128MB, 256MB, 512MB, or 1GB (1024MB).

Most versions of Windows, a 32-bit operating system, can recognize up to 4GB (4096MB) of RAM. If your purposes require more RAM than this, you'll need to use a specialized 64-bit version of Windows or another 64-bit operating system, such as Unix or Linux.

As RAM has no moving parts, a module that is initially tested as fully functional will probably continue to work for years. Some manufacturers of RAM include:

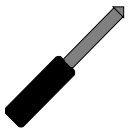
- Samsung,
- Crucial,
- Kingston,
- PNY,
- PQI,
- and Corsair.

The following table describes current RAM prices.

RAM Size:	Price:
128MB	$20
256MB	$30
512MB	$50
1024MB	$80

Table 2: Prices for ordinary (single-channel, 400MHz) RAM are falling quickly.

Very low-intensity computer users will be able to get by with 512MB RAM, but most users will want to start with 1GB of memory. This allows for good performance at a good price, while still allowing room to expand should it prove inadequate for more RAM-intensive tasks. RAM is only really noticed when there isn't enough. If, for example, your RAM usage peaks at between 450 and 550 MB, 512MB of RAM will grate heavily on the nerves. However, installing large amounts of RAM (more than 2-3 GB) will usually prove to be a waste of money, as the unneeded RAM will simply sit idle.



To install RAM modules, first locate your motherboard's RAM slots and push out the plastic pieces at the ends of each slot you plan on using. Insert the module with the correct orientation, and the plastic pieces will close around the RAM, ensuring a secure hold.

The Video Card

One of the most important components to computer gamers is the video card, which can be equated to the potential visual detail of a worker's files. A bad video card would be something like working with old, basic LEGO blocks, and a really good video card is more like having one of Michelangelo's sculptures sitting in front of you.

Video cards are connected to the motherboard with one of several connection ports:

- the PCI slot,
- the AGP slot,
- and the PCI-X/PCI-E (PCI-Express) slot.

PCI-based video cards were popular several years ago when PCI was the only way to connect expansion cards. When the many-times-faster Accelerated Graphics Port (AGP) came along, most new video cards started to use AGP. Within the past year or two, however, the AGP video card has begun to be displaced by the PCI-X video card, boasting bandwidth speeds to and from the motherboard of up to double that of the fastest AGP connection (16x, as opposed to AGP's best of 8x).

All true video cards have their own onboard RAM. Most of these video cards today use DDR RAM, just like most computers' own memory. Some video cards use faster (and more expensive) RAM known as GDDR3. Of major consideration is the amount of RAM. Many video cards today have 128MB RAM, mid- to high-end cards have 256MB RAM, and very high-end cards have 512MB RAM.

Type	Output	Input	Purpose
VGA	Yes	No	Analog Monitor
DVI	Yes	No	Digital Monitor
Composite (RCA)	Yes	Yes	Standard A/V Equipment
S-Video	Yes	Yes	High-Quality A/V Equipment
Coaxial (NTSC/PAL)	Yes	Yes	Broadcast/Cable/Satellite Antenna
High-Def. (YPbPr)	Yes	No	High Definition Television

Table 3: Available input and output formats for video cards.

Most users will want to consider the types of input and output available with a video card. The large majority of video cards can output to the standard VGA connection used by the large majority of monitors. Many video cards can also output to the increasingly popular DVI connectors. Other capabilities include output to composite video and audio, S-video,

coaxial, and YPbPr (for output to a television), and input from a variety of sources, including composite video and audio, S-video, and coaxial. Video cards with the above inputs usually have at least some form of PVR capability, allowing you to watch and record television shows or console-based videogames. Some of the highest-end video cards can be doubled up in a single computer system with dual PCI-X slots, yielding drastically improved performance.

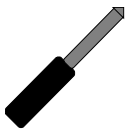
The two major video card manufacturers are ATi and NVIDIA. These two companies have been competing with each other for years, and, as a result, have produced many quality products. Additionally, some third party manufacturers, such as:

- LeadTek,
- Diamond,
- MSI,
- Sapphire,
- and others,

have designed their own video cards based on ATi or NVIDIA technology.

A low-end video card will cost between $40-$90, but higher-end cards can be quite expensive, and the trend points toward ever-more-expensive cards. Just a few years ago, a top model from either major manufacturer cost between $400-$500, but today's top models can cost up to $700 (depending on retailer and location).

When purchasing a video card, you can usually base your decision on what kind of games you want to play: if you just want to play your four-year-old games without fear, an appropriate video card should cost between $80-$130. If you want to play the very newest games at their very highest settings, however, you might need to purchase a $600-$700 card, or even install two specialized cards in a system specifically designed to take advantage of two video cards.



