

**EVERYTHING YOU EVER WANTED
TO KNOW ABOUT COMPUTERS**

(But now I bet you are sorry you asked)



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Most people have a passing curiosity about these mysterious devices that seem to infiltrate every aspect of Modern Life.

Unfortunately, sometimes they make the mistake of asking me, an engineer/geek 'Just how do those things work?'

I usually start with the history of the atom and four hours later I am still trying to explain the need for the Flux Capacitor.

The purpose of this presentation is to curtail my need to explain every boring detail and to make computers easier to understand for the Sub Genius.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

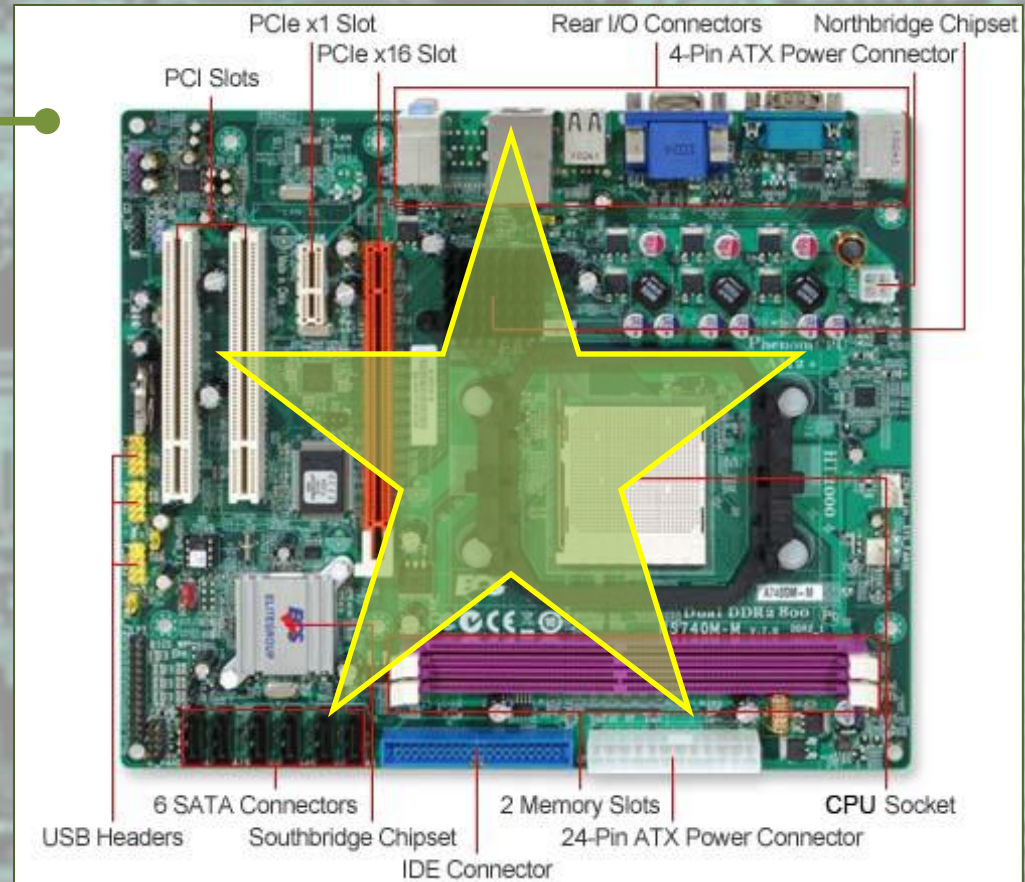
Just the Facts, Jack

Inside of every computer there a few basic parts.

The Motherboard



This is the main part that everything else plugs into or onto.



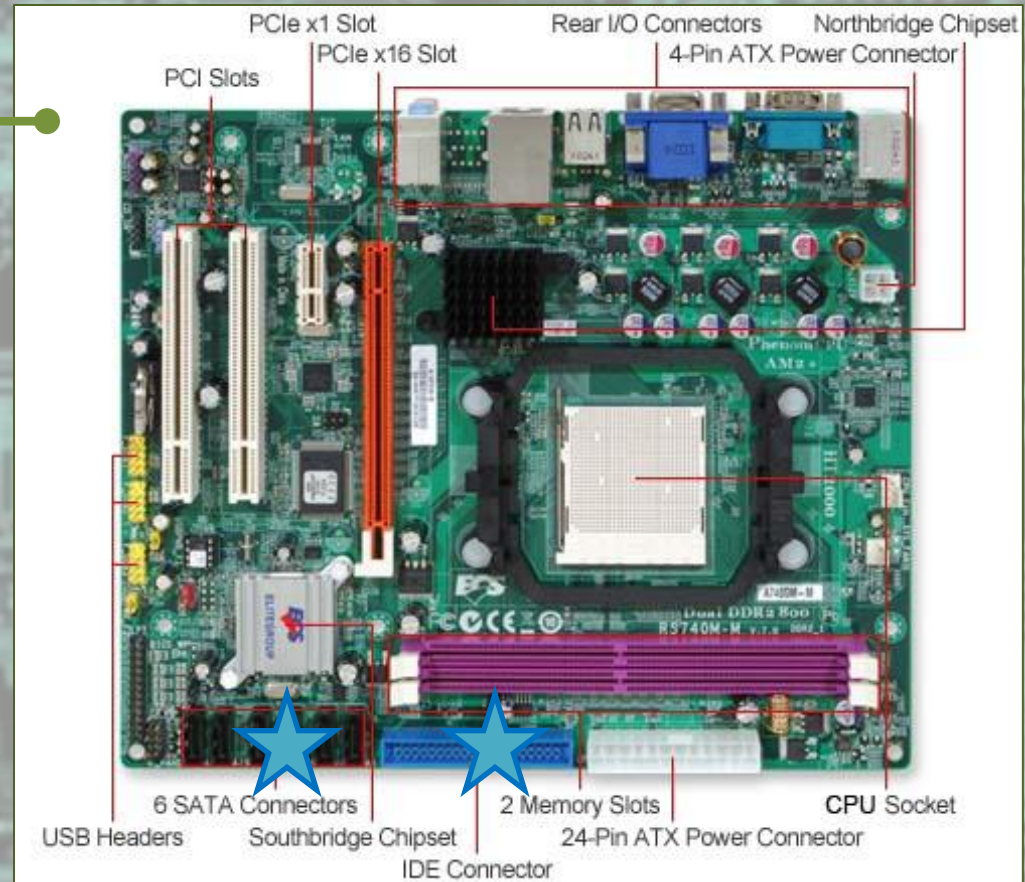
EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Just the Facts, Jack

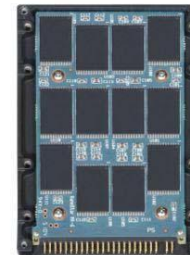
Inside of every computer there are a few basic parts.

The Drives ★
(Hard Drives, CD/DVD or Solid State Drives)

The drives connect to the Motherboard through the SATA connectors or the M.2 or PCI lanes.



