1.1 Systems Architecture

Keywords & Definitions

CPU - Central Processing Unit. Fetches, decodes and executes instructions.

Clock Speed - The number of instructions the CPU can carry out per second

Cores - processors working together to perform instructions simultaneously

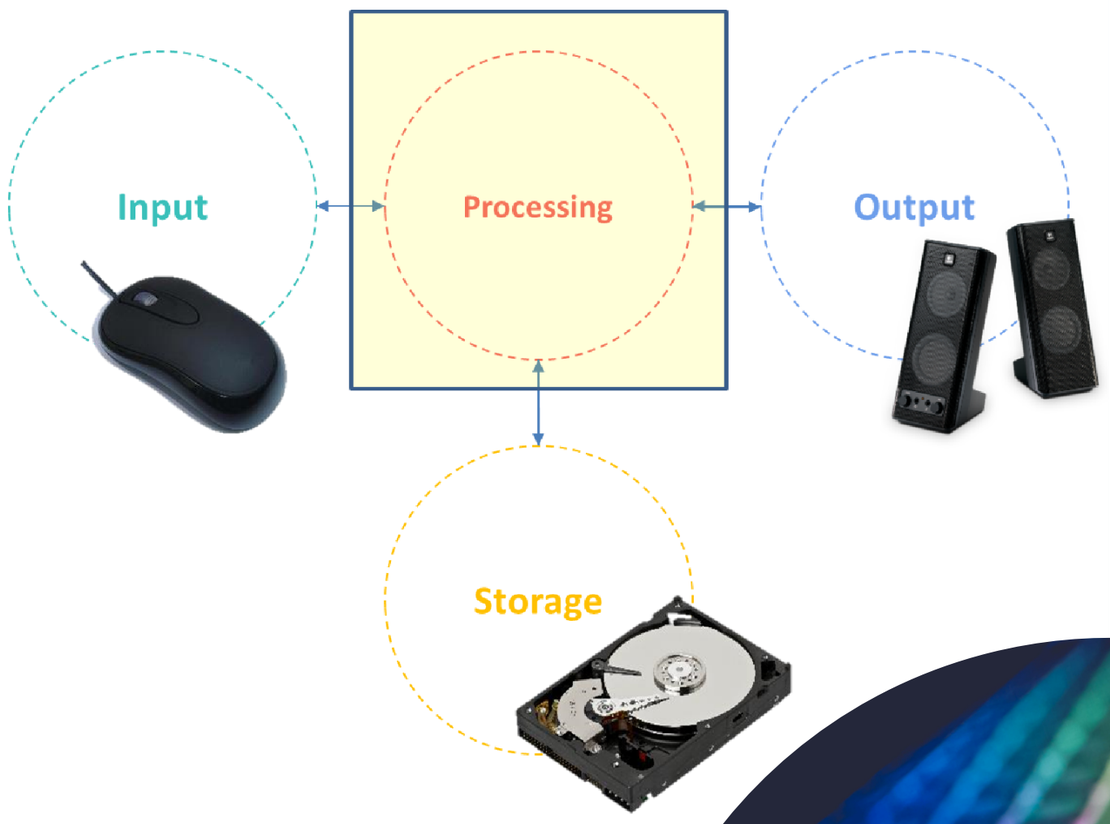
Cache - superfast memory inside the CPU. Used to store frequently run programs and data

Registers - Temporarily holds tiny bits of data needed by the CPU, and are much faster than any other form of memory.

