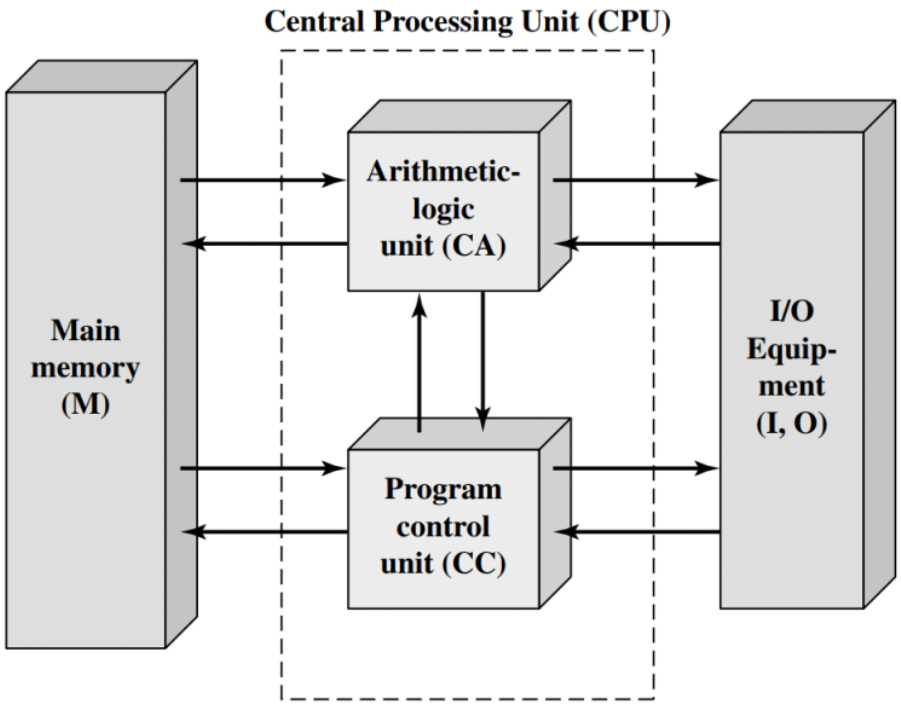
Computer Systems Lecture-2 (18/01/24)

16 January 2024 18:05

Source: 1. Computer Organization and Architecture, William Stalling, 8th Edition
2. NPTEL Course Material: Computer Architecture and Organization, Prof. Indranil Sengupta, Prof. Kamalika Dutta

1. Block Diagram of Computer System



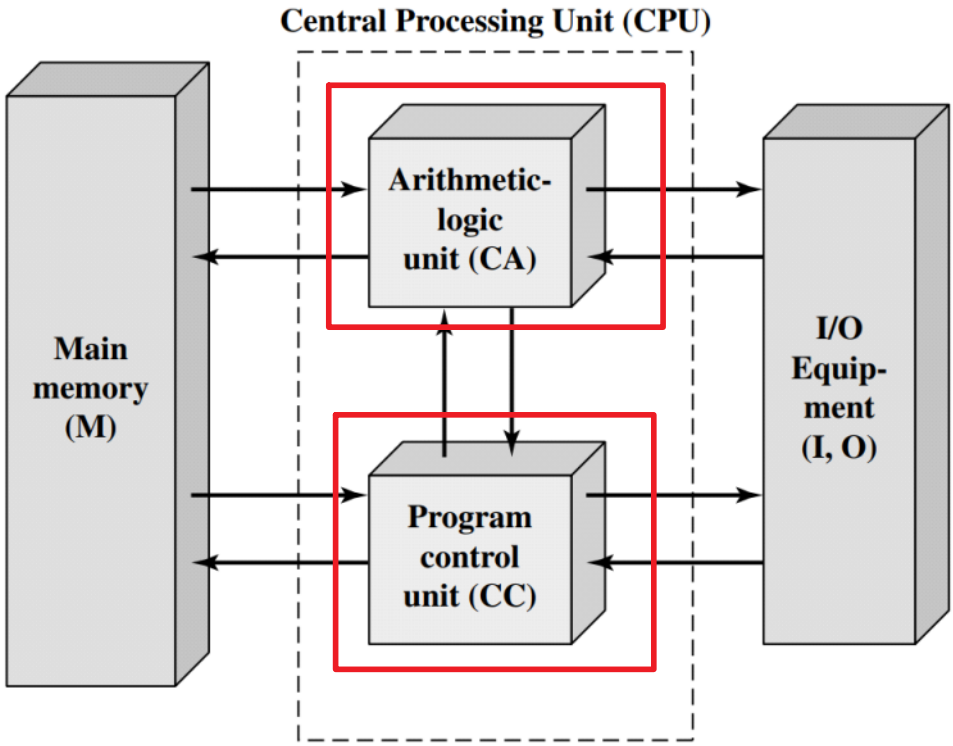
All instructions and data are stored in memory.