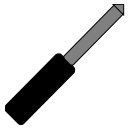
To install most video cards, look for the AGP or PCI-X slot and insert the card's contacts into it, with the I/O ports accessible from the outside of the computer. Some video cards, especially those which may run side-by-side with another, will have more specific installation instructions.

The Sound Card

A less vital part is the sound card, which processes all audio information for the computer. Without a sound card, very basic sounds are processed on the motherboard and played with a primitive speaker on the case, which sounds like a kazoo. A good sound card (combined with comparable speakers, of course) can put you next to figher jets on an aircraft carrier, or in the Lobby with Neo and Trinity. A sound card usually connects to the motherboard via a PCI slot.

High end sound cards have professional-quality audio and audio processing tools. However, as mentioned in the motherboard section above, many modern motherboards have reasonable sound processing capabilities built right in. The most basic of these will allow you to use five speakers and a subwoofer, and many will allow seven speakers and a subwoofer. These will actually produce 3D sound without any additional hardware installation.

With the advent of this convenient new motherboard feature, sound cards are more suited to users who have extensive audio equipment and wish to work with MIDI, optical S/PDIF, and high quality audio conversion. For those planning on these high-end activities and wishing to purchase a dedicated sound card, the biggest manufacturer is Creative Labs, with their Sound Blaster line of audio equipment. Prices range from $20 for the most basic cards to around $350 for the highest end cards.



Thankfully, installation is simple: insert the card's contacts into a PCI slot, with the audio ports accessible from outside the computer. Some cards have additional equipment that must be placed near the computer or mounted into a 5.25-inch drive bay, and some are even simpler to connect, requiring only that you plug a wire into an available USB port.

The Network Card

A network card is what allows you to connect your computer to the Internet or to other computers in your home or office. A wired network card provides a jack for an RJ45 Ethernet cable (with a connector slightly wider than that of a standard RJ11 phone cord), and wireless network cards allow access to a wireless network.

The most basic wired cards of today are 10/100 Fast Ethernet, which means that they can connect to an Ethernet connection at 10Mbps (Megabits per second) or to a Fast Ethernet connection at 100Mbps. Ethernet cards that can connect to Gigabit Ethernet networks at 1000Mbps have become much more prevalent in the past few months, with even basic Ethernet jacks integrated into motherboards capable of gigabit performance.

Wired	Format	Speed	Compatibility
Yes	Ethernet	10Mbps	10Mbps Ethernet
Yes	Fast Ethernet	100Mbps	10Mbps Ethernet, 100Mbps Fast Ethernet
Yes	Gigabit Ethernet	1000Mbps	10Mbps Ethernet, 100Mbps Fast Ethernet, 1000Mbps Gigabit Ethernet
No	802.11b	11Mbps	802.11b
No	802.11a	54Mbps	802.11a
No	802.11g	54Mbps	802.11b, 802.11g

Table 4: Various aspects of the available networking standards.

Wireless Ethernet is even more complicated, with new standards appearing every few years. First was 802.11b, which has speeds of up to 11Mbps, quite slow compared to the wired 100Mbps Fast Ethernet already available at the time. Next came 802.11a, which, though it has speeds of up to 54Mbps, is not backward-compatible with preexisting 802.11b networks. The most recent standard is 802.11g, which operates at 802.11a's 54Mbps while still being backward-compatible with the old 802.11b equipment.

There are several major manufacturers of network equipment, including:

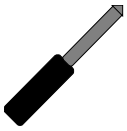
- Linksys,
- Netgear,
- and D-Link.

These companies all have a solid reputation for producing reliable equipment.

When choosing networking equipment, there are advantages and disadvantages to wired and wireless networks. Wired networks are faster, simpler, and more secure, while wireless networks allow great portability for laptops and do not require additional equipment to introduce more computers into the network (although speed will decrease, of course).

Format	PCI (Desktop) Price	PCMCIA (Notebook) Price	USB (Universal) Price
Fast Ethernet	$5	$15	$15
Gigabit Ethernet	$10	$35	$60
802.11b	$15	$20	$20
802.11a	$40	$50	$50
802.11g	$15	$15	$15

Table 5: The price to hook up a single computer to a network in various ways.



Network cards can be installed in a PCI slot, in a PCMCIA port, through USB, or can be integrated into a motherboard or laptop.

The Hard Drive

A hard drive stores a computer's operating system, programs, and files on magnetic disks that keep their data even when they're turned off. A hard drive is like a file cabinet, in that it stores files not currently in use, which can be accessed reasonably quickly, but not as quickly as from RAM, or on a desk.