Traditional hard disk drive



Solid state hard drive



DVD drive

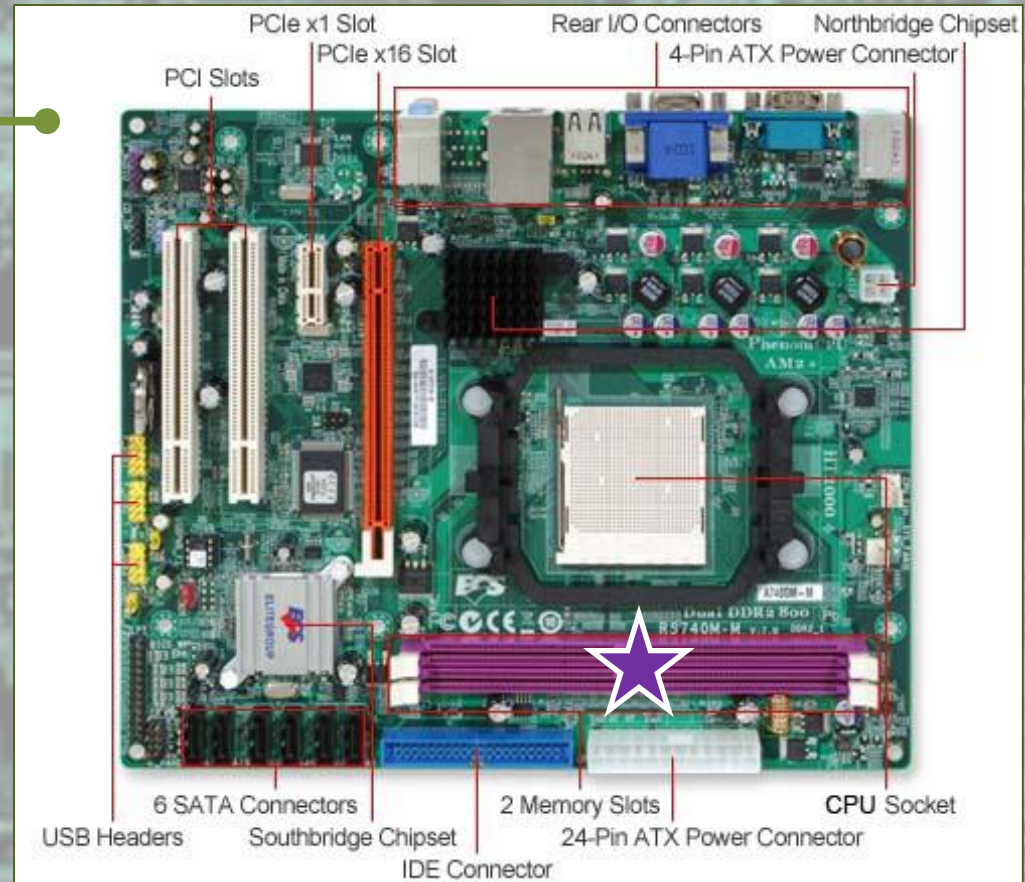
EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Just the Facts, Jack

Inside of every computer there a few basic parts.

The Memory 
or RAM
(Random Access Memory)


There are many flavors of RAM, but these days you probably have either DDR3 or DDR4 = newer and faster.



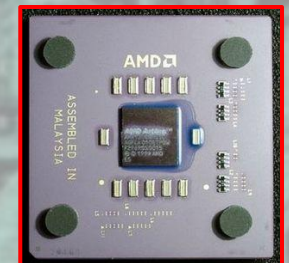
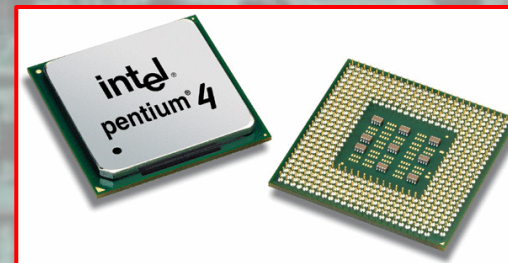
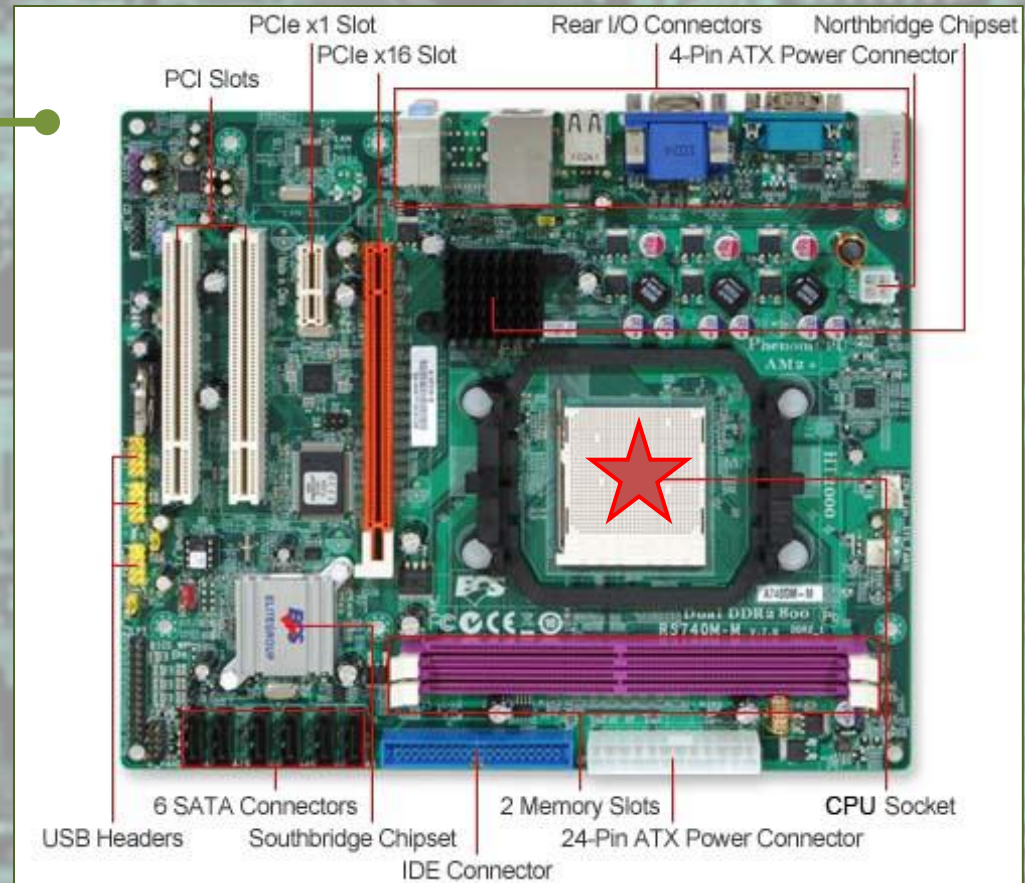
EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Just the Facts, Jack

Inside of every computer there are a few basic parts.

The Central  Processing Unit or CPU

Usually made by Intel or AMD (American Micro Devices).