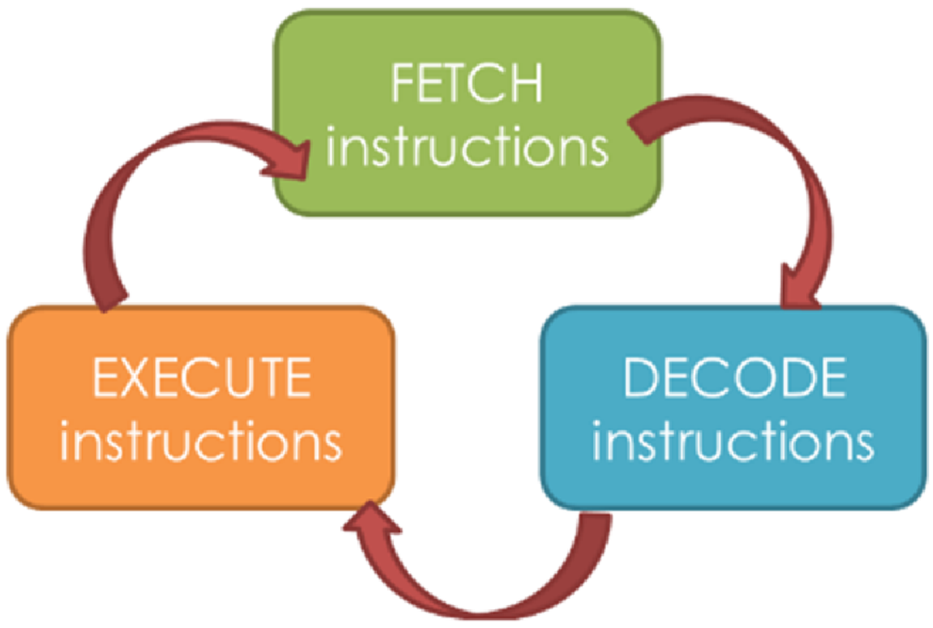
Von Neumann Architecture - the concept of storing a program which can be run on a computer. This architecture is still used when designing and creating computers today.

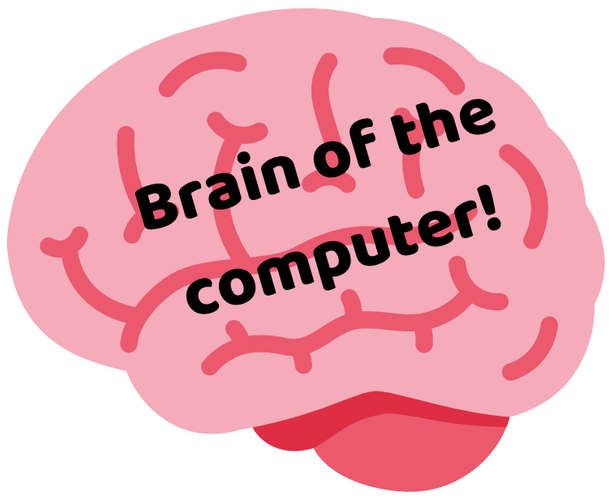
Embedded Systems - A microprocessor within a device, which does not need an operating system and performs a specific task such as a dishwasher.

What makes a computer system?



The purpose of the CPU





Fetches the instructions that it needs to run

Breaks the codes down (to binary numbers – 0s and 1s) to perform instructions

Based on instructions it can perform difficult calculations or move data from one memory place to another

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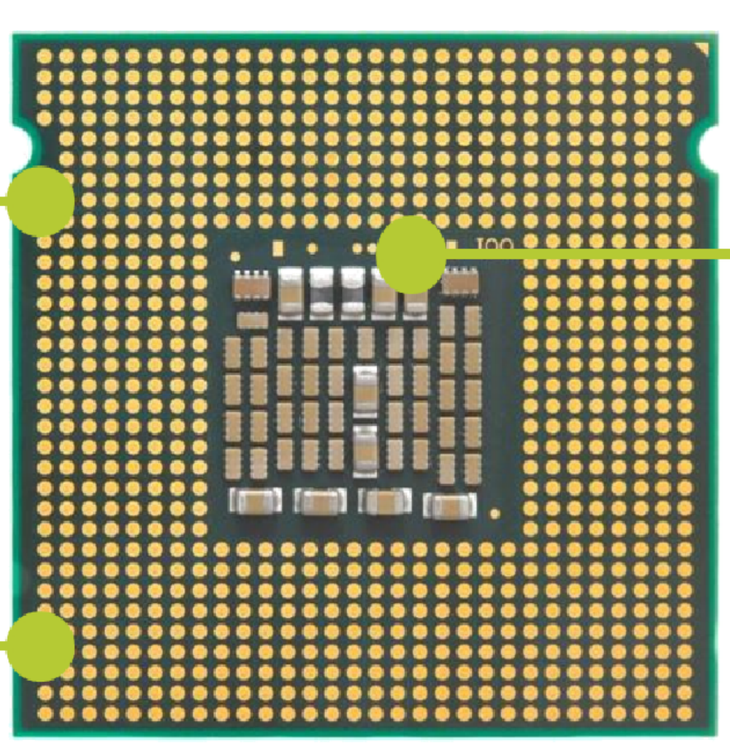
Characteristics of the CPU

