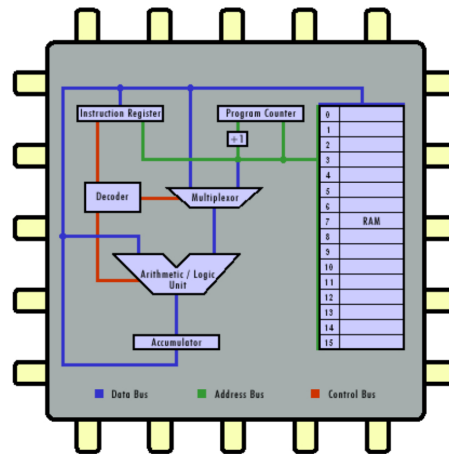


# CPU Architecture

## 1 Components of a CPU



5 major components

- **Memory** - RAM - "the mailboxes"
- **Registers** - The special memory locations that can be accessed very fast. 3 registers are shown: the Instruction register (IR), the Program Counter (PC) and the Accumulator
- **Arithmetic/Logic Unit** - "the calculator"
- **Buses** - bundles of tiny wires that carry data between components. The three most important buses are the address, data and control buses
- **Control Unit** - Responsible for directing the flow of instructions and data within the CPU

In the diagram the Decoder and Multiplexor comprise the Control Unit

## 2 Registers

"Work space" of the CPU

Storage locations in the CPU, often with a defined purpose and wired to perform that purpose

Hold a binary value for

- Storage
- Manipulation
- Calculation

Manipulated directly by the Control Unit

Vary in size from 1 to 128 bits

### 2.1 Accumulator

This is considered part of the ALU

These are general purpose registers used for:

- Holding data
- Holding interim and final results of arithmetic operations
- Holding data waiting to be transferred between different memory locations
- Holding data waiting to be transferred between I/O and memory

## 2.2 Registers in the Control Unit

### 2.2.1 Program Counter

Holds the address of the next instruction to be executed

### 2.2.2 Instruction Register (IR)

Holds the actual instruction being executed

### 2.2.3 Flags

1 bit registers used to keep track of special conditions e.g. Arithmetic Carry, Overflow  
Flags are grouped together into one or more status registers (SR)

## 2.3 Memory management

### 2.3.1 Memory Address Register

Holds the address of a memory location to be accessed, always written to, never from  
Hardwired with an address bus to the ram, activate it to get the correct data

### 2.3.2 Memory Data Register

Holds the value that is being stored to or retrieved from the memory location currently addressed by the MAR  
May be written to or from  
Also known as the Memory Buffer Register

## 3 Buses

Bus - A physical connection that makes it possible to transfer data from one location in a system to another is called a bus

A bus is a group of electrical conductors (**lines**) used to carry signals

- **Data Bus** - Transfer Data
- **Control Bus** - Controls what bits of circuitry are active
- **Address Bus** - Activates the right part of the RAM to get data out of
- **Power Bus** - Feed power to all parts of the chip

### 3.1 Point-to-point

Bus carries the signal from a specific source to a specific destination e.g. Home PC to Printer

### 3.2 Broadcast

Bus used to carry signals to many different devices

### 3.3 Bus Interface Bridges

Allows communications between the different buses, for example USB or PCIe