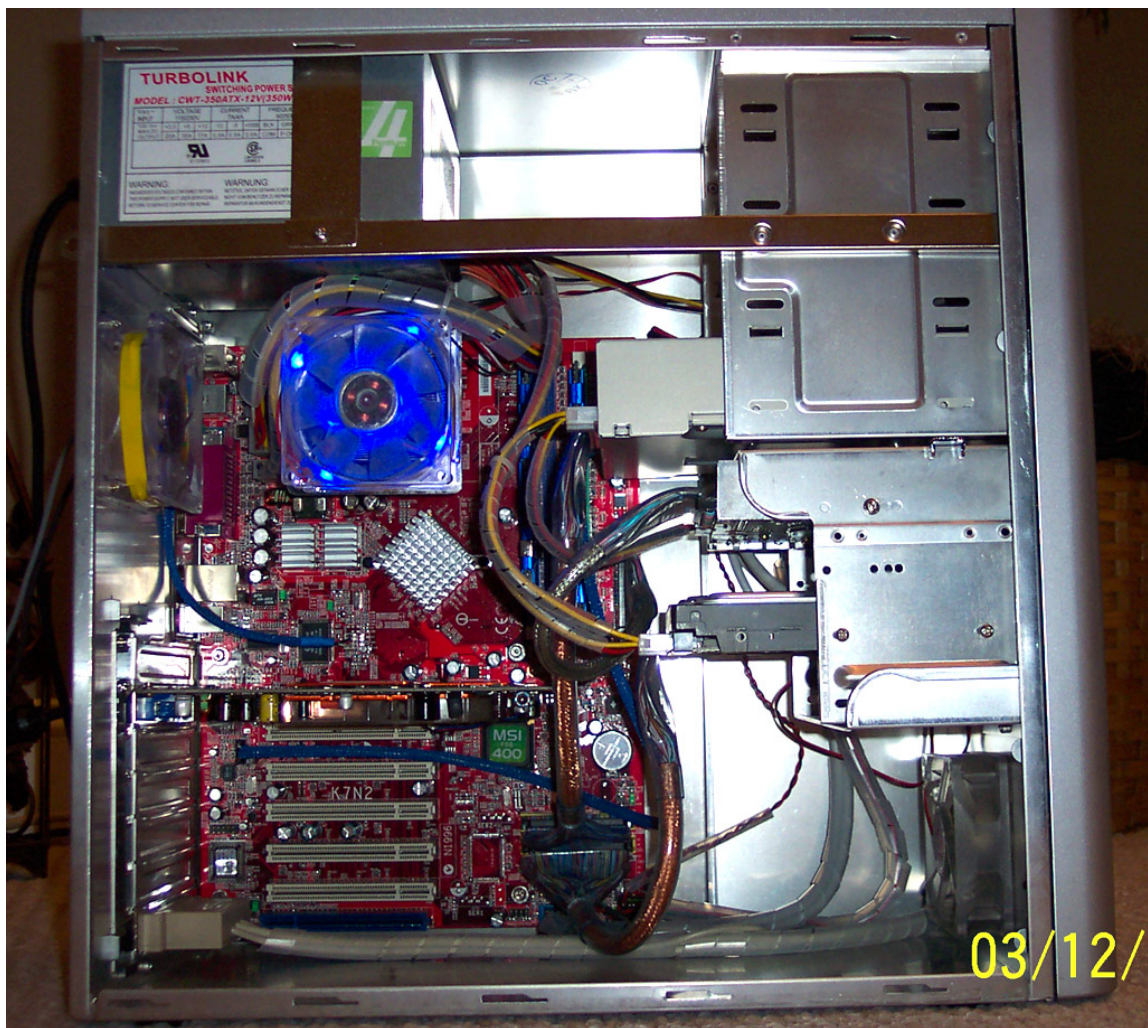# Computers - What's Inside?

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INTRODUCTION:

Computers have become virtually ubiquitous (now that's a good vocabulary word!) in our world. You probably use them and rely on them daily, maybe without even realizing it! Modern computers are extremely small, extremely powerful and seemingly extremely complicated. However, at their very core they rely on "simple" electrical switches and four main components: input, processing, storage, and output. In this week's lab, we will be exploring the world of computers, their history, what they do, and how they do it. After a short presentation you will carry out a computer dissection to take a look at "what's inside".

MANY THANKS TO DAN STEVENS FOR LEADING THIS LAB AND FOR HELPING TO TEACH THIS MODULE.

