By the time you are finished with this study unit you will have gained quite a bit of knowledge, become very familiar with how a computer works, and understand how the motherboard is the main factor in determining the computer's performance and abilities.

Please be patient while this study unit's page loads. (This study unit is a large file and will take a while to download with slower Internet connections.) Some images can be viewed by clicking on them to a larger format for clarity.

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What is a Motherboard?

Naming Convention: Motherboard, Mainboard, System Board. The name Motherboard is used in this study unit, however you need to be familiar with the knowledge that the three names above are all the same thing. The motherboard is likened to the mother of the PC (Personal Computer), or caretaker/controller/holder/connection point of everything needed to run a PC.

The motherboard is the main PCB (Printed Circuit Board) in a PC that enables the integration and control of all other components and devices in a complete computer system. A motherboard can be compared to a large city with many neighborhoods, individual stores and shopping centers, storage companies, repair shops, banks, etc. The motherboard has a built-in transportation system, just as a city has connected streets, roads and highways that are used for transportation. Data and information is transported on a motherboard, via the bus, which can have numerous components branching into its roadways. In a city, we have traffic lights, stop signs and other ways of controlling vehicles and people who use the transportation system to get from place to place. If we did not incorporate ways to control traffic, we could get lost, end up with traffic jams, accidents, or other undesirable misfortunes. The motherboard incorporates a similar system to keep data and information flowing smoothly to its correct designation, and hopefully without error. (Also see BUS below.)

Usually, when you purchase a motherboard it will already contain the CPU, memory, BIOS and basic controllers that are needed for the system to operate. Some of these components can be upgraded as newer technologies evolve, but only to a point. It is better to purchase a new motherboard if you are considering a major upgrade for improved and faster performance. Note: Not all CPU's, memory, BIOS, etc., will work in all motherboards. In fact, motherboards are built and designed with a limited range of specific components that can be used in them, which are dependent upon the manufacturers design.

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What does a Motherboard look like?
Pictured here is a typical Pentium-class 430HX-chipset motherboard (Asus P55T2P4), which is labeled for identifying parts. Although this is an older board, it contains most of the components and technologies that have been used, and that are studied in this lesson. It is a good example for learning what is incorporated into motherboards, and what everything looks like.

Use it to compare its individual components when working on your computer projects, or to learn more about the structure and framework of a motherboard. An important fact to remember is that all motherboards are not the same. They may integrate some of the same technologies, but the way those technologies work together may be completely different in nature. Some can appear to be very similar, yet have hidden differences. Their appearances can vary in circuit board size, shape, design and configuration. Many manufacturers and developers use a similar blank circuit board to start (depending on the generation or form factor), but each manufacturer designs their motherboards differently, incorporating different components, parts, layouts, configurations and technologies.

(Click HERE or on image for full-sized view of the motherboard without labeling.)

## Motherboard Differences

Each motherboard is different. They can be different in design, size, shape, capabilities and configuration possibilities. Some may look the same and have subtle differences. These differences are dependent upon the form factor and manufacturer.

Back in the early days of the industry, when computers were first beginning to be introduced in the market, there were very few differences, and actually very few
motherboards available. As the industry progressed, the computer began to take on popularity for many different reasons. As with any product, when popularity begins to rise, so does its demand. Demand for a product produces competition, and if the product continues to stay popular, the competition increases. This is what happened with computers, and with the motherboard. Home-user versions were complete and out-of-the-box, and upgradeable motherboards were not available. As the industry continued to grow in popularity, newer versions were popping up faster than most could keep up with.

Soon, a new idea led to upgradeable computers, with manufacturers coming into the ring with upgradeable parts, for upgrading the computer as close as possible to the latest and greatest technologies. This especially came into play, many years later, with the advent of the Internet. New processors, memory and systems began to change as often as monthly, and the motherboard became the best way to upgrade a computer without replacing the entire unit. Complete, out-of-the-box systems continued to stay popular, but a new breed of computer users began to spring from out of nowhere, many being self-taught, that began to experiment with the insides of a computer, fixing or replacing parts to avoid having to purchase a new system, and trying to find ways to increase performance and speed. This soon led to the popularity of “build-your-own computer” users, and the new words such as TECHIE and GEEK were born into the dictionary, and those wearing the titles have come to be known as an elite and popular group.

Today, whether you are a techie, or if you hire someone to do it for you, the best and least expensive way to upgrade a computer, and get what you really want, is to purchase a new motherboard, and re-use the existing devices to make the unit complete. The other option is to buy everything new, and build a computer specific to your desires. Devices and peripherals are now individually upgraded in the same way. A slightly older computer can be dramatically changed by upgrading piece-by-piece as needed, and can also be a great pocket saver if funds for a new system are not available.

However, there are two problems that can arise from this. One is the fact that the motherboard may not fit in the existing case. The second is that the case needs to be compatible with the motherboards AT (Advanced Technologies) or ATX (Advanced Technologies Extended) standards, mainly because of connector differences, and the power supply. A few motherboards were manufactured that incorporated both AT and ATX connectors into their boards (only one, either the AT or the ATX, could be used and was dependent on the case), but the case form factor layout still had to be considered in the upgrade. As ATX became the standard, the AT began to phase out, and most motherboards were sold as only ATX. Pictured below are AT & ATX power supply to motherboard connectors and sockets. With the ATX there is only one connector as opposed to using 2 connectors in an AT motherboard.
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