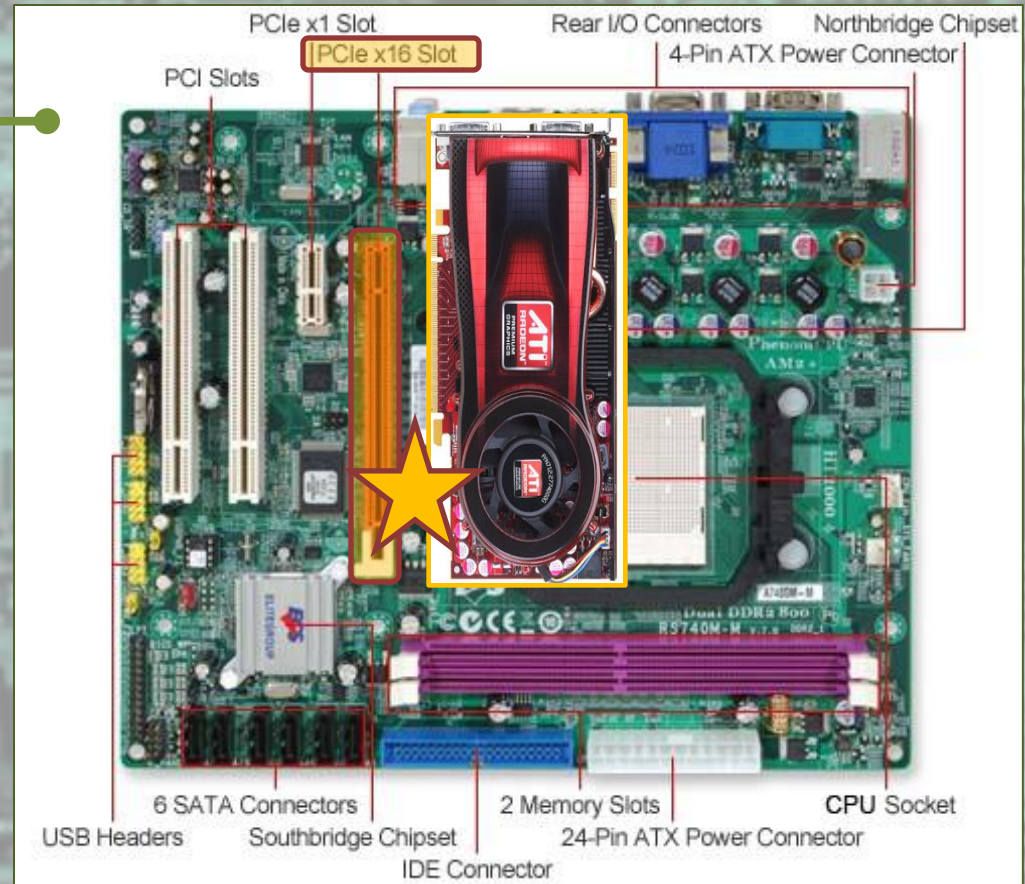
EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Just the Facts, Jack

Inside of every computer there a few basic parts.

The Graphics Processing Unit or GPU.

Usually made by Nvidia or AMD.

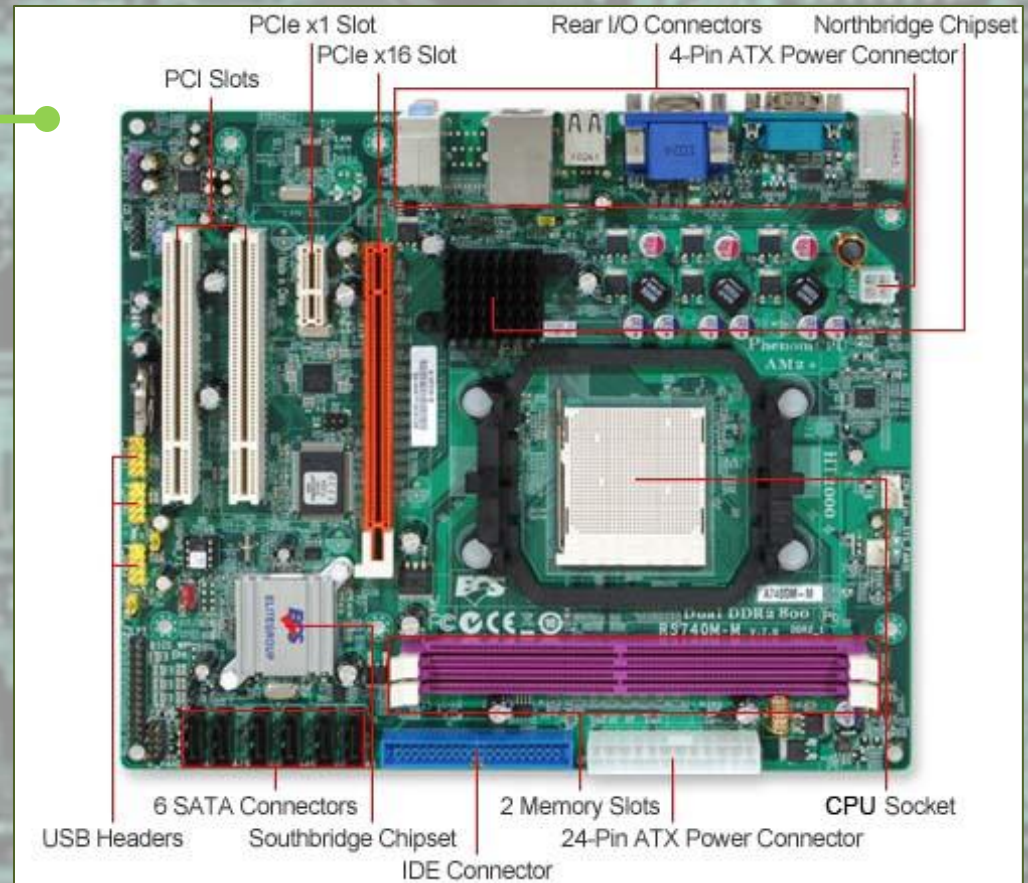


EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

The Motherboard

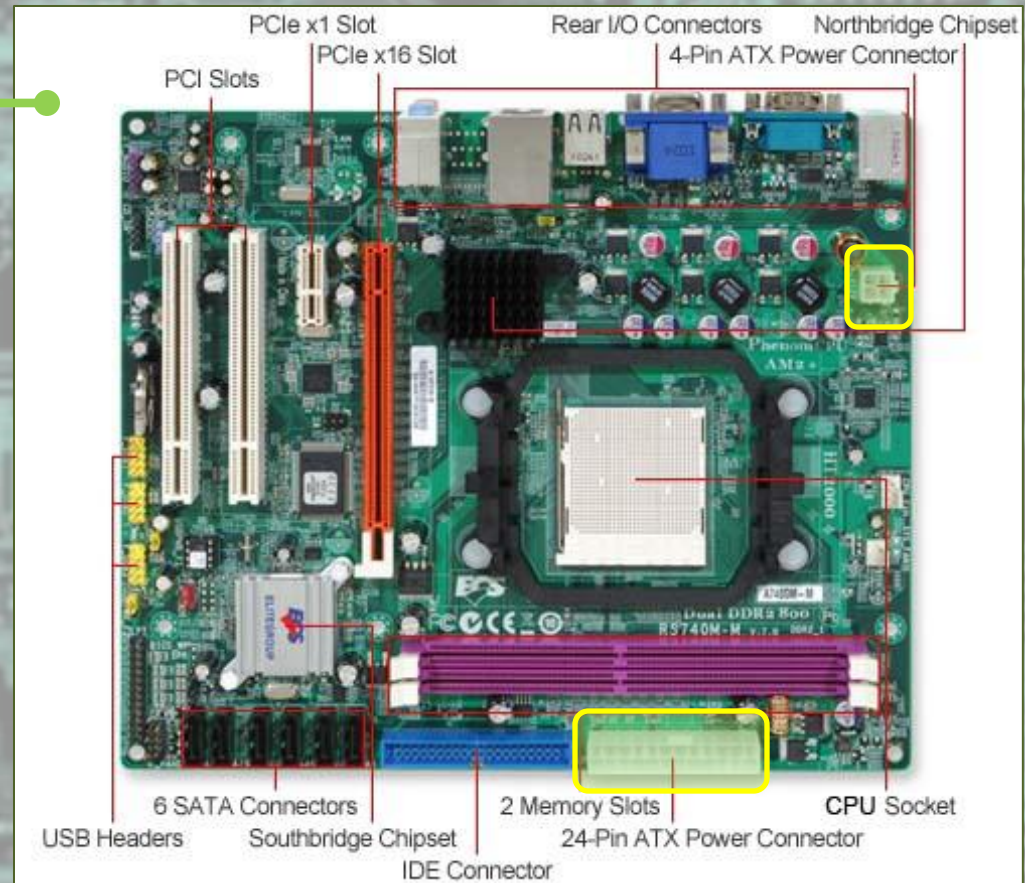
This is the main part that everything else plugs into or onto.