PURPOSE:

To answer the following questions:

1. When and how were the first computers invented?

   The very first computer was fully operational in 1943, named ENIAC which is short for Electronic Numerical Integrator And Computer, built for calculating missile trajectories. It Consisted of 17,468 vacuum tubes, weighed 30 tons, 5 million hand assembled joints.

2. What single trend has had the greatest impact on computer design?

   The event that had the greatest affect on the hardware design was when the transistor was invented. The single event that completely changed computers software design was when Apple inc. released the very first graphical user interface and mouse, replacing the standard command line interface.

3. What parts make up each of the 4 main components of a computer?

   The Microprocessor, Disk Drive, Graphics controller, and Memory (RAM).

4. How do all of these parts fit together and communicate?

   The microprocessor and Memory (RAM) are always located on the system board, the graphics controller can either be a separate card or integrated on the system board, and the disk drive is always a separate component that can be located in the computer boxing or be external. The microprocessor communicates with all other major components through wires which are imbedded in the system board, (a ribbon cable connects the hard drive with the system board).

MATERIALS & EQUIPMENT:

- ❏ Personal Computer Tower
- ❏ Screwdrivers
- ❏ Tweezers
- ❏ Pliers
- ❏ Ruler

PROCEDURE:

PART 1:

Listen to Dan Stevens' presentation and take LOTS of notes.

PART 2:

1. Work with your team to dissect your computer tower.
2. Identify, measure, and draw the following parts:
   a. Microprocessor
   b. Disk drive
   c. Graphics Controller
   d. Memory
3. Be sure to write down any observations

DATA, NOTES, AND OBSERVATIONS:

History:

1943- First Computer, used to calculate the trajectories of bombs for the government

Consisted of 17,468 vacuum tubes, weighed 30 tons, 5 million hand assembled joints called ENIAC

Parts:

Microprocessor -----------------

Disk Drive --------------------
                                System Board
Graphics-----------------------

Memory (RAM) -------------

A current typical personal computer:

512 MB - 1 GB of RAM

500 GB hard drive space

Microprocessor:

Bit = A 1 or 0

Byte (primary basic unit) = 8 bits

Kilobyte = 1,024 Bytes

Megabyte = 1,024 Kilobytes

Gigabyte = 1,024 Megabytes

Terabyte = 1,024 Gigabytes

The microprocessor speed or "frequency" is the number of cycles the computer can do, how many calculations it can do. A gigahertz is unit of microprocessor speed.

The microprocessor was developed by Ted Hoff who worked for intel, it contained 2,300 transistors and had the equal power of ENAIC

The personal computers were always intel based (PC's), intel did something to make the computers personal.

Hard Disk:

Information was first was stored on tape

Then on a spinning disk

And in some iPods apple is using flash memory storage

The files on a hard disk are read and interpreted magnetically, not by a laser like a DVD player.

Moore's Law:

Moore was the co-founder of intel, he hypothesized that about every two years (18 months) the amount of microprocessors should double in the same amount of space. So far this is true. One debate is if there is a limit of how many processors you can fit in a certain amount of space.

Graphics Card:

The ability to see things on your computer, the ability to generate and manipulate visual images. And to turn information in binary format (0's and 1's) into visual images.

Memory (RAM):

-DRAM

-Has to periodically refresh
-Randomly access memory

-Flash

-When powered off, data stays
-Usually found in phones, cameras, printers and some MP3 players

Operating System:

The operating system tells the computer what to do, it turns the commands (copy, paste, print, save, open, locate) into buttons you can easily access. An example of operating systems are: Window's XP, Windows Vista, Mac OS X, Linux and many more. I came up with a very good way to remember the operating system. You can think of the operating system as being built over the commands, however with the newest computers the companies have eliminated the older way of computers, and now have only the operating system.

<u>Inside the Computer</u>

I noticed that the computer has a lot of empty space. This is because the internals of the computer get very warm and need the air from the fan to circulate through the computer, the reason it gets so hot is because some of the energy that is traveling through the computer is lost and given off as heat. One of the reasons intel was not able to make any more of there computers at higher generations was because in testing they got too hot and could potentially damage the computer. The reasons the outside of the computers are outlined with metal is because the computer gives off a great deal of electromagnetic rays that can be harmful. All of the major parts of the computer are on the system board. They have space for expansion such as adding more memory.

Drawings and measurements of the four main components are attached

DATA ANALYSIS AND RESULTS:

In this lab I first viewed a presentation given by a volunteer about the history of computers, and how they work. We began by discussing the types of computers and how they differ from each other. For instance most current Macintosh computers and Dell computers differ from each other because they use different operating systems. We then moved onto discussing the first computer and it's properties. ENIAC the first computer consisted of 17,468 vacuum tubes, weighed 30 tons, and had 5 million hand assembled joints.