The following three factors can affect the performance of the CPU:



Clock speed

Cycles per second measured in hertz

Number of cores

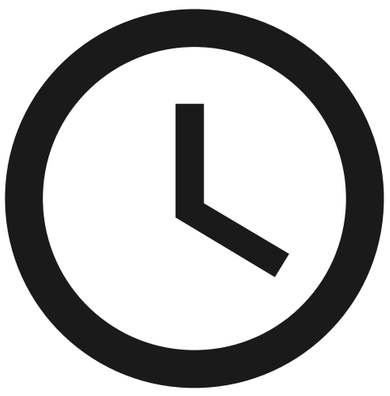
The number of duplicate processors linked together on a single chip

Cache size

Superfast working memory

Cache Size

- Very fast memory in the CPU
- Holds commonly used instructions & data
- Quicker to access than RAM
- Helps improve the performance of the CPU



Clock Speed

- the number of instructions that are carried out per second
- The higher the clock speed, the greater the number of instructions that are carried out per second

Number of cores

- the number of instructions that can be run simultaneously (at the same time)
- the more cores a CPU has, the more instructions that can be run at the same time

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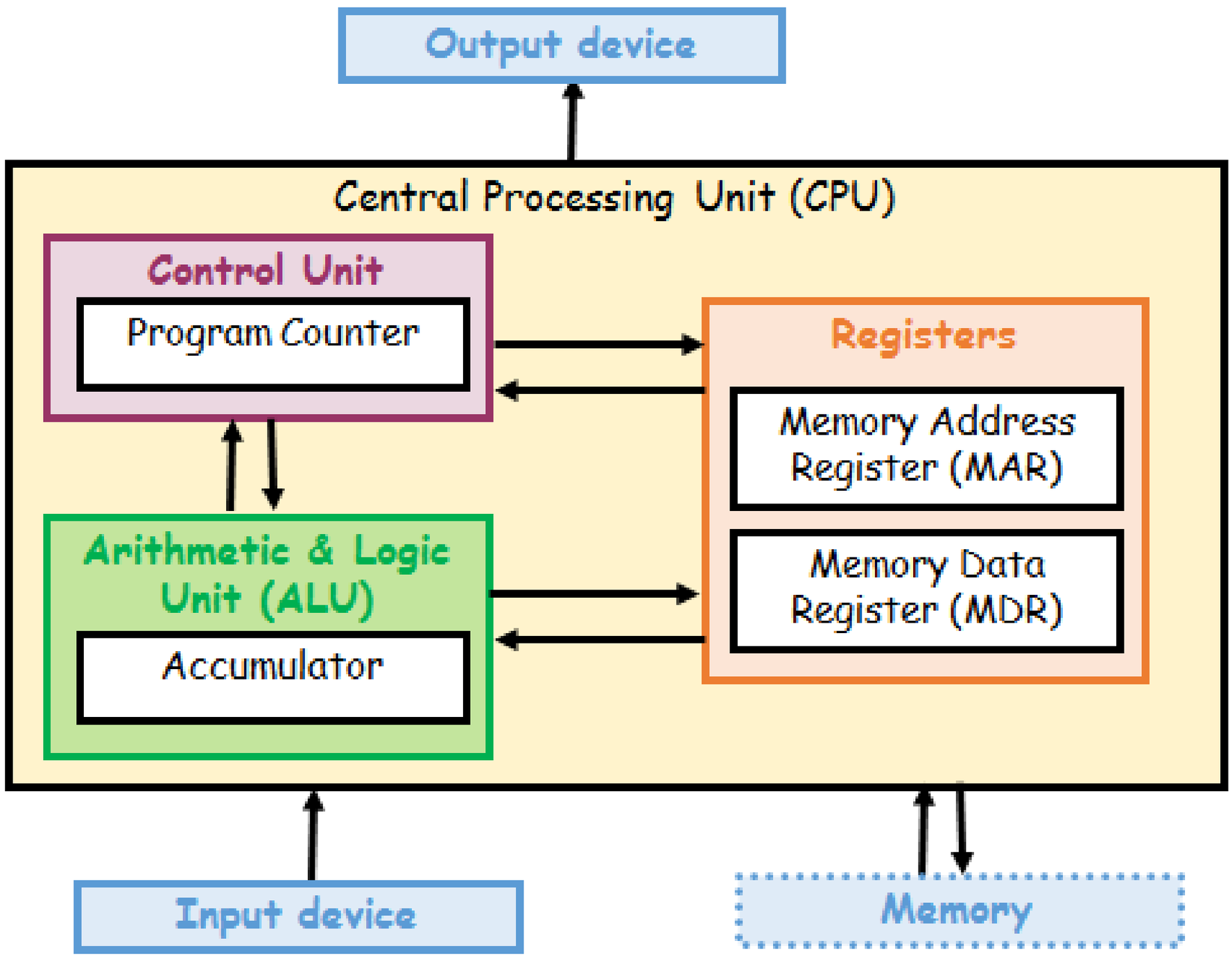
Von Neumann Architecture