The MB has many chips, slots, plugs and circuits that are printed onto a piece of plastic. It serves to connect a bunch of stupid chips into a smart collection of silicon that we can occasionally make to do something useful.



The Motherboard

The Power Connectors – Inside of your box or lying on the floor near your laptop is a Power Supply Unit or PSU. It converts wall power at 120 volts alternating current (~) into power the computer can use. The computer needs 12 or 5 or 1.273 etc. volts direct current (+/-), going to the right place at the right time.

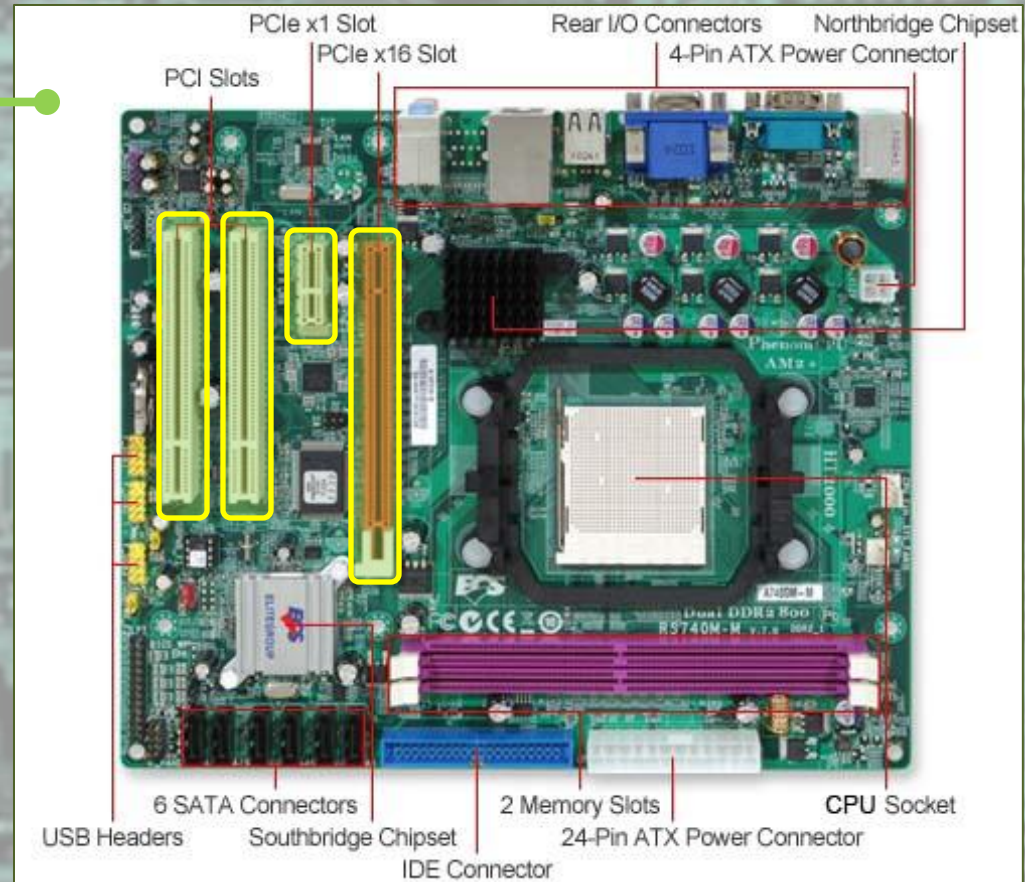


EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

The Motherboard

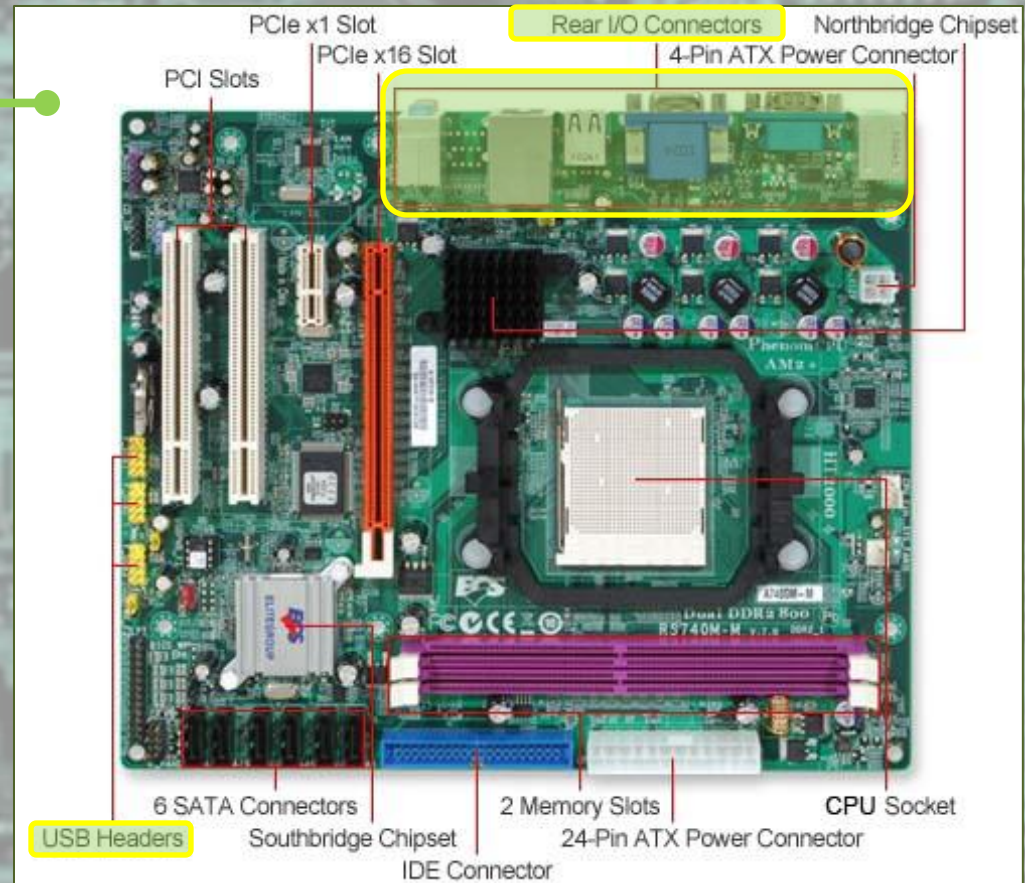
The PCI slots – PCI means Personal Computer Interface. These provide a means to add devices to your computer such as a Video Graphics Card, or more USB ports. PCI is standard. PCIe(xpress) x1 is newer, and PCIe x16 is a high speed slot used for graphics cards. Many computers have the graphics chips built onto the Motherboard, as a lower performance alternative.

Most laptops do not have PCI expansion slots.



The Motherboard

The I/O connectors. Without Input and Output the computer would not know what to do, nor would we know what it was doing. These include mice, keyboards, monitors, printers, scanners, joysticks, wheels, speakers, networks, cameras and other USB (Universal Serial Bus) devices.