Hard drives have grown astronomically in size (and affordability). Modern hard drives have capacities of up to 500GB. Most hard drives have capacities between 100GB and 250GB. Any of these now-common hard drive capacities will serve almost any user and use. A lesser factor for most users is the speed of the hard drive, measured in RPM (rotations per minute). Most laptop hard drives are 4200RPM, the high-capacity hard drives of several years ago came in at 5400RPM, and virtually all common hard drives today function at 7200RPM. Some specialized hard drives with severely limited capacities (and enormous price tags) have speeds of 10.000RPM, but very few people need this kind of performance.

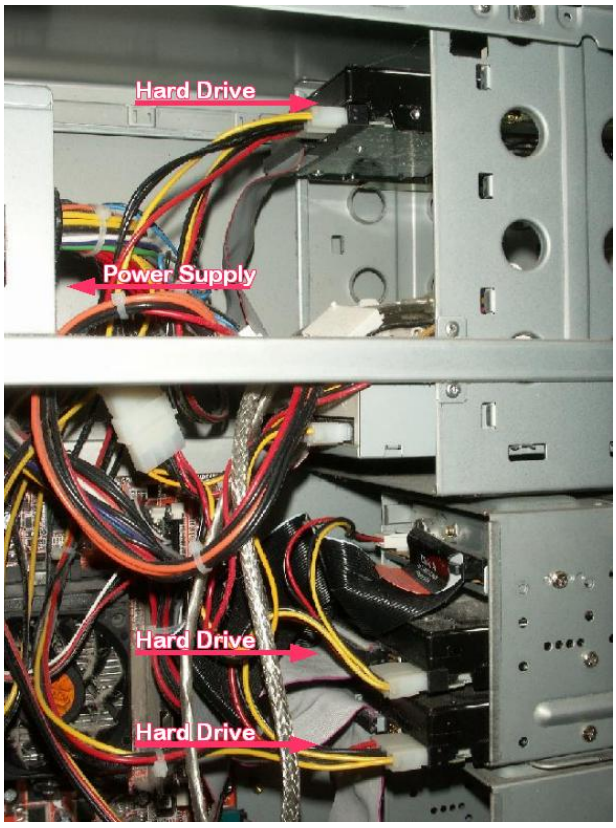
If you're buying a ready-built computer from Dell, HP, or some other similar service, skip this section. If you're planning on buying a new hard drive to hold Windows and be the main hard drive of a computer, remember the following: A motherboard by itself can only recognize up to 137GB of any hard drive. To recognize the rest, you'll need to have Windows already loaded. This means that if you buy a 200GB hard drive, you'll have to install Windows on a partition (non-physically separated part of a drive) approximately 137GB in size, and then use Windows to recognize and access the rest of it. You will be left with two "drives" appearing in My Computer. To avoid this, buy a 120GB drive for Windows and whatever other capacities you want for extra storage.

The drives you buy will be dictated by other components you have installed and what your motherboard can handle. All modern motherboards have room for four UDMA drives, a connection characterized by a wide, flat ribbon allowing two drives to be connected to each ribbon. Most hard drives use this connection, but so do most optical drives (covered below), so you won't be able to have three UDMA hard drives and two UDMA optical drives in the same computer. One way around this is to use SATA connections instead. Many modern motherboards allow for two SATA devices, but a UDMA device cannot be converted to SATA, so make sure you buy a drive that specifically mentions an SATA connection on the box.

There are several brands to choose from when you buy a hard drive, including:

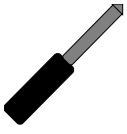
- Maxtor,
- Western Digital,
- Seagate,
- and Quantum.

Prices are as low as $50 (depending on retailer and after rebates) for a 250GB drive, and around $200 for a 500GB drive. Just a few years ago, hard drives could cost as much as two dollars for each gigabyte, but today, the balance has shifted as far as five gigs (gigabytes) to the dollar.



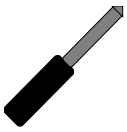
The upshot of all this is to just buy more than you ever think you'll need, because the things have gotten very, very inexpensive. You'll need at least 200GB if you're going to be installing lots of games, and about as much if you're planning on storing hundreds of hours of video. If you're planning on both, buy two large (250-300GB) drives.

Figure 3: The author's computer has multiple hard drives.



To mount the drives, find a 3.5-inch bay in your computer and put in the hard drive, inserting the proper screws through the bay and into the screw holes on the hard drive. If you only have the larger 5.25-inch bays available, simply attach the metal brackets usually included with your hard

drive for just this purpose. They'll make the drive wider so that it can fit snugly into the larger bay. Also available are external hard drives that connect through USB and conversion kits that allow an ordinary internal drive to become external and connect through USB. These add to the cost of the drive.



