



Educational Series

Episode 1: How do I turn this thing on?

Transcript

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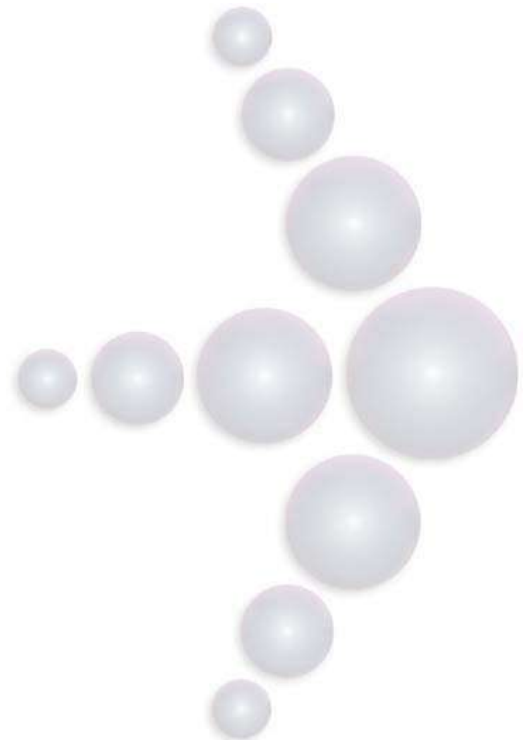




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Introduction

Who is this for?

This document is for people who do not possess basic computer knowledge or experience. As the title “How do I turn this thing on?” suggests, this document contains a very basic view of computers and how they work. The goal is to help bring someone, who might be classified as computer illiterate, up to speed with the modern day personal computer. This information was originally created for a short educational video. If you are interested in purchasing the video, please contact sales@dktek.com.

Where to get more information

There are many places that one can go to gather more information on the topics discussed in this document.

- Internet websites such as www.dktek.com, www.cnet.com, www.microsoft.com, www.tomshardware.com, www.thescreensavers.com, www.techtv.com
- Tech TV is an excellent resource for both beginner and advanced computer users.
- The magazine rack at your local supermarket.
- User groups in your city/town.
- The local computer store.

The Bits

To start things off, we must talk about the light switch on the wall of the room you're currently in. If you take away all the brand names, acronyms and general hoopla that surrounds computers it all comes down to two things: on and off. You see, the way computers work is by manipulating electricity. A voltage of almost nothing represents the value ZERO. A significant measurable voltage represents the value ONE. That is why you may have heard someone say it all comes down to ones and zeros. It is kind-of similar to Morse Code where messages are transmitted over a wire with a series of dots and dashes. Computers represent characters, numbers and symbols by patterns of ones and zeros. Each one or zero is called a BIT.

To make it possible for humans to communicate with each other when talking about computers, we needed a mathematical system. The binary number system only has two digits rather than the ten that most people are used to. To count from 0 to 10 in binary it is best to think of the odometer in a car with only two digits possible in each position. In binary you would count to ten like this: 0000, 0001, 0010, 0011, 0100, 0101, 0110, 0111, 1000, 1001, and 1010. Mathematically this works out to 2^n where n represents the position of the digit starting from the right-most digit. So to determine the largest number you could represent with 8 binary digits you would calculate $2^8 + 2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0 = 256$. Of course you have to remember that little rule you learned in school: “Anything to the 0th power is equal to one”.

The value 256 or eight binary digits (called a BYTE) is a significant number when it comes to computers. In July 1960, Bob Bemer of IBM described a communication method for which machines could communicate with machines¹. Later ASCII (American Standard Code for Information Interchange) was born. Without an international standard, we would have had a very difficult time getting computers and other technology to communicate with each other. ASCII is based on the concept that eight bits are capable of representing 256 unique patterns. With 256 patterns, it is possible to represent every character in the English alphabet for both upper and lower case characters and more. Interestingly, one half of a byte is called a nybble².

¹ <http://www.bobbemer.com/ASCII.htm>

² <http://info.astrian.net/jargon/terms/n/nybble.html>



As computers progressed through the years, the amount of information that could be stored and manipulated by a computer began to increase substantially. This phenomenon still continues today in that every time you look at an advertisement for a computer, it has way more power and can store way more information than the computer that you just purchased a couple months ago. If you are new to computers and are thinking of purchasing one, this is one fact that you will need to get used to real fast.

Prefixes for measurement (Byte/Hz)

To make communication easier when discussing how much storage space the computer has, prefixes are used. As mentioned above the basic unit for a value that a computer can store is called a byte. If you have a thousand bytes, you have 1 kilobyte. If you have a million bytes, you have 1 megabyte. If you have a billion bytes then you have 1 gigabyte. If you continue past one trillion bytes, you are talking about terabytes.

