Systems Architecture

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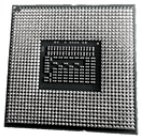
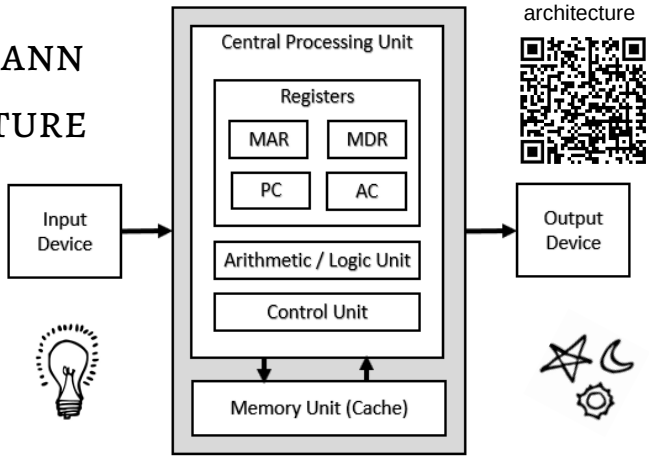
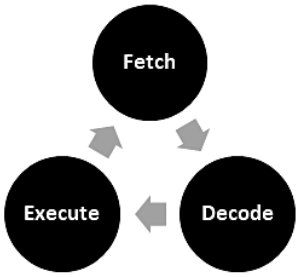
THE PURPOSE OF THE
Central Processing Unit (CPU)



The CPU is an electrical circuit that is responsible for processing the instructions on a computer system.

Von Neumann Architecture





FETCH

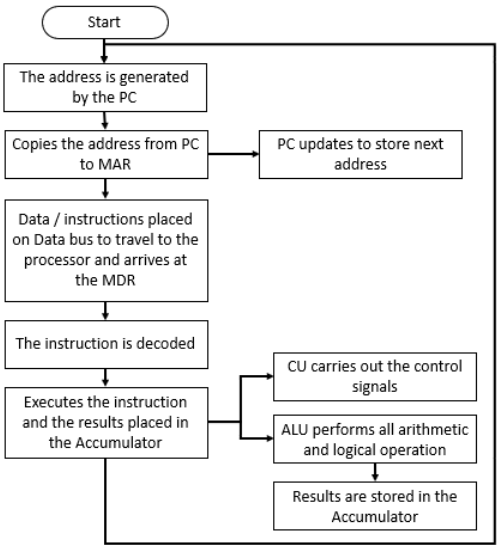
The address is generated by the Program Counter (PC) and is carried to the Memory Address Register (MAR) using the **Address Bus**. The PC then updates and stores the next memory address, ready for the next round of the cycle. The data or instruction that is in that memory location is placed onto the **Data Bus** and carried to the processor and is stored in the Memory Data Register (MDR).

DECODE

The data or instruction is then decoded to find out if it is a piece of data or if it is an instruction to do something such as ADD, STORE, SWITCH, REPEAT etc.

EXECUTE

The CPU performs the actions required by the instruction. If it is an instruction to control input or output devices the Control Unit will execute the instruction. If it is a calculation then the Arithmetic and Logic Unit (ALU) will execute the instruction. The results of any calculations are recorded in the Accumulator.



Memory Address Register (MAR)

Stores the memory location of data that needs to be accessed

Memory Data Register (MDR)

Stores the data that is being transferred to and from memory

Program Counter (PC)

Stores the address of the next instruction to be executed

Accumulator (AC)

Stores results from calculations

Arithmetic / Logic unit (ALU)

Carries out calculations and makes decisions on the data sent to the processor

Control unit (CU)

Controls how data moves through the processor and controls the timing of operations and the instructions sent to the processor and the input and output devices (I/O devices)

Performance of the CPU

Clock speed

The clock speed describes how fast the CPU can run. This is measured in megahertz (MHz) or gigahertz (GHz) and shows how many fetch-execute cycles the CPU can deal with in a second.

Cores

CPUs with multiple cores have more power to run multiple programs at the same time.

Memory

The more cache there is, the more data can be stored closer to the CPU and cache is described as Level 1 (L1), Level 2 (L2) and Level 3 (L3):

- L1 is usually part of the CPU chip itself and is both the smallest and the fastest to access.
- L2 and L3 caches are bigger than L1. They are extra caches built between the CPU and the RAM. L2 and L3 caches take slightly longer to access than L1.

Cache size

The more data that can be held in the cache, the shorter the trips the electric pulses need to make so this speeds up the processing time of each of those billions of electrical signals, making the computer noticeable faster overall.

Embedded Systems

Embedded systems are computerised circuits that have been created for one specific purpose. For instance, the circuits inside a washing machine, car engine or MP3 player were created to perform tasks and cannot be re-programmed to perform something else.