To install a UDMA drive, first connect one end of a 40-pin UDMA cable to the motherboard and the other end to the drive. This is the data cable, a wide, flat ribbon with three connectors on it. Next, attach a 4-pin Molex connector (from the computer's power supply) to power the drive. Consult each drive's manual for instructions on jumpers.

The Optical Drive And Its Media

Optical discs are like different writing materials; some can be written on once, others many times; some can store decent amounts of data, others enormous amounts. These drives work by shining a laser up at the silvery underside of a disc, which has microscopic pits that reflect the laser back to a reader in a particular way. These pits are located very near the top (label side) of the disc. The rest of the disc gives a layer of protection to the data and makes the disc more durable.

Drive Type	Read	Write
CD-ROM	CD-ROM	-
CD-RW	CD-ROM, CD-R, CD-RW	CD-R, CD-RW
DVD-ROM	DVD-ROM, CD-ROM, CD-R, CD-RW	-
Combo Drive	DVD-ROM, CD-ROM, CD-R, CD-RW	CD-R, CD-RW
DVD-RW	DVD-ROM, DVD-R, DVD-RW, CD-ROM, CD-R, CD-RW	DVD-R, DVD-RW, CD-R, CD-RW, various others depending on model

Table 6: A very brief overview of some of the available drive types and formats.

Optical drives were, several years ago, limited to CD-ROM capabilites. This meant that all they could do was read CDs, and not very quickly either. Now there are CDs (low capacity) and DVDs (very high capacity), and different drives can read or write either one. A CD-ROM drive can read CDs, a CD-RW drive can read and write CDs, a DVD-ROM drive can read DVDs, a so-called "combo" drive can read CDs and DVDs and write CDs, and DVD-RW drives can read and write both CDs and DVDs.

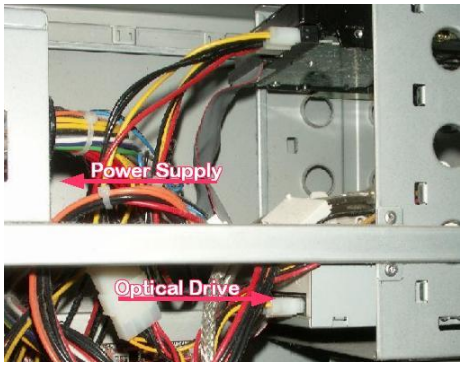
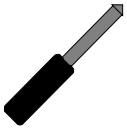


Figure 4: The author's computer has a single optical drive.

The only real option these days is a DVD-RW drive, the cheapest and most basic of which costs about forty bucks and can do all of the above tasks and write to many specific DVD formats.

If a disc gets scratched, a scratch repairing device (from $30-$70) grinds off a thin layer under the disc until there are no imperfections to interfere with the laser.



An optical drive can connect through UDMA, SATA, or USB, just like the hard drives described above. Mounting is different, however. Optical drives can only be mounted in a 5.25-inch bay. There are no brackets to install, however, because they are already large enough to fit into the larger bay. Consult your computer case's manual for specifics on installing a 5.25-inch drive.

Some ready-built computers (Dell, HP, etc.) make it very difficult and sometimes impossible to add a drive yourself. This is one of the major disadvantages to buying a preassembled computer.

The Monitor

The monitor, along with the computer's speakers, is one of the most common methods of output from a computer. The monitor lets you view pictures, movies, and documents, along with displaying other information produced by the computer. The two main types of available monitors are the CRT, or cathode ray tube, and the LCD, or liquid crystal display (often redundantly called an LCD display).

Warning: A CRT can carry an enormous amount of electricity even after it's been off for a while. Only open one if you are a professional, fully trained to do it. If you don't know exactly what you're doing, **DO NOT OPEN A MONITOR**.

A CRT has an electron gun at its rear, which projects electrons through a fine grille, hitting red, green, and blue phosphors. These phosphors glow at different intensities depending on the intensity of the electron beam. This is the same technology used in conventional television sets, except it is carried to a much greater level of detail. An LCD makes a layer of liquid crystal align or not align light from the backlight in the rear of the monitor, depending on the electric currents running through it. These differing technologies result in widely varying performances in each of the several aspects of monitor capabilities.

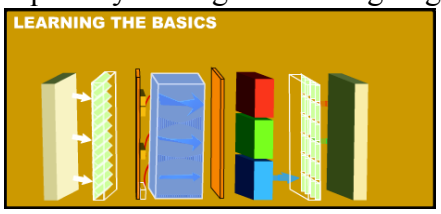
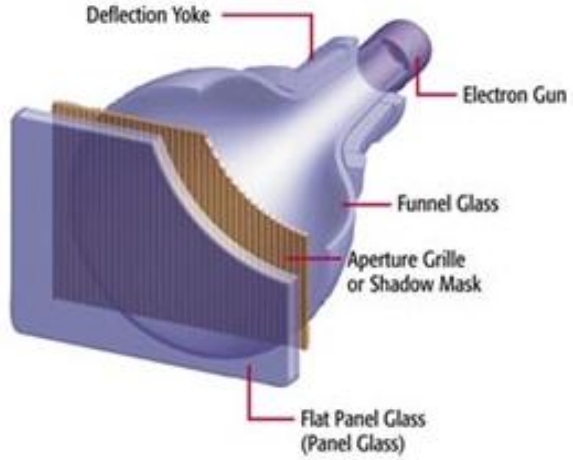


Figure 5: LCD technology.

