Introduction to how pcs work

Business, Work

When you mention the word " technology," most people think about computers. Virtually every facet of our lives has some computerized component. The appliances in our homes have microprocessors built into them, as do our televisions. Even our cars have computers.

But the computer that everyone thinks of first is typically the personal computer, or PC. A PC is a general-purpose tool built around a microprocessor. It has lots of different parts -- including memory, a hard disk, a modem, and more -- that work together. " General purpose" means that you can do many different things with a PC. You can use it to type documents, send e-mail, browse the Internet and play games. PCs trace their history back to the 1970s, when a man named Ed Roberts began to sell computer kits based on a microprocessor chip designed by Intel. Roberts called his computer the Altair 8800 and sold the unassembled kits for $395.

Popular Electronics ran a story about the kid in its January 1975 issue, and to the surprise of just about everyone, the kits became an instant hit and the era of the personal computer began [source: The Computer History Project]. A few years later, the dynamic duo of Steve Jobs and Steve Wozniak unleashed the Apple II computer on the world. From that point on, the personal computer really began to take off. Other manufacturers followed suit, and soon there were computers from Commodore, Atari and Texas Instruments. Not long after the debut of the Apple II, IBM got into the personal computer game. Today, when someone says PC, chances are they mean a machine running on the Microsoft Windows operating system with an x86-compatible microprocessor. While Apple Macintosh computers are technically personal computers, most people wouldn't call them PCs.

In this article, we will talk about PCs in the general sense and all the different parts that go into them. You'll learn about the various components and how they work together in a basic operating session. You'll also find out what the future may hold for these machines. PC Parts Let's take a look at the main components of a typical desktop computer: • Central processing unit (CPU) - The microprocessor " brain" of the computer system is called the central processing unit. It's a chip that holds a complete computational engine. It uses assembly language as its native language. Everything that a computer does is overseen by the CPU.

• Memory - This is very fast storage used to hold data. It has to be fast because it connects directly to the microprocessor. There are several specific types of memory in a computer: • Random-access memory (RAM) - Used to temporarily store information with which the computer is currently working • Read-only memory (ROM) - A permanent type of memory storage used by the computer for important data that doesn't change • Basic input/output system (BIOS) - A type of ROM that is used by the computer to establish basiccommunicationwhen the computer is first powered on • Caching - The storing of frequently used data in extremely fast RAM that connects directly to the CPU • Virtual memory - Space on a hard disk used to temporarily store data and swap it in and out of RAM as needed • Flash memory - a solid state storage device, Flash memory requires no moving parts and retains data even after the computer powers off • Motherboard - This is the main circuit board to which all of the other internal components connect. The CPU and memory are usually on the motherboard. Other systems may be found directly on the motherboard or connected to it through a secondary connection. For example, a sound card can be built into the motherboard or connected through an expansion slot. Power supply - An electrical transformer regulates the electricity used by the computer.

• Hard disk - This is large-capacity permanent storage used to hold information such as programs and documents. Traditional hard drives contain moving parts -- the drive has platters on which it stores data. The drive spins the platters to record and read data. But some newer hard drives are flash-based with no moving parts. These drives are called solid-state drives. • Operating system - This is the basic software that allows the user to interface with the computer. • Integrated Drive Electronics (IDE) Controller - This is the primary interface for the hard drive, CD-ROM and floppy disk drive.

Accelerated Graphics Port (AGP) - This is a very high-speed connection used by the graphics card to interface with the computer. • Sound card - This is used by the computer to record and play audio by converting analog sound into digital information and back again. • Graphics card - This translates image data from the computer into a format that can be displayed by the monitor. Some graphics cards have their own powerful processing units (called a GPU -- graphics processing unit). The GPU can handle operations that normally would require the CPU. • Ports - In computer hardware terms, a port is an interface that allows a computer to communicate with peripheral equipment. • Real-time clock - Every PC has a clock containing a vibrating crystal.

By referring to this clock, all the components in a computer can synchronize properly. • Complementary Metal-oxide Semiconductor - The CMOS and CMOS battery allow a computer to store information even when the computer powers down. The battery provides uninterrupted power. • Fans, heat sinks and cooling systems - The components in a computer generate heat. As heat rises, performance can suffer. Cooling systems keep computers from overheating. PC Connections A typical computer connects to the world around it in three different ways: input/output devices, ports and networking.

No matter how powerful the components inside your computer are, you need a way to interact with them. This interaction is called input/output (I/O). The most common types of I/O in PCs are: • Monitor - The monitor is the primary device for displaying information from the computer. • Keyboard - The keyboard is the primary device for entering information into the computer. • Mouse - The mouse is the primary device for navigating and interacting with the computer. • Removable storage - Removable storage devices allow you to add new information to your computer very easily, as well as save information that you want to carry to a different location. There are several types of removable storage: o CD-ROM - CD-ROM (compact disc, read-only memory) is a popular form of distribution of commercial software.

