

# Knowledge Organiser 1.1 : Systems Architecture

1. The purpose of the CPU	
The purpose of the CPU	To manage basic operations of the computer. To be the 'brains' of the computer
The main components of the CPU	Control Unit. Arithmetic Logic Unit. Registers. Cache
Von Neumann Architecture	The architecture that allows for the storage of instructions and data in the same location
The FDE Cycle	The cycle the CPU continuously carries out to process instructions
Binary	The number system used to store instructions and data in the computer
The role of a register in the CPU	It is a place to temporarily hold data and instructions as they are being processed by the CPU.
The PC	The Program Counter keeps the address of the <u>next</u> instruction to be processed
The MAR	The Memory Address Register is used to tell the CPU where to locate data in Main Memory
The MDR	The Memory Data Register is used to store data that is fetched from Main Memory
The ACC	The Accumulator stores results of logic operations and calculations used
4. Performance of the CPU	
Cores	CPUs with multiple cores have more power to run multiple programs at the same time.
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.
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.

2. Common CPU Components and their Function	
The Control Unit has two functions	(1) Sending signals to control the flow of data and instructions, and (2) decoding instructions
Cache memory	A small section of extremely fast memory used to store commonly used instructions and data. It is useful as the CPU can access the (fast) cache directly. L1 cache is closest to the CPU, L3 cache furthest
The ALU has the following functions	It carries out mathematical operations / logical operations / shifting operations on data; for example multiplication, division, logical comparisons
An Address	This is a location in the Main Memory (RAM) that stores data or instructions

### 3. The F-D-E (Fetch Decode Execute) Cycle

The F-D-E Cycle repeatedly cycles	
The Fetch Stage	<p>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 on the data bus and carried to the processor and is stored in the Memory Data Register (MDR)</p>
The Decode Stage	<p>The data or instruction is then the Memory Data Register (MDR). 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.</p>

5. Embedded Systems	
Definition	A computer system which forms part of an electronic device
Re-programmable	Not for different purposes but firmware can sometimes be upgraded

Reasons	They are cheaper to make and smaller than a General Purpose Computer
Examples	Washing machine, Smart Oven, Car Engine, Pacemaker