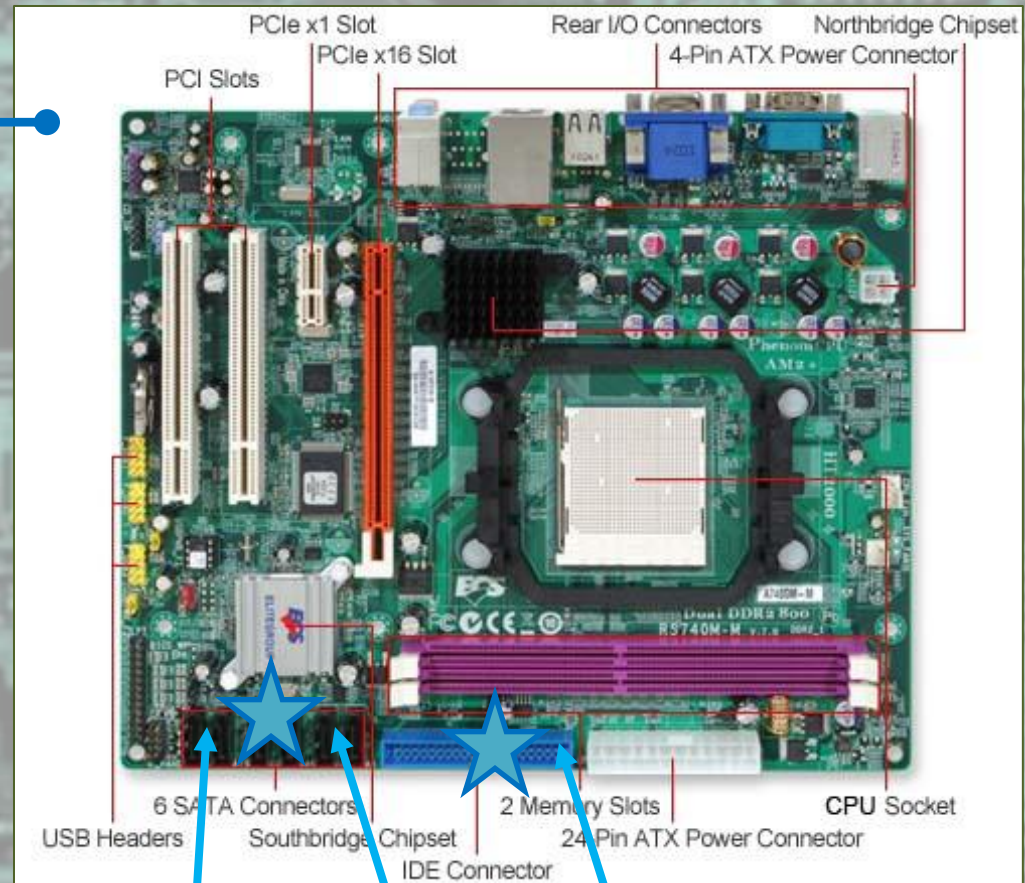
EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

The Drives

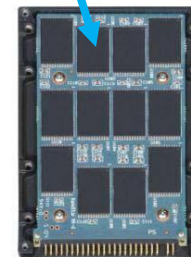
(Hard Drives, CD/DVD or Solid State Drives)

The drives connect to the Motherboard through the SATA connectors or the M.2 or PCI connectors.

The drives are the only way your computer can 'remember' anything once the power has been shut off. They are used to load data into the memory chips.



Traditional hard disk drive



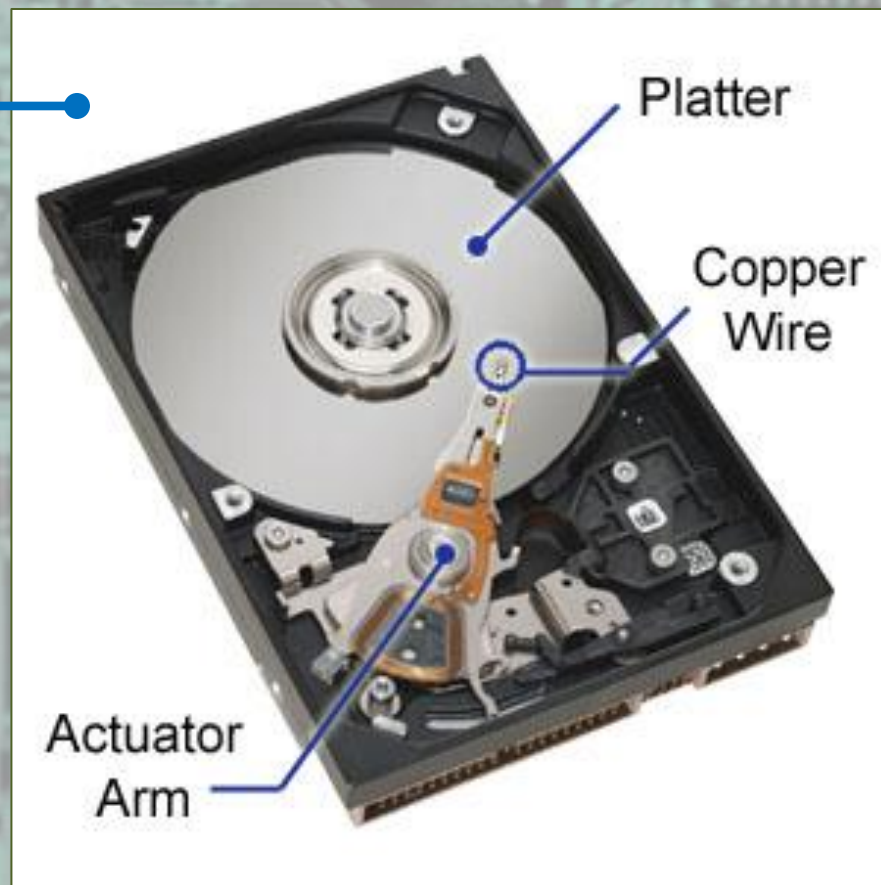
Solid state hard drive



DVD drive

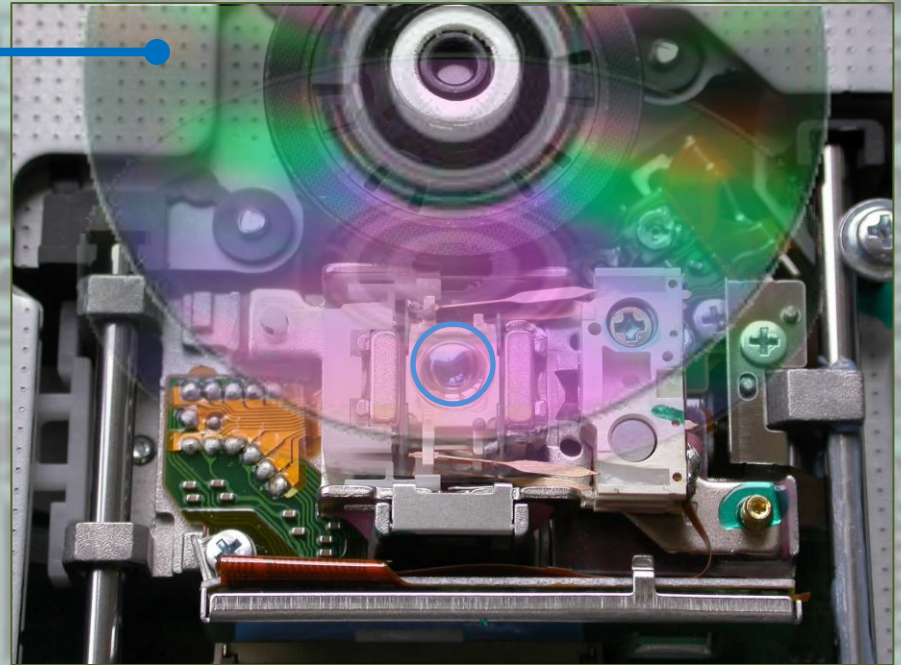
The Drives

Hard Drives are an unholy marriage between a record player and a cassette tape (Kids, ask your parents). The aluminum platter is coated with magnetic stuff (rust). The actuator arm moves back and forth like a record needle, zapping the platter with magnetic pulses as it spins. The arm does not move in a spiral, it can go anywhere at anytime.