Many systems now offer CD-R (recordable) and CD-RW (rewritable), which can also record. CD-RW discs can be erased and rewritten many times. o Flash memory - Based on a type of ROM called electrically erasable programmable read-only memory (EEPROM), Flash memory provides fast, permanent storage. CompactFlash, SmartMedia and PCMCIA cards are all types of Flash memory. o DVD-ROM - DVD-ROM (digital versatile disc, read-only memory) is similar to CD-ROM but is capable of holding much more information. You may use Bluetooth or Wi-Fi to sync yourmusicplayer or print driving directions, but many computers still have ports to help you connect to a wide selection of peripherals. While there have been others, two are most commonly found on newer computers: • Universal Serial Bus (USB) - The most popular external connection, USB ports offer power and versatility and are incredibly easy to use.

• FireWire (IEEE 1394) - FireWire is a very popular method of connecting digital-video devices, such as camcorders or digital cameras, to your computer. Networking, especially to the Internet, is very important to today's computer users. Your computer can probably use one or more of these methods: • Modem - This is the standard method of connecting to the Internet. • Local area network (LAN) card - This is used by many computers, particularly those in an Ethernet office network, to connect to one another. Cable modem - This type of modem uses the cable system in your home, like the kind you might use to subscribe to cable TV, to connect to the Internet. • Digital Subscriber Line (DSL) modem - This is a high-speed connection that works over a standard telephone line. • Very high bit-rate DSL (VDSL) modem - A newer variation of DSL, VDSL requires that your phone line have fiber-optic cables.

An even faster version called the gigabit per second DSL (GDSL) may follow [source: Cioffi, et al.]. Powering Up a PC A typical computer session begins with turning on the power. Here's what happens in that process: 1. You press the " On" button on the computer and the monitor. 2. You see the BIOS software doing its thing, called the power-on self-test (POST).

On many machines, the BIOS displays text describing such data as the amount of memory installed in your computer and the type of hard disk you have. During this boot sequence, the BIOS does a remarkable amount of work to get your computer ready to run. • The BIOS determines whether the video card is operational. Most video cards have a miniature BIOS of their own that initializes the memory and graphics processor on the card. If they don't, there is usually video-driver information on another ROM on the motherboard that the BIOS can load. • The BIOS checks to see if this is a cold boot or a reboot. It does this by hecking the value at memory address 0000: 0472.

A value of 1234h indicates a reboot, in which case the BIOS skips the rest of POST. Any other value is considered a cold boot. • If your computer is undergoing a cold boot, the BIOS verifies RAM by performing a read/write test of each memory address. It checks for a keyboard and a mouse. It looks for an expansion bus and, if it finds one, checks all the connected cards. If the BIOS finds any errors during the POST, it notifies you with a series of beeps or a text message displayed on the screen. An error at this point is almost always a hardware problem.

• The BIOS displays some details about your system. This typically includes information about the following: o Processor o Floppy and hard drive o Memory o BIOS revision and date o Display • Any special drivers, such as those for expansion cards, are loaded from the adapter and the BIOS displays the information. • The BIOS looks at the sequence of storage devices identified as boot devices in the complementary metal-oxide semiconductor (CMOS) setup. Boot is short for " bootstrap," as in the old phrase " Pull yourself up by your bootstraps. " Boot refers to the process of launching the operating system. The BIOS tries to initiate the boot sequence from the first device using the bootstrap loader. 3.

The bootstrap loader loads the operating system into memory and allows it to begin operation. It does this by setting up the divisions of memory that hold the operating system, user information and applications. The bootstrap loader then establishes the data structures that are used to communicate within and between the sub-systems and applications of the computer. Finally, it turns control of the computer over to the operating system. PC Operating Systems Once loaded, the operating system's tasks fall into six broad categories: • Processor management - Breaking the tasks down into manageable chunks and prioritizing them before sending to the CPU • Memory management -Coordinating the flow of data in and out of RAM and determining when virtual memory is necessary • Device management - Providing an interface between each device connected to the computer, the CPU and applications • Storage management - Directing where data will be stored permanently on hard drives and other forms of storage • Application Interface - Providing a standard communications and data exchange between software programs and the computer • User Interface - Providing a way for you to communicate and interact with the computer Say, for example, that you open up a word processing program and type a letter, save it and then print it out. Several components work together to make this happen: ? The keyboard and mouse send your input to the operating system. The operating system determines that the word-processing program is the active program and accepts your input as data for that program.