The same is true for the measure of frequency or clock speed. The main unit of frequency is Hertz and you will commonly hear people referencing the speed of a computer in Gigahertz. This measurement usually refers to the clock speed of the CPU or Central Processing Unit, which is the heart of the computer. The other measurement you may hear quite often is the speed of the system bus. The system bus is the highway that information travels down when the components that make up a computer communicate with each other.

The Computer

Personal computers, or PCs, are composed of some basic pieces that are similar between various brands or makes of machines. These important components are: Motherboard, Memory, CPU, Hard Drive, Removable Disks, Video Card, Sound Card and Network Card. We will discuss each of these pieces in more detail.

The Motherboard

A Computer's motherboard is the place where it all comes together. Each component of the computer attaches in some way to the motherboard and it allows them to communicate with each other. Some important aspects of the motherboard are size, bus speed and the number of expansion slots. The size of the motherboard is important because it needs to fit inside the case that holds all the computer's components. Although most cases accept many different sizes of motherboards, it is possible to have a case where the motherboard is too large or too small to fit properly.

The bus speed of the motherboard is important because the faster the system bus, the faster the information can be transmitted between the computer's memory, CPU and peripheral devices. It is important to keep in mind that the components that connect to the motherboard, such as the CPU, memory and hard drives also need to be compatible with the speed of the system bus. In other words, you can't go too fast or the components will not be able to communicate.

The number of expansion slots on a motherboard is important depending on how the computer will be used. For a home computer user, it is nice to have several expansion slots so that the computer can be upgraded and new components added as the needs arise. If the computer has a very specific purpose, like a server in a corporate environment, it is not as likely that people will require as much room for peripherals because the computer will not be taking advantage of the latest video games or digital photo editing gear.



Memory & Hard Drives

Both Memory and Hard Drives are similar in that they both provide storage space for the computer to keep the information and code that makes it work. The most obvious difference is that memory is only temporary storage and a hard drive is considered to be permanent storage.

Everything that a computer does happens in memory. The software programs that are run to do personal finances, surf the Internet and even play games must first be loaded into memory, usually off the hard drive. This is because the computer is so fast at doing what it does; it needs some very high-speed storage space to hold on to everything it is working with. A hard drive is, comparatively, very slow. In fact, computers are getting so fast that hard drive manufacturers are having a difficult time keeping up. Why don't we just load our computers up with lots and lots of memory and not worry about spending money on hard drives? The reason is that memory is volatile. Once electricity is gone, so is all the information that was stored in the memory. Although hard drives are much slower, they retain the information even without electricity for a very long time.

You can think of memory as the surface of your desk, the hard drive as a filing cabinet and yourself as a computer. When you wish to work on a document, for example, you go to the filing cabinet and look for the correct folder. Then you remove the contents of the folder, and go back to your desk. You work on your desk with the document until you are done, then you go back to the filing cabinet and put the document back in the correct folder. This metaphor also helps to clarify why people should organize things on their hard drive properly. If you do not, it makes it very hard to find what you are looking for.

CPU

The Central Processing Unit, or CPU, also known as the processor, is the heart of the computer. This is where all the very sophisticated technology comes into play. Many years ago, when computers were made up of wires and vacuum tubes, it took an entire room full of hardware to make up a computer that was no more powerful than a simple calculator today. With the invention of the microchip, the entire room and much more can be placed inside a piece of silicone no larger than a dime.

With modern processors, there are trillions of little circuits inside that are so small you need a microscope to view them in detail. When electricity flows through these small circuits, there is a great deal of heat generated. That is why computers have several electric fans including at least one on the processor itself. Computers work much better when they stay cool. The CPU can be considered the "brain" of the machine.

Removable Disks

When we refer to removable disks, we are talking about technology similar to a hard drive, but at a smaller level. For example a 3.5-inch floppy disk is similar to a hard drive in function, but is only the size of a shirt pocket and cannot contain very much information. A CDROM on the other hand is a bit larger, but it can hold a great deal more information and is more stable and permanent than a floppy disk. Both of these types of media can be easily removed from the computer and stored elsewhere. A hard drive is usually installed inside the computer and is not easily removable.

Another form of removable media is called Flash Memory. This type of memory is very common in digital cameras, MP3 players and Personal Digital Assistants like the popular Palm Pilots. You can even purchase a device called a thumb drive which works exactly the same as a floppy disk drive except there are no moving parts. Flash memory is a special type of Random Access Memory that is not volatile when electricity is removed. It is much slower than regular computer memory, but it has the advantage of being able to "remember" the information after it is removed from the device that stored the information on it.



Audio & Video cards

As mentioned above, some of the other devices that make up a computer include expansion cards to handle specific tasks that the CPU is not designed to do. Although some motherboards have Audio and Video technology built right into them, most people choose to “upgrade” these components by purchasing higher quality expansion cards.