Memory Data Register - Holds the actual data/instruction – may be fetched from memory

Memory Address Register - Holds the memory address about to be used by the CPU.

Control Unit - Controls data flow and the timing of processes.

Program Counter - Holds the location of the next instruction/data address in Main Memory

Accumulator - Stores the results of calculations

Arithmetic & Logic Unit (ALU) - Performs arithmetic and logical operations including +, -, AND, OR

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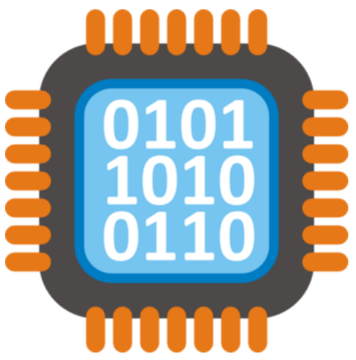
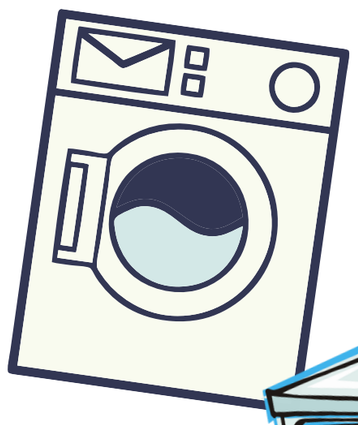
Embedded Systems



What is an embedded system?

- **Small computer system (microprocessor)built into a larger device**
- **has a built in OS that cannot be changed**
- **dedicated to one function**



Examples of embedded systems

- **Washing machine**
- **Smart TV**
- **Dishwasher**
- **Oven**

Advantages of embedded systems

- **smaller so can make the device smaller**
- **On a single circuit board so it is easier to replace the part**
- **More reliable than a general purpose computer**

Disadvantages of embedded systems

- **Need to be designed by a specialist to complete the task, so design may be expensive**
- **Need to have specialist expertise to replace the embedded computer if it fails**

World of work links

Programmer, IT Technician, Software Engineer, Teacher, Systems Architecture, Data Engineer, Software Developer