Definitions

The central processing unit (CPU) of a computer is a piece of hardware that carries out the instructions of a computer program. It performs the basic arithmetical, logical, and input/output operations of a computer system. The CPU is like the brains of the computer - every instruction, no matter how simple, has to go through the CPU. So let's say you press the letter 'k' on your keyboard and it appears on the screen - the CPU of your computer is what makes this possible. The CPU is sometimes also referred to as the central processor unit, or processor for short. So when you are looking at the specifications of a computer at your local electronics store, it typically refers to the CPU as the processor.

When we start to look at the various components of a CPU and how they function, remember that this is all about speed. When we use a computer, we want the instructions to be carried out very fast. As the instructions become more complicated (for example, creating a 3D animation or editing a video file), we demand more from the CPU. Thus, the technological advances we have seen in processor technology have largely been driven by the need for speed.

Components

A typical CPU has a number of components. The first is the arithmetic logic unit (ALU), which performs simple arithmetic and logical operations. Second is the control unit (CU), which manages the various components of the computer. It reads and interprets instructions from memory and transforms them into a series of signals to activate other parts of the computer. The control unit calls upon the arithmetic logic unit to perform the necessary calculations.

Third is the cache, which serves as high-speed memory where instructions can be copied to and retrieved. Early CPUs consisted of many separate components, but since the 1970s, they have been constructed as a single integrated unit called a microprocessor. As such, a CPU is a specific type of microprocessor. The individual components of a CPU have become so integrated that you can't even recognize them from the outside. This CPU is about two inches by two inches in size.

CPUs are located on the motherboard. Motherboards have a socket for this, which is specific for a certain type of processor. A CPU gets very hot and therefore needs its own cooling system in the form of a heat sink and/or fan.

The ALU is where the calculations occur, but how do these calculations actually get carried out? To a computer, the world consists of zeros and ones. Inside a processor, we can store zeros and ones using transistors. These are microscopic switches that control the flow of electricity depending on whether the switch is on or off. So the transistor contains binary information: a one if a current passes through and a zero if a current does not pass through.

Transistors are located on a very thin slice of silicon. A single silicon chip can contain thousands of transistors. A single CPU contains a large number of chips. Combined, these only cover about a square inch or so. In a modern CPU, however, that square inch can hold several hundred million transistors - the very latest high-end CPUs have over one billion! Calculations are performed by signals turning on or off different combinations of transistors. And more transistors means more calculations. You may be interested to know that the material, silicon, used in chips is what gave the Silicon Valley region of California its name.