The Drives

CD/DVD Drives use a laser beam to detect or burn tiny holes onto an aluminum foil disk. You can see the laser lens in the middle (blue circle). The drive spins the disk and the laser moves back and forth to see the entire disk (you can see the rods it slides on at either side of the picture). CDs use a red laser and DVDs use a blue laser. The blue laser can make a smaller hole.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

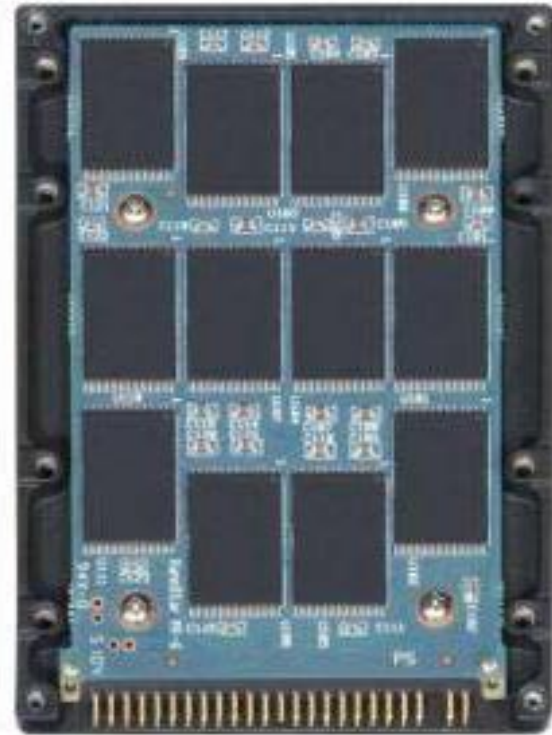
The Drives

Solid State Drives - SSDs

These are a new and expensive type of drive that is essentially a huge and fast USB Flash Drive that uses non-volatile memory (it retains its memory when the power goes off).

They cost more than a normal drive, but they can be more than 50 times faster and use less electricity. They are used in businesses that need to cram more capacity into the same IT room. One thing SSDs are excellent at is as Internet servers where 1000's of tiny bits of info need to be delivered super fast. Those kind of operations make a mechanical hard drive slow down when the arm has to wiggle all over the disk.

They are great for putting programs on, so the Operating System and other software can load up faster. Most people then use a conventional Hard drive for saving their data.



Solid state hard drive



The Drives

The Internet

It is best to think of the Internet as just another Hard drive that is connected to your computer. It is just a Hard drive that is infinitely HUGE, Complex and getting bigger all the time. The World Wide Web is just the agreed upon means to organize and display all of that stuff so that mere mortals don't get their LOL Kittens mixed up with their WikiLeaks.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

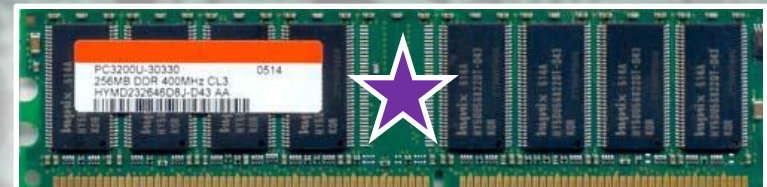
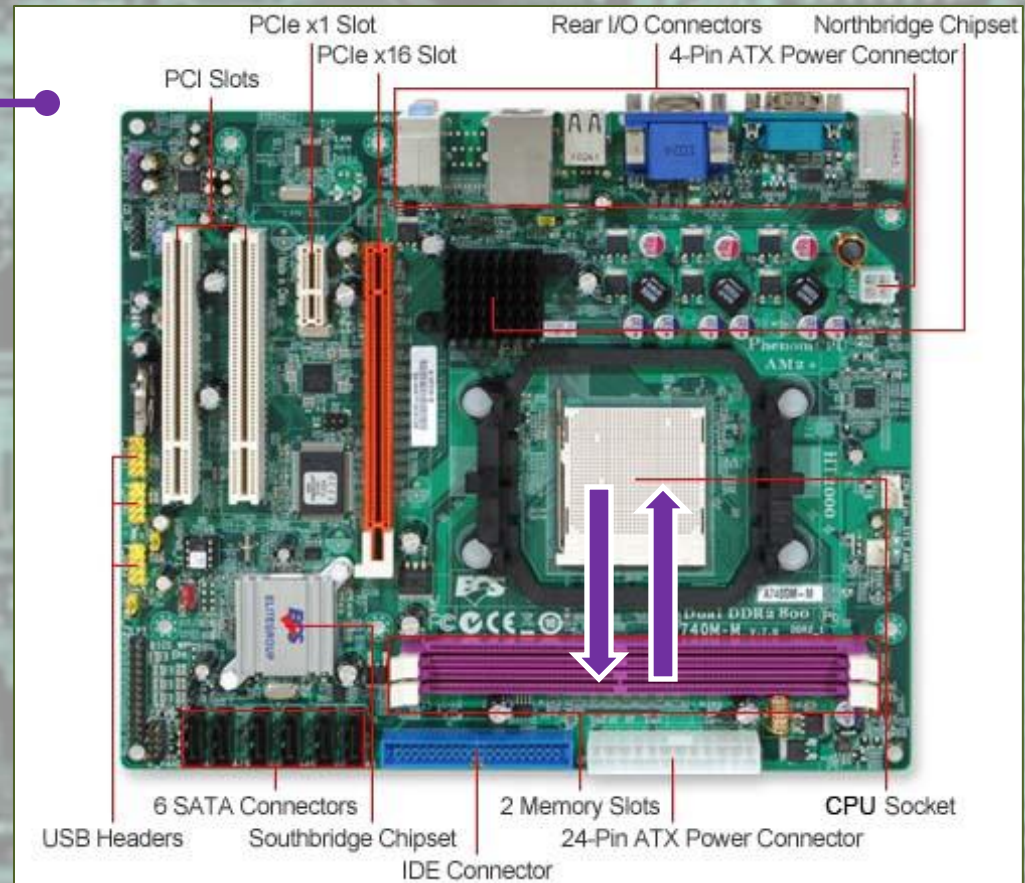
Memory or RAM

(Random Access Memory)

This is the computers REAL brain.

A computer can not 'think' about anything until one of the drives places the data into memory.