The first and possibly most important aspect of a monitor is the resolution. A monitor screen is composed of hundreds of thousands of tiny dots, known as pixels, that can change color and brightness to create images, like a mosaic's tiles. Like a mosaic, the more tiles, or pixels, a display has, the more detailed the images it can create. However, if more of these pixels are packed into a screen of a fixed size, the pixels will be more



tightly packed, resulting in a smaller image than created by a monitor with the same amount of pixels in a larger area.

Figure 6: CRT technology.

A 17-inch CRT (measured along the diagonal) will generally have a resolution of 1280x1024 pixels, with the first number representing the number of pixels in a horizontal row. A 19-inch CRT will generally have a resolution of 1600x1200, and a 21-inch CRT will generally have a resolution of 2048x1536. These monitors are capable of using a lower resolution in the same screen area, making the image less detailed but easier to see. LCDs of any size will generally have a resolution of 1280x1024. LCDs of any size can also have a resolution of 1600x1200, and only 21-inch LCDs can have a resolution of 2048x1536.

The large majority of people will use a resolution of 1024x768 or 1280x1024, each one of which is a popular default resolution for ready-made computers. A few people will use resolutions of 1600x1200 or 2048x1536 on a 19-inch or 21-inch CRT, but these resolutions are harder for those with poor vision to use due to the smaller size of a given pixel dimension compared to a lower-resolution monitor.

LCDs can only use their natural or “native” resolution, with lower resolutions always making the viewable image smaller, with the rest of the screen blackened. CRTs, conversely, can make lower resolutions fill the entire screen.

Less important technical aspects that are still worth considering are refresh rate, reponse time, brightness, viewing angle, size, and power consumption. The refresh rate is how many times per second a new image is displayed (usually between 60 and 80 Hz), response time is the amount of time it takes a monitor to respond to new instructions, brightness is self-explanatory, a wider viewing angle makes it less important to be directly in front of the screen, and size and power consumption are also self-explanatory.

The vast majority of CRTs are head and shoulders above most LCDs in most of these categories. In the categories of size and power consumption, however, LCDs trump CRTs. CRTs can be a foot deep or more and very heavy. This is due to the bulky electron gun and plentiful lead (for containing harmful radiation). LCDs, on the other hand, can be as light as a laptop and are only a few inches deep, making them both stylish and portable. LCDs also use only about half as much power as similarly-sized CRTs, which translates to savings of

approximately $40-$80 per year. Some well-known manufacturers of CRTs and LCDs include:

- Envision,
- ViewSonic,
- Apple,
- Dell,
- Gateway,
- NEC,
- Panasonic,
- and Philips.

CRTs gain yet another advantage over LCDs when considering initial purchase cost. A 17-inch CRT will cost between $50 and $70, a 19-inch CRT will cost between $100 and $140, and a 21-inch CRT will cost between $400 and $500. A 15-inch, 17-inch, 19-inch, and 21-inch LCD, however, will cost approximately $150-$500, $100-$500, $500-$700, and $500-$10,000, respectively, depending on resolution and quality.

Monitor Type	Monitor Size In Inches	Monitor Weight in Pounds	Maximum Resolutions	Prices
CRT	17	30	1280x1024	$50-70
	19	50	1600x1200	$100-140
	21	70	2048x1536	$400-500
LCD	15	7-9	1600x1200	$150-500
	17	8-13	1600x1200	$100-500
	19	10-20	1600x1200	$200-700
	21	15-30	2048x1536	$500-10,000

Table 7: The relation between type, size, and resolution. (Prices may vary and are subject to change.)

If size, weight, and style are more important for your needs than picture quality and price, then go with an LCD. Otherwise, stick with a CRT.

Regardless of which one you choose, however, installation is easy. First, simply plug the VGA cord of the CRT into your video card, or plug your VGA or DVI cord (depending on model) into your video card. Next, plug the male end of a standard power cord into a wall outlet and the female end into what is usually the only available port on a monitor. If you want to use the digital connection of DVI, make sure your video card supports it.

Glossary

3D Sound: Sound that seems to come from all around the listener.

Accelerated Graphics Port: See **AGP**.