In spite of it's massive size ENIAC (Electronic Numerical Integrator And Computer) was only operational half of it's life. Mostly during power up and shut down the vacuum tubes would become too hot and would either break, or malfunction. Later on we discussed the typical personal computer today, which is 512 MB - 1GB of Memory (RAM) and a 500GB hard drive. The computer I am working on now has 768MB of Memory (RAM) and only a 60GB hard drive, however this is a laptop.

We discussed the major components of a computer, the Microprocessor, Memory (RAM), Graphics Card, and the Hard Drive. These units are the key building blocks of a computer. We later discovered what each of these components did in the computer. The Microprocessor is in a sense the computers speed. How many calculations the computer can do in a certain amount of time. The units of microprocessor speed are Megahertz or Gigahertz, for example my Microprocessor speed is 1.33 GHz (Gigahertz) which is 1,333,333,333 cycles per second.

The Hard Disk is where all of the information is stored in binary format (0's and 1's). Originally data was stored on tape, but is now stored on a hard disk. Another method of story information is flash memory, which is most commonly found in digital cameras and in some of the smaller iPods. Flash memory also provides speed, which is a component that is very useful in cameras and USB drives. Noise is another very attractive qualities of flash memory. However the cost of flash memory is much higher than any type of Hard Disk.

Then we learned about Moore, who was the co-founder of Intel. Gordon E. Moore proposed a theory that about every two years (18 months) in the same amount of space the performance of microprocessors will double. This is also true for memory capacity, the amount of memory that can be stored on a disk will double in the same amount of space. One debate however is if there is a limit to how many microprocessors you can fit in one space, because with the performance doubling the heat given off would increase and after a certain amount of microprocessors heat could damage the computer.

He later explained what a Graphics card does, and how it is important to a computer. A graphics card displays the information onto output devices such as a monitor. And finally he explains what Memory (RAM) is. Essentially Memory is temporary storage. When you have multiple applications open there stored on your Memory (RAM). So when you have more applications open than your RAM can hold it starts to save to applications to the Hard Disk. And when that happens it takes longer to access the application and switch between others. One of the ways you can tell when you don't have enough RAM is when your computer is very slow put your ear up to it and if you can hear what sounds like a disk spinning you need to buy and physically install more RAM.

QUESTIONS TO CONSIDER:

Why is Moore's law so important?

Because we can predict in the future how much a typical computer will cost and how many microprocessors there will be in a certain amount of time. It also allows computer technicians to predict the speed of computers in the future to help make products that properly fit the computer.

How do computers get input? Be specific.

Information is inputed into the computer by the mouse, keyboard, microphone, tablet, touch screen, and camera. All of these devices input information into your computer. The computers operating system works with the BIOS (Basic input output system) to process the inputted information.

How do computers deliver information (i.e. output)? Be specific.

Information is outputted from the computer by speakers, printers, and monitors or any other device that can receive information as a result from a process of computer.

What are transistors and why are they important to computers?

Transistors are small inexpensive devices that can be used for amplification, switching and voltage regulation. They replaced the vacuum tubes in the computer which generated enormous amounts of heat, were bulky and very unreliable. When the transistor was invented it allowed the miniaturization of computers, allowed faster and more reliable computers

What is binary code?

Binary code is a set of instructions for the microprocessor that are in a binary form (1's and 0's).

What is a bit? What is a byte?

A bit is one binary digit, either a 0 or 1, and a byte is a sequence of 8 bits.

What is ASCII?

ASCII is a mapping specification for converting letters and digits into binary format. When you type a letter or number on your computer the operating system locates the letter or number on an ASCII table and based on what it finds on the table converts it to binary format.

HINT: Use the web links below for help.

CONCLUSIONS:

I learned how all the pars of a computer fit together. I learned the essential parts of a computer. I learned why a computer has a lot of empty space in it. I learned why the computers are outlined in metal. I learned the actual definition of RAM. I learned how to dismantle a computer. I learned what computers were like in the twentieth century. I learned how computers went from 30 tons to 5 pounds. I learned what discoveries and inventions had to occur to have the computers we have today. I learned what binary format is.

I learned what roles each of the primary parts of the computer play in. I learned how an operating system fits in to the computer. I learned how computers save information. I learned computers transform letters and numbers into binary format. And finally I learned what specific inventions had to take place to allow computers to miniaturize. This lab did not trigger and additional questions.

WEB LINKS:

http://www.kids-online.net/learn/c_n_l.html

http://educate.intel.com/discover/JourneyInside/TJI_Intro/default.aspx