

### CPU Components

**Arithmetic Logic Unit (ALU):** Responsible for carrying out Arithmetic calculations & Making logical decisions

**Control Unit:** Responsible for sending signals to how data moves around the CPU & Coordinates the CPU operations

**Cache:** Provides fast access to frequently used instructions & data Information written to cache is retrieved quicker then information written to RAM

**Clock:** An electronic unit that synchronises related components by generating pulses at a constant rate

**Registers:** Tiny, super fast pieces of on-board memory inside the CPU Each has a very specific purpose

**Program Counter:** Holds the address in memory which data or an instruction needs to be read from or written to

**Memory Data Register:** Holds either data or an instruction which has been fetched from memory of is about to be written back to memory

**Memory Address Register:** Holds either data or an instruction which has been fetched from memory of is about to be written back to memory

**Accumulator:** Set of general purpose registers

**Buses:** Collection of wires through which data & instructions are transmitted from one component to another

**Address bus:** Unidirectional Carries the addresses which data needs to be written to or read from

**Data bus:** Bidirectional Carries the actual data or instructions

**Control bus:** Bidirectional Carries command & control signals telling components when they should be receiving reads or writes etc.

### Fetch Decode Execute

**Computer:** An electronic device which takes input, processes data & delivers output

**Simple Example:** Input - 5 Process - Multiply by 2 Output - 10

**Complex Example:** Input - Buttons on controller Process - Conversion in the console Output - Update to a monitor, sound out of a speaker or vibration feedback through a controller

In order to process data a computer follows a set of instructions known as a computer program in addition their are 2 critical components that allow this to happen RAM: Stores the programs & CPU: Carries out instructions

**Fetch Stage:** Fetches the next instruction from RAM & Brings it back to the CPU

**Decode Stage:** Inspects the instruction & works out what it is that needs doing

**Execute Stage:** Carries out the instruction which could involve many thing such as going back to RAM to grab some data, performing a calculation or storing information back into main memory

**Clock speed:** Amount of cycles per second measured in Hertz e.g. 3GHz = 3 billion cycles per second

### Von Neuman & Harvard Architectures

| Von Neuman Architecture                                                 | Harvard Architectures                                   |
|-------------------------------------------------------------------------|---------------------------------------------------------|
| Instruction & data are shared/stored with the same memory space/-format | Instructions & data are stored in separate memory units |
| Each have the same set of buses (System Bus)                            | Each having their own set of buses                      |

### Von Neuman & Harvard Architectures (cont)

A single control unit or processor follows a linear fetch, decode, execute cycle

Reading & writing data can be done at the same time as fetching an instruction

One instruction at a time

Used by RISC processors

Registers are used as fast access to instruction & data

### Alternative Architecture

| Parallel Processing:                       | Multiple Instructions on Multiple Data (MIMD) | Distributed computing: Each computer on the network takes part in the problem |
|--------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------|
| Single Instruction on Multiple Data (SIMD) | Using multiple cores                          |                                                                               |



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