AGP: The **video card** port of choice for many years because of its excellent speed.

Backlight: A bright light in the rear of a **monitor** that shines forward through the **screen** to create a bright image.

Bandwidth: The rate at which data can be transferred between two points.

Basic Input/Output System: See **BIOS**.

BIOS: The set of instructions executed by the **motherboard** just after a computer has been powered on and before its **operating system** has loaded.

Bit: The smallest unit of data available to computers. A bit can either take the form of a zero (0) or a one (1), and these bits can be grouped together to form more complex data.

Byte: Eight **bits**. This is the size of an alphanumeric character and is also a very common unit of measurement for computer data.

Case: See **Chassis**.

Cathode Ray Tube: See **CRT**.

CD: A **Compact Disc**, these discs have the shape of a round coaster and the approximate diameter of a bagel. They store data in the form of millions of microscopic pits. A laser can be shined at these pits and the reflections interpreted to read the data. A common CD today can hold 700**MB** of data.

CD-R: A Compact Disc Recordable can be written on once.

CD-ROM: A Compact Disc Read Only Memory has already been written on and its data cannot be erased or changed.

CD-RW: A Compact Disc ReWritable can be written on and erased many times.

Central Processing Unit: See **CPU**.

Chassis: A chassis houses and supports the internal components of a computer system.

Coaxial: A standard copper or silver insulated wire. The type of wire that generally transmits signals from an antenna, satellite receiver, or other service to a television.

Compact Disc: See **CD**.

Composite: See **RCA**.

CPU: The **Central Processing Unit** is a silicon chip (or group of chips) that performs the actual calculations in a computer.

CRT: The Cathode Ray Tube is a type of monitor that creates a bright, clear picture by shooting electrons through a grille at a layer of colored phosphors.

Drive: A device that holds and/or reads data, such as a **hard drive** or a **CD-ROM** drive.

DVD: A Digital Versatile Disc looks and acts much the same as an ordinary **CD** except that it holds 4.7**GB** of data.

DVD-R: A Digital Versatile Disc Recordable can be written on once.

DVD-ROM: A Digital Versatile Disc Read Only Memory has already been written on and its data cannot be erased or changed.

DVD-RW: A Digital Versatile Disc ReWritable can be written on and erased many times.

DVI: A Digital Video Interface cable provides a digital connection between **video cards** and **monitors** and is not compatible with the analog **VGA** standard.

Ethernet: The most prevalent hardware and software networking standard.

Fan: A fan moves air around to keep electronics from overheating.

Female: A port, cable end, or other receptacle that has holes in which the pins from a male port, cable end, or other receptacle are inserted.

Gb: A **Gigabit** is equal to one billion **bits**.

GB: A **Gigabyte** is equal to one billion **bytes**.

Gbps: Billions of **bits** per second.

GHz: Billions of cycles (**Hertz**) per second.

Gigabit: See **Gb**.

Gigabyte: See **GB**.

Gigahertz: See **GHz**.

GUI: A Graphical User Interface allows users to communicate with computers by manipulating visual images and icons.

Hard Drive: See **HDD**.

HDD: The hard disk drive stores data on a stack of magnetic platters. Tiny magnetic pieces on the platters align themselves to represent the **bits** of computer data.

Heatsink: A metal surface attached to an electronic component in order to dissipate heat.

Hertz: See **Hz**.

Hz: One cycle per second.

I/O: Input/Output. These describe the various ports in a computer through which data is transmitted to and from various devices and components.

LCD: A Liquid Crystal Display **monitor** aligns light through a layer of liquid crystal in order to create an image.

LED: A Light Emitting Diode produces light very efficiently by running current through a specialized circuit. This type of light can last for thousands of hours and is very resistant to impact.

Linux: A variant of **Unix** that adds user-friendliness with a **GUI**.

Male: A port, cable end, or other receptacle that has pins which are inserted into the holes in a female port, cable end, or other receptacle.

Mainboard: See **Motherboard**.

Mb: A **megabit** is equal to one million **bits**.

MB: A **megabyte** is equal to one million **bytes**.

Mbps: Millions of **bits** per second.

Megabit: See **Mb**.

Megabyte: See **MB**.

Megahertz: See **MHz**.

MHz: Millions of cycles (**Hertz**) per second.

MIDI: The Musical Instrument Digital Interface is a connection standard and file format for relatively primitive computer-generated audio.

Monitor: A device that can display moving images.

Molex: A connector used to connect a **PSU** to a computer's various internal components.