Then the data passes back and forth between the CPU and the RAM through the Motherboard circuits.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

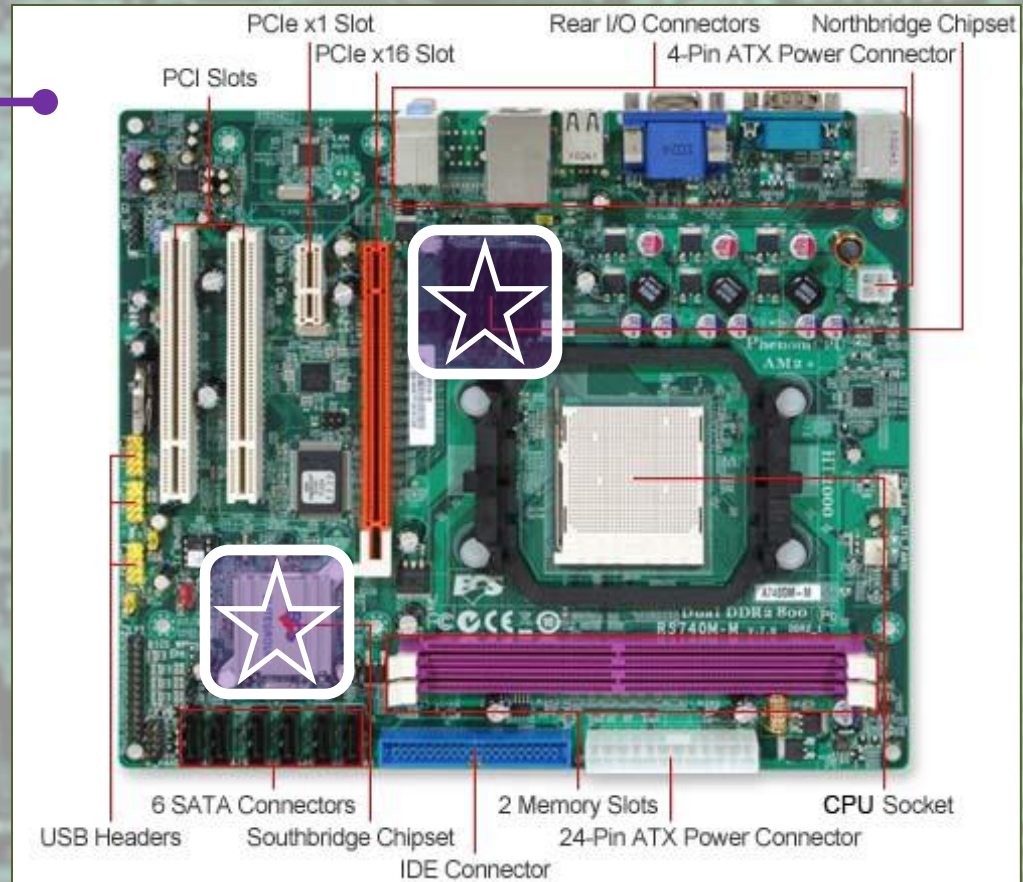
Memory: The Sequel or ROM

(Read Only Memory)

The ROM chips do not lose their memory when the power goes off.

A powered down computer is beyond stupid. The main ROM is called the BIOS (Basic Input Output System) and it tells the Motherboard how to turn this confusing collection of chips and wires into a computer that can then load the Operating System (Windows, Mac, etc.).

When you see the black and white text as the computer is starting up you are looking at the BIOS in action.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

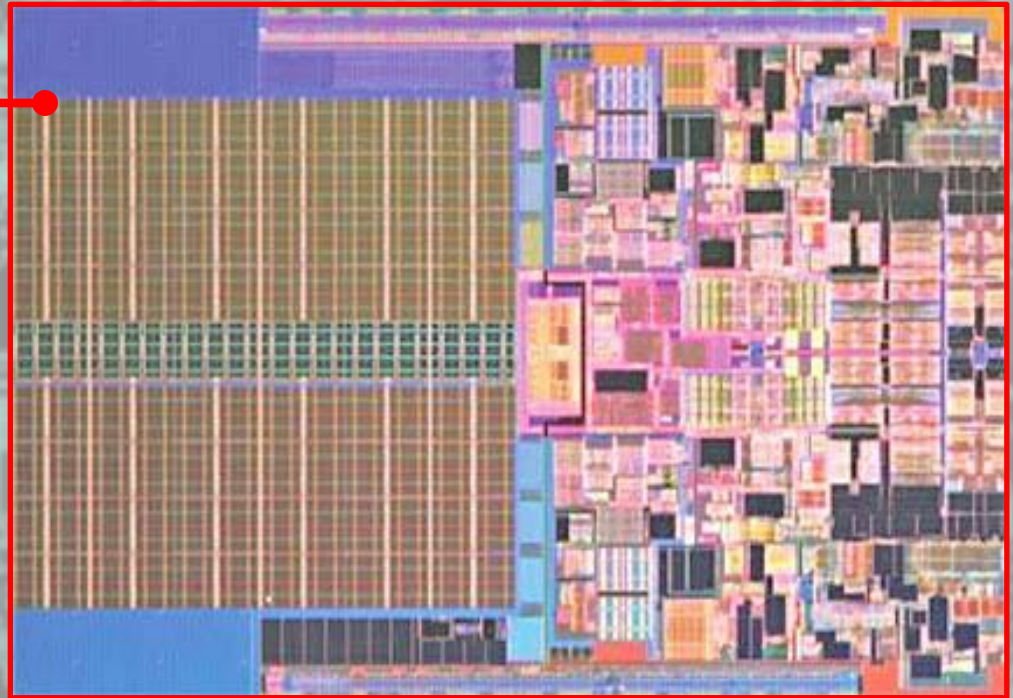
The CPU

Have you ever wondered what 410 million transistors on circuitry so dense it is equal to a map of every street in the U.S. miniaturized down to less than 1 centimeter square looks like?

And this is an obsolete Intel Core 2 Duo.

CPUs have progressed to the point that only other Super CPUs can design them, kind of like the Terminator.

Scary isn't it?



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

The CPU

The CPU is like the engine of your car. It makes everything go, but without hundreds of other systems supporting it, the CPU is as dumb as the sand from whence it came.

Many PC sellers try to fool people into buying the fastest CPU. But if the Motherboard, Drives, Memory and Graphics are junk, the CPU can not do its job properly.

Just imagine if you tried to race a car with a huge amount of horsepower, but it had skinny tires. You would go nowhere fast and crash at the first corner.