? The word-processing program determines the format that the data is in and, via the operating system, stores it temporarily in RAM. ? Each instruction from the word-processing program is sent by the operating system to the CPU. These instructions are intertwined with instructions from other programs that the operating system is overseeing before being sent to the CPU. ? All this time, the operating system is steadily providing display information to the graphics card, directing what will be displayed on the monitor. When you choose to save the letter, the word-processing program sends a request to the operating system, which then provides a standard window for selecting where you wish to save the information and what you want to call it. Once you have chosen the name and file path, the operating system directs the data from RAM to the appropriate storage device. ? You click on " Print.

" The word-processing program sends a request to the operating system, which translates the data into a format the printer understands and directs the data from RAM to the appropriate port for the printer you requested. ? You open up a Web browser and check out HowStuffWorks. Once again, the operating system coordinates all of the action. This time, though, the computer receives input from another source, the Internet, as well as from you. The operating system seamlessly integrates all incoming and outgoing information. ? You close the Web browser and choose the " Shut Down" option. ? The operating system closes all programs that are currently active.

If a program has unsaved information, you're given an opportunity to save it before closing the program. ? The operating system writes its current settings to a special configuration file so that it will boot up next time with the same settings. ? If the computer provides software control of power, then the operating system will completely turn off the computer when it finishes its own shut-down cycle. Otherwise, you will have to turn the power off manually. The Future of PCsSilicon microprocessors have been the heart of the computing world for more than 40 years. In that time, microprocessor manufacturers have crammed more electronic devices onto microprocessors. In 1965, Intel founder Gordon Moore predicted that microprocessors would double in complexity every two years.

Since then, the number of electronic devices put on a microprocessor has doubled every 18 months, and the prediction has come to be known as Moore's Law. Many have predicted that Moore's Law will soon reach its end because of the physical limitations of silicon microprocessors. 2008 HowStuffWorks Extreme ultraviolet lithography is the future of computer-chip manufacturing. The current process used to pack more transistors onto a chip is called deep-ultraviolet lithography (DUVL), which is a photography-like technique that focuses light through lenses to carve circuit patterns on silicon wafers. While new manufacturing techniques have extended the useful lifep of the DUVL process, before long chip manufacturers will have to use new techniques to keep up with Moore's Law. Many are already looking at extreme-ultraviolet lithography (EUVL) as a way to extend the life of silicon at least until the end of the decade. EUVL uses mirrors instead of lenses to focus the light, which allows light with shorter wavelengths to focus on the silicon wafer accurately.

To learn more about EUVL, see How EUVL Chipmaking Works. Beyond EUVL, researchers have been looking at alternatives to the traditional microprocessor design. Two of the more interesting emerging technologies are DNA computers and quantum computers. DNA computers have the potential to take computing to new levels, picking up where Moore's Law leaves off. There are several advantages to using DNA instead of silicon: • As long as there are cellular organisms, there will be a supply of DNA. • The large supply of DNA makes it a cheap resource. • Unlike traditional microprocessors, which are made using toxic materials, DNA biochips can be made cleanly.

• DNA computers are many times smaller than today's computers. DNA's key advantage is that it will make computers smaller than any computer that has come before, while at the same time increasing storage capacity. One pound (0. 45 kilogram) of DNA has the capacity to store more information than all the electronic computers ever built. The computing power of a teardrop-sized DNA computer, using the DNA logic gates, will be more powerful than the world's most powerful supercomputer. More than 10 trillion DNA molecules can fit into an area no larger than 1 cubic centimeter (. 06 cubic inch).

With this small amount of DNA, a computer would be able to hold 10 terabytes (TB) of data and perform 10 trillion calculations at a time. By adding more DNA, more calculations could be performed. Unlike conventional computers, DNA computers could perform calculations simultaneously. Conventional computers operate in linear fashion, taking on tasks one at a time. Parallel computing will allow DNA to solve complex mathematical problems in hours -- problems that might take electrical computers hundreds of years to complete. You can learn more about DNA computing in How DNA Computers Will Work. Today's computers work by manipulating bits that exist in one of two states: 0 or 1.

Quantum computers aren't limited to two states; they encode information as quantum bits, or qubits. A qubit can be a 1 or a 0, or it can exist in a superposition that is simultaneously 1 and 0 or somewhere in between. Qubits represent atoms that are working together to serve as computer memory and a microprocessor. Because a quantum computer can contain these multiple states simultaneously, it has the potential to be millions of times more powerful than today's most powerful supercomputers. A 30-qubit quantum computer would equal the processing power of a conventional computer capable of running at 10 teraops, or trillions of operations per second. To equal the top of the line in supercomputers you'd need more qubits. The Roadrunner supercomputer can run at a petaflop -- 1, 000 trillian floating point operations per second.

You can learn more about the potential of quantum computers in How Quantum Computers Will Work.