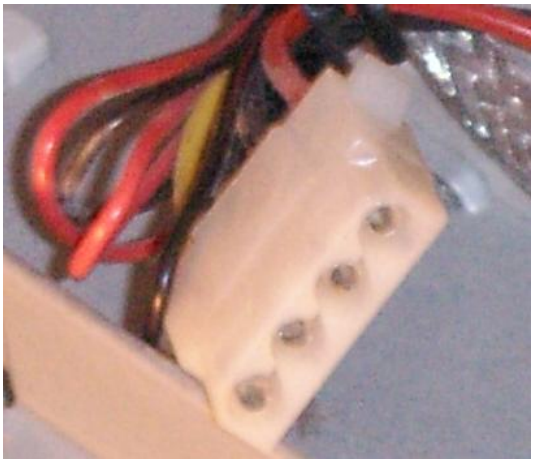


Figure 7A: A front and top view of a common four-pin Molex connector.

Motherboard: The motherboard is a platform mounted in the **chassis** that supports and connects all of a computer's other components.

Motherboard Form Factor Standards: All **motherboards** have a certain size and basic layout. The standards include ATX, Micro-ATX, Extended ATX, and BTX. The most common form factor by far is ATX.

NTSC: The National Television System Committee set the standard for television signals in the United States, Canada, and other countries.

Operating System: See **OS**.

Optical Drive: A **drive** that reads and/or writes various formats of **CD** and/or **DVD**.

OS: An **Operating System** provides the computing environment that users work with. Examples include Windows, Unix, Linux, and Macintosh.

PAL: The Phase Alternation Line is the standard for television signals in China, Australia, and much of Europe and Africa.

PCI: The Peripheral Component Interconnect is a high-speed port located on modern **motherboards** that allows users to connect expansion cards to a computer system.

PCI-Express: This port operates a sixteen times the speed of standard **PCI**, making it an emerging favorite for mid- to high-end video cards.

PCI-E: See **PCI-Express**.

PCI-X: See **PCI-Express**.

PCMCIA: The Personal Computer Memory Card International Association sets standards that are most seen today in the popular format for expansion cards for laptops.

Pixel: A discrete dot of color created by a **monitor**.

Power Cable: One of these connects your computer to a power outlet, and another connects your **monitor** to a power outlet.

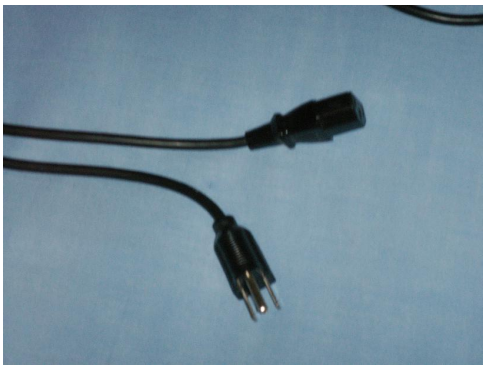


Figure 2A: A common power cable.

Power Supply: See **PSU**.

PSU: A Power Supply Unit is located inside a computer's **chassis** and provides power for the computer's internal components.

PVR: A Personal Video Recorder allows users to digitally record television or other signals.

RAM: Random Access Memory stores data and programs that the **CPU** is working on. It is much slower than the tiny amount of memory built into the **CPU**, but much faster than the **hard drive**.

RCA: The Radio Corporation of America is another term for the video standard it created. An RCA connection consists of a yellow-tipped video connector, a white-tipped left-audio connector, and a red-tipped right-audio connector. This is used to connect VCRs, DVD players, and console-based videogames to televisions or to a computer's **PVR**.

Resolution: The number of **pixels** displayed by a **monitor**. A **monitor** with a resolution of 1600x1200 is 1,600 **pixels** wide and 1,200 **pixels** tall.

Ribbon Cable: The common, inexpensive cable that connects **UDMA** devices. One end attaches to the **motherboard** and the other two connectors attach to **drives**.

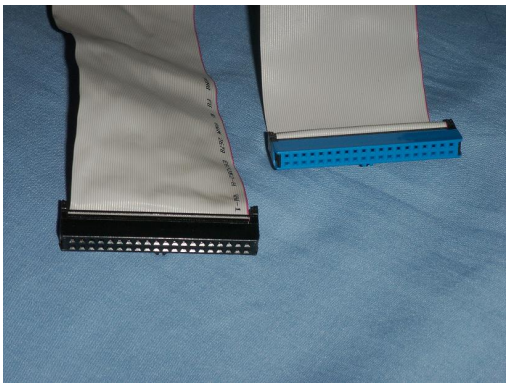


Figure 3A: A common UDMA ribbon cable.

RJ11: A standard telephone cord connection.

RJ45: A standard **Ethernet** cable connection.

SATA: A 150MB/s interface for **drives**. Most computers can accommodate two SATA **drives**.

Screen: The part of a **monitor** where the image is displayed. The screen is the part of the **monitor** that seems to attract fingerprints created by guests' greasy fingers.