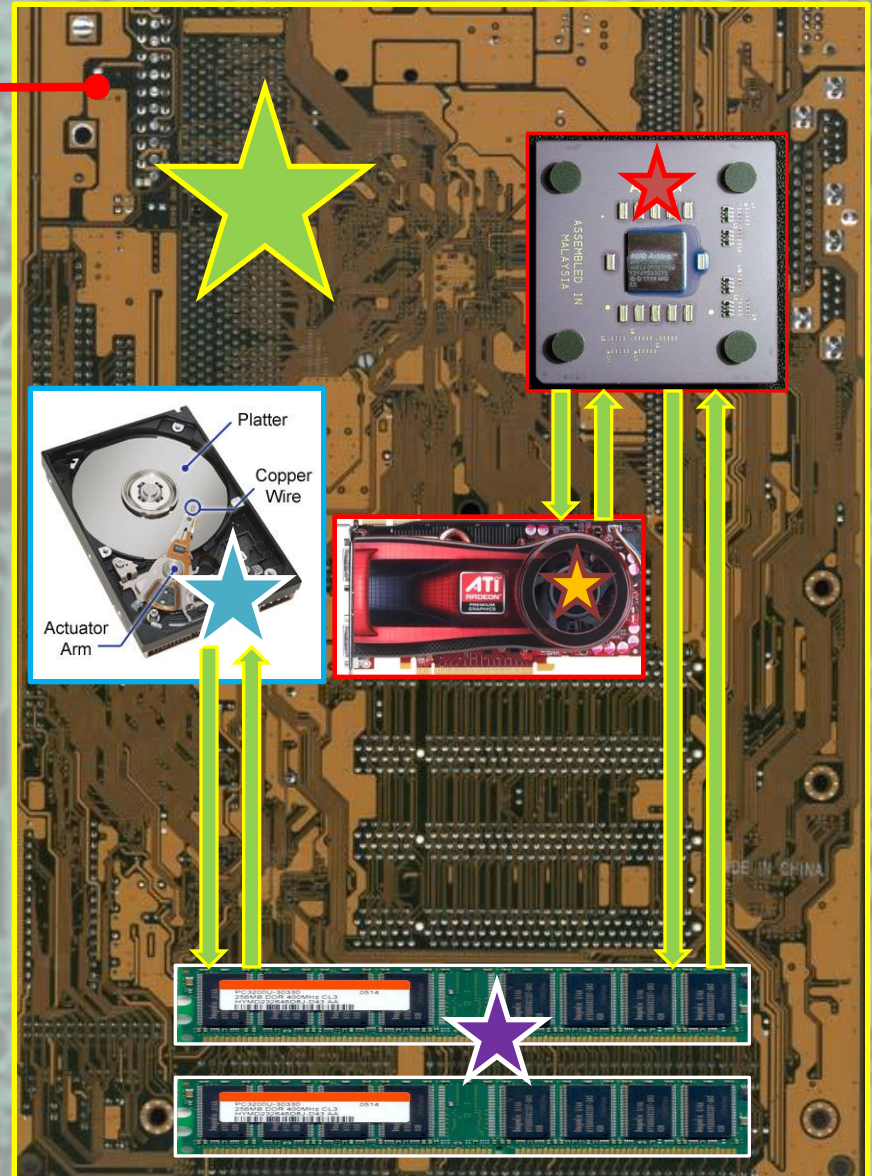


EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

The CPU

When one is building a computer the slowest part is the weakest link. This is commonly referred to as a 'bottleneck'.

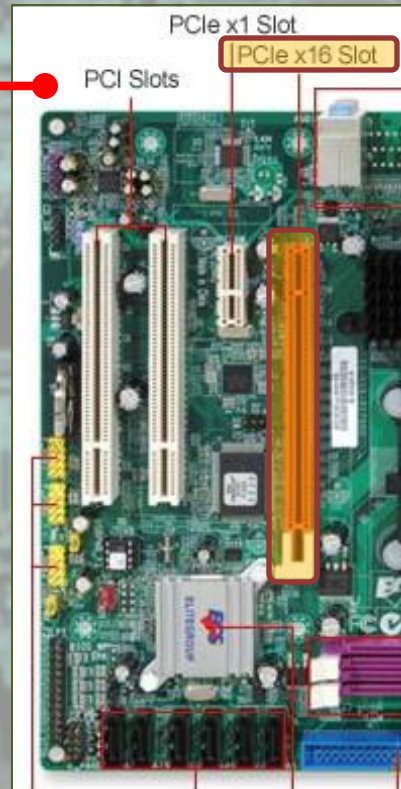
One needs fast Motherboard circuitry (referred to as the Front Side Bus or FSB), Memory speed, Drive speed and a Graphics Processing Unit (GPU) to give the CPU the ability to flex its muscles. Typically the CPU is bottlenecked by the rest of the system.



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Graphics Processing Unit

The GPU is the part of the computer that draws on the screen. A long time ago it was determined that it is much better to have a specialized mini computer on a card (or a chip) to handle all of the graphics. This frees up the CPU to do the heavy thinking. The most popular GPU's are made by Nvidia – GeForce or AMD – Radeon. And there are very expensive GPU's made for professional use such as engineering or digital content creation (movies and games).



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

Graphics Processing Unit

For many people an on the Motherboard or Integrated Graphics Chip is just fine. If you do graphics or play games, A good GPU is one of the most cost effective ways to upgrade your computer. This is me comparing the speed of my old 9600 GPU in red to my new 465 in green. Laptops usually can not upgrade the GPU, so look before you buy.

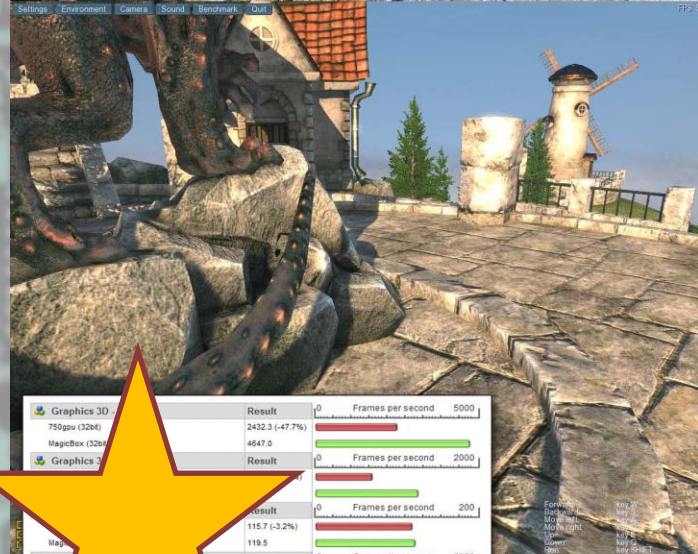
For professional work some GPUs can cost more than the computer they are plugged into.



DirectX-11

Notice the spikes on the dragon's tail, the cracks between the stones the roof tiles, The circular window over the door.

45 frames/sec



DirectX-9

The spikes on the dragon's tail are smaller, the cracks between the stones look painted on, the roof tiles are flat, The circular window over the door is flat.

63 frames/sec



Geforce 9600GT = Red
Geforce 465GTX = Green
465 is better at simple 3D

EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

How it all works

The CPU thinks in clock cycles. It is like a very limited person that can do things extremely fast. Let us look at the schedule of a typical CPU cycle.

- 12:00- Read the Mouse
- 01:00- Write the Mouse to RAM
- 02:00- Read the Keyboard
- 03:00- Write the Keyboard to RAM
- 04:00- Read the Hard drive to RAM
- 05:00- Write the RAM to the Hard drive
- 06:00- Try to figure out what that idiot pounding the keyboard wants
- 07:00- Tell the GPU to draw something
- 08:00- Read the Internet
- 09:00- Tell the sound chip to beep
- 10:00- Send a bit of power to all the components
- 11:00- The cycle is almost over, I better crunch a few numbers
- 12:00- Lather, Rinse, Repeat



EVERYTHING YOU EVER WANTED TO KNOW ABOUT COMPUTERS

How it all works

Smart Phones, Tablets and MP3 players are a special breed of computers that are usually powered by a System On a Chip or SOC. Apple makes their own SOCs and another popular brand is made by ARM in England. Inside they work just like any other Mainframe, Desktop or Laptop.

Most of these smaller devices do not have hard drives and use non-volatile memory much like a Solid State Drive. A regular Hard drive is 3.5 inches, Laptops use 2.5 inch drives, but iPods and other MP3 players use 1 inch Hard drives.

It amazes me that a drive the size of a Quarter can hold more information than the entire computer network that I used to manage in my engineering office back in the 1990's



EVERYTHING YOU EVER WANTED
TO KNOW ABOUT COMPUTERS

(Are you still sorry you asked?)

protosynthethos

Synthesizing Prototypes is our Ethos

protosynthethos – 2015
Cort Anthony Byron – Graphic Designer