A video card processes the information that the computer is going to display on the computer's monitor or screen. The information is converted to a signal that the screen understands and can display properly. The more expensive video cards have special 3D graphics processors on them and can render realistic three dimensional graphics in real time. Other video cards have the capability of processing cable or satellite signals so that you can record T.V. shows and also input information from a video camera or other video source. These cards make it possible for people to edit their own home movies and some of them even have a special interface to record live T.V. broadcasts the same way a VCR does.

Almost all computers have some sort of capability to reproduce sound. Generally, a home computer has a separate audio card that gives the computer special audio capabilities such as playing music and even environmental audio signals for really sophisticated video games. Many audio cards provide the ability to input and output a special signal called MIDI (Musical Instrument Digital Interface) that allows the computer to communicate with a digital keyboard or other musical instrument.³

USB (Universal Serial Bus)

Computers generally have several different ways of connecting peripheral components without having to open up the computer or even touch a screwdriver. Some of the oldest connections are called Serial and Parallel connections. Serial connections are generally used for input devices such as a computer mouse and parallel connections are generally used for printers, although the number of other devices that have been used for either of these interfaces are numerous. A newer technology known as USB provides high speed serial connectivity with several other benefits. One of the main benefits is that multiple devices can be used in a USB port by connecting a simple device called a USB HUB. Another benefit to this interface is that the instructions on how the computer communicates with the USB device can be provided by the device over the USB connection. In other words if you plug a USB device, such as a digital camera into your computer, the computer should instantly recognize the device and configure itself to communicate with that device.

Fire Wire

Some computers have a very high speed interface called FireWire, IEEE – 1394 or i.LINK. This interface provides a very high speed connection to the computer for devices like digital video cameras and other consumer electronics. It is similar to USB in that the computer can recognize a device attached to this port and configure itself automatically.⁴

Networking

Networking is simply the connecting of multiple computers together so that they can communicate with one another. The most widely installed local area network technology is called Ethernet. It allows computers to communicate at speeds of 10 or 100 megabits per second, the latter is generally referred to as Fast Ethernet. When computers are connected together in one localized area such as an office it is commonly referred to as a LAN (Local Area Network). If multiple LANs are connected together such as separate office locations in one city, it is commonly referred to as a WAN (Wide Area Network). With the

³<http://www.borg.com/~jglatt/tutr/whatmidi.htm>

⁴http://www.firewire-1394.com/what_is_firewire.htm



Internet, you have millions of computers all around the world connected together. This is a very large network, but much of the technology that is used is similar to LAN and WAN technology only on a much larger scale.

You can use wireless technology to connect computers and other devices such as cell phones and PDAs together. The "rules" that these devices use to communicate with each other is called a protocol and since the communication is wireless, it is called WAP or the Wireless Access Protocol.

Security

When computers are connected together, especially over the Internet, it is a MUST to have a Firewall installed on every computer that has a direct connection to the Internet. A Firewall is a piece of software or hardware that monitors all network communication and can disallow any communication that is not permitted by the owner of the computer.

There are many people in the world that try to take control of computers that are connected to the Internet to do malicious things. These people are commonly referred to as Hackers or Crackers and people can debate for hours over what each name means. A firewall can help to prevent Hackers from accessing a computer over the Internet, but there are other things that should be done as well. Some of the simplest methods are ensuring that access to your computer requires a password that is more complicated than a simple word or person's name. The best passwords are made up of words, numbers and symbols so they become very difficult to guess. Another thing that computer owners should do to prevent Hackers from accessing their computers is to be aware of running software on the computer that they are not familiar with. This can happen even without the computer owner realizing it by means of a Trojan Horse. Just like in the age old story of the Trojan Horse, Hackers can trick people into opening Email attachments that are actually programs which give the Hacker access to the person's computer. Other programs that are commonly referred to as computer viruses can actually cause damage to the person's computer by deleting files and changing computer settings. It is very important to not open any Email attachments unless the person knows exactly what they are doing. There are a number of companies that have created Anti-Virus programs that a person can run on their computer. These programs monitor all activity on the computer and can detect most viruses before they cause any damage. Because new viruses are created almost every day, it is important to keep these anti-virus programs up-to-date. This is accomplished by installing the latest virus definition files provided by the company that created the software.

Summary

When it comes to computers, the topic is so incredibly large that it can take years to learn. On top of that, technology keeps changing every day so it is impossible to be very knowledgeable in every aspect of computers. A newcomer to computers must simply acquire a basic understanding of computers and proceed to learn what they feel is relevant to their interests.

I hope that the information provided here has been valuable to you and I encourage you to explore the exciting world of computers. No matter what your age, race, religion or sex there is an area of computers that you will find fascinating, or might help you with your career or hobby. Just think, next time you want to go and buy a particular product that you do not know that much about, you can go onto the Internet and find out more information than you ever wanted to know about that product and then make an intelligent buying decision. Enjoy life and technology, but be safe.