S/PDIF: The Sony/Philips Digital Interface is a high-quality audio transfer format. The **RCA** connection uses ordinary coaxial S/PDIF, while uncommon optical S/PDIF eliminates interference along the cable.

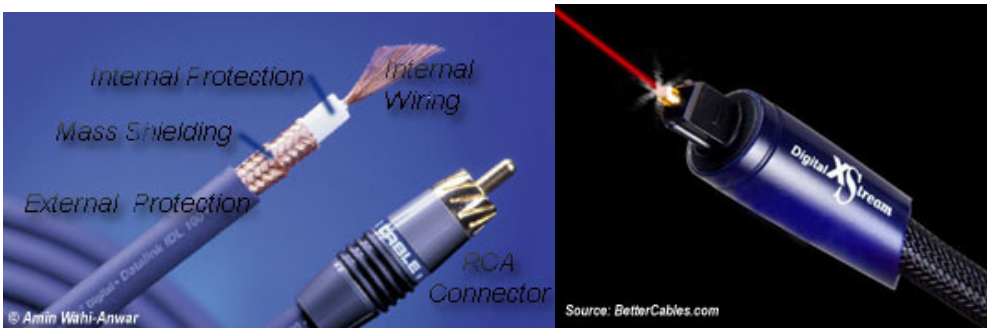


Figure 4A: Coaxial S/PDIF and optical S/PDIF connectors.

Speakers: These play sounds transmitted from a computer (or other device) by vibrating a surface that vibrates the air in front of it.

Subwoofer: These speakers play only deep sounds of very low frequency.

S-Video: An S-Video connection consists of the standard white and yellow **RCA** audio connectors and a specialized connector for vivid, detailed video.

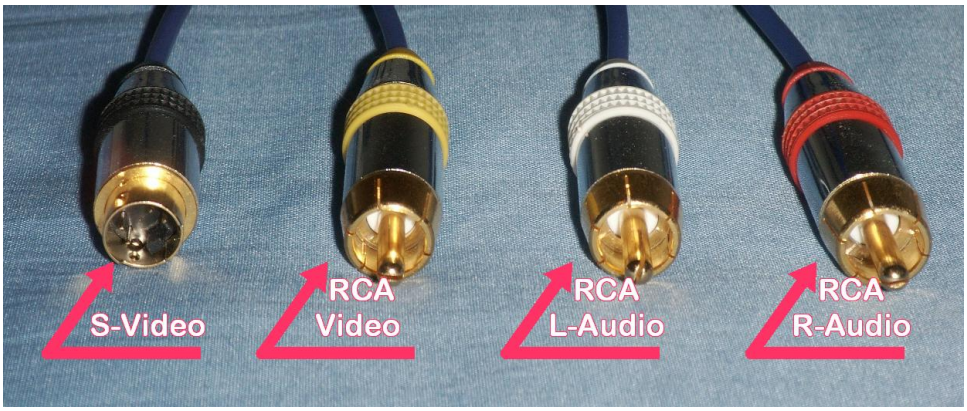


Figure 5A: The S-Video and RCA connectors.

UDMA: A 100MB/s interface for **drives**. Most computers can accommodate four UDMA **drives**.

Unix: A free, ultra-stable, command-line **OS**. It is difficult to use and is not compatible with very many consumer applications, but its stability makes it very popular with Internet servers.

USB: The Universal Serial Bus is an interface that connects keyboards, mice, external **hard drives**, scanners, headphones, and a wide

variety of other equipment to a computer. The original USB standard could transfer data at 12Mbps, or 1.5MB/s. A few years ago, USB2.0 was introduced, which retained compatibility with older devices while bringing the maximum **bandwidth** to 480Mbps, or 60MB/s.

Figure 86A: A USB cable with type-A connector below and type-B above.

VGA: An analog video connection that provides an interface between most **video cards** and the large majority of **CRTs**.

Video Card: A device that calculates what to display on the **monitor**.

YPbPr: A term for a high-definition video connection. It consists of a green-tipped video connector (Y), a blue-tipped left-audio connector (Pb), and a red-tipped right-audio connector (Pr).

Sources/Resources

The image of the dollar sign was found at:
<http://dixiehost.com/images>

The images of the CPUs were found at:
<http://www.microsoft.com/windowsxp/using/moviemaker/expert/dunn_03august11_cpu.mspx>

The images and explanations for the monitor technologies was found at:
<http://www.viewsonic.com/monitoruniversity/>

More explanations on DVI and other topics were found and can be found at:
<http://www.datapro.net/techinfo/>

The images and explanations for S/PDIF were found at:
<http://homepage.mac.com/beepboy/definition/index.html>