

What is a Processor:

A processor (CPU) is the logic circuitry that responds to and processes the basic instructions that drive a computer. The CPU is seen as the main and most crucial integrated circuitry (IC) chip in a computer, as it is responsible for interpreting most computer commands.

Functions:

CPUs will perform most basic arithmetic, logic and I/O operations, as well as allocate commands for other chips and components running in a computer.

The basic elements of a processor include:

The arithmetic logic unit (ALU), which carries out arithmetic and logic operations on the operands in instructions.

The arithmetic logic unit is divided up into two separate units, the logic unit and the arithmetic unit, which uses four logic gates, and, or, xor, not to execute simple operations, such as multiplication, addition, subtraction, and division on 8 bit binary numbers. ALUs use ripple carry adders in order to complete operations on 8 bit binary numbers. Comprised of a series of full adders, inputs are passed from one adder to the next in order to create a full sum. Each full adder consists of two half adders and one or logic gate. It takes two inputs and generates two outputs, a sum and a carry. Finally, the half adder is comprised of a xor gate and an and logic gate. The logic unit is similar to the arithmetic unit, however it accomplishes different tasks such as checking if a number is zero, or negative. In essence, the ALU is just a complex series of several basic logic gates.

The floating point unit (FPU), also known as a math coprocessor or numeric coprocessor, a specialized coprocessor that manipulates numbers more quickly than the basic microprocessor circuitry can.

Definition - What does Floating-Point Unit (FPU) mean?

A floating point unit is an integrated circuit which handles all mathematical operations that have anything to do with floating point numbers or fractions. It is a dedicated logic unit specifically designed to work on floating point numbers and nothing else, hence the name. It can be defined as a specialized coprocessor that can manipulate numbers quicker than the basic microprocessor circuitry itself.

The FPU performs simple mathematical tasks which include addition, subtraction, division, multiplication and square root. Older FPUs process transcendental functions like exponential and trigonometric calculations but these can be expensive and complicated to implement, so in modern FPUs, these are done via software library routines.

Not all computer systems have hardware FPU. Those that do not have FPU can emulate its functions in multiple ways:

In an operating system as inherent functions.

It can be emulated in the CPU as a microcode or microprogram.

Or in user code; typically this is what is called software emulation.

Registers, which hold instructions and other data. Registers supply operands to the ALU and store the results of operations.

A processor register (CPU register) is one of a small set of data holding places that are part of the computer processor.

A register may hold an instruction, a storage address, or any kind of data (such as a bit sequence or individual characters). Some instructions specify registers as part of the instruction. For example, an instruction may specify that the contents of two defined registers be added together and then placed in a specified register.

A register must be large enough to hold an instruction - for example, in a 64-bit computer, a register must be 64 bits in length. In some computer designs, there are smaller registers - for example, half-registers - for shorter instructions. Depending on the processor design and language rules, registers may be numbered or have arbitrary names.

A processor typically contains multiple index registers, also known as address registers or registers of modification. The effective address of any entity in a computer includes the base, index, and relative addresses, all of which are stored in the index register. A shift register is another type. Bits enter the shift register at one end and emerge from the other end. Flip flops, also known as bistable gates, store and process the data.

L1 and L2 cache memory. Their inclusion in the CPU saves time compared to having to get data from random access memory (RAM).

L1 and L2 are levels of cache memory in a computer. If the computer processor can find the data it needs for its next operation in cache memory, it will save time compared to having to get it from random access memory. L1 is "level-1" cache memory, usually built onto the microprocessor chip itself. For example, the Intel MMX microprocessor comes with 32 thousand bytes of L1.

L2 (that is, level-2) cache memory is on a separate chip (possibly on an expansion card) that can be accessed more quickly than the larger "main" memory. A popular L2 cache memory size is 1,024 kilobytes (one megabyte).

CPU Operations

The four primary functions of a processor are fetch, decode, execute and write back.

Fetch- is the operation which receives instructions from program memory from a systems RAM.

Decode- is where the instruction is converted to understand which other parts of the CPU are needed to continue the operation. This is performed by the instruction decoder

Execute- is where the operation is performed. Each part of the CPU that is needed is activated to carry out the instructions.

Components and how CPUs work

The main components of a CPU are the ALU, registers and control unit. The basic functions of the ALU and register are labeled in the above “basic elements of a processor section.” The control unit is what operates the fetching and execution of instructions.

The processor in a personal computer or embedded in small devices is often called a microprocessor. That term means that the processor's elements are contained in a single IC chip. Some computers will operate using a multi-core processor—a chip containing more than one CPU. A CPU is typically a small device with pins on it facing down in a motherboard. CPUs can also be attached to a motherboard with a heat sink and a fan to dissipate heat.