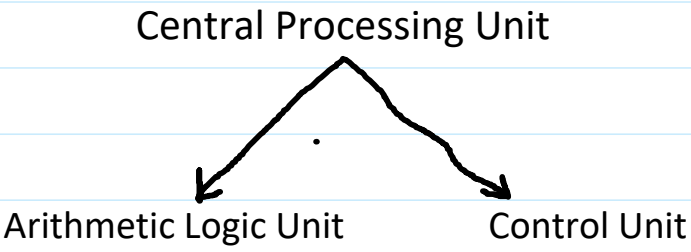
An instruction and the required data are brought into the processor for execution.

An Input and output device interface with the outside world.

von-Neumann architecture.

2. Central Processing Unit (CPU)





Arithmetic Logic Unit

All calculations happen inside ALU.

(any arithmetic computation, like we need to add two numbers, we need to divide two numbers or any arithmetic operation that are performed inside the ALU)

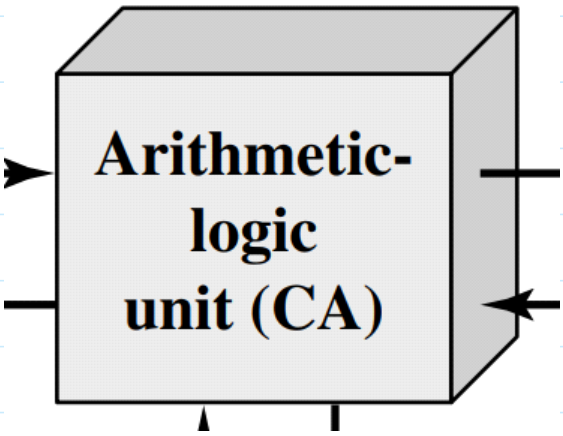
Control Unit generates sequence of control signals to carry out all operations.

(giving the computer some kind of instruction, some kind of control signals that, execute this --> execute that --> finally, you have to store the result/you have to display the result.
All these steps that we are instructing to a computer is generated by the control unit.)

Instruction --> ADD A, B.

A, B are some operands that perform the required operation, like ADD.

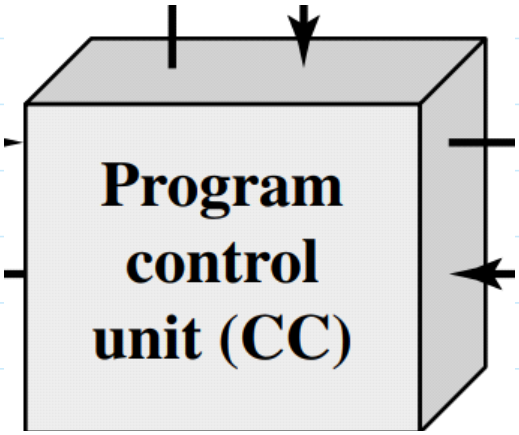
Program --> A program is a set of instructions.

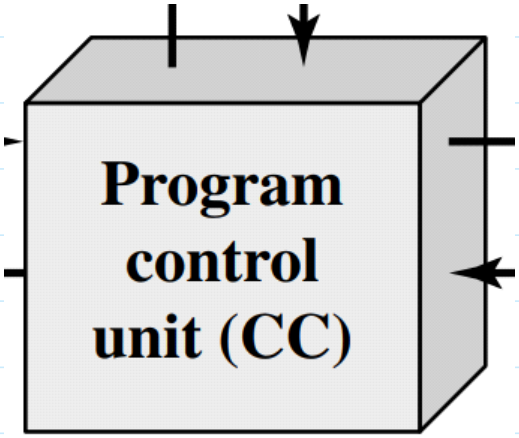


ALU consists of registers.

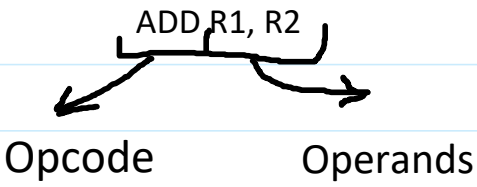
- general purpose registers, special purpose registers, and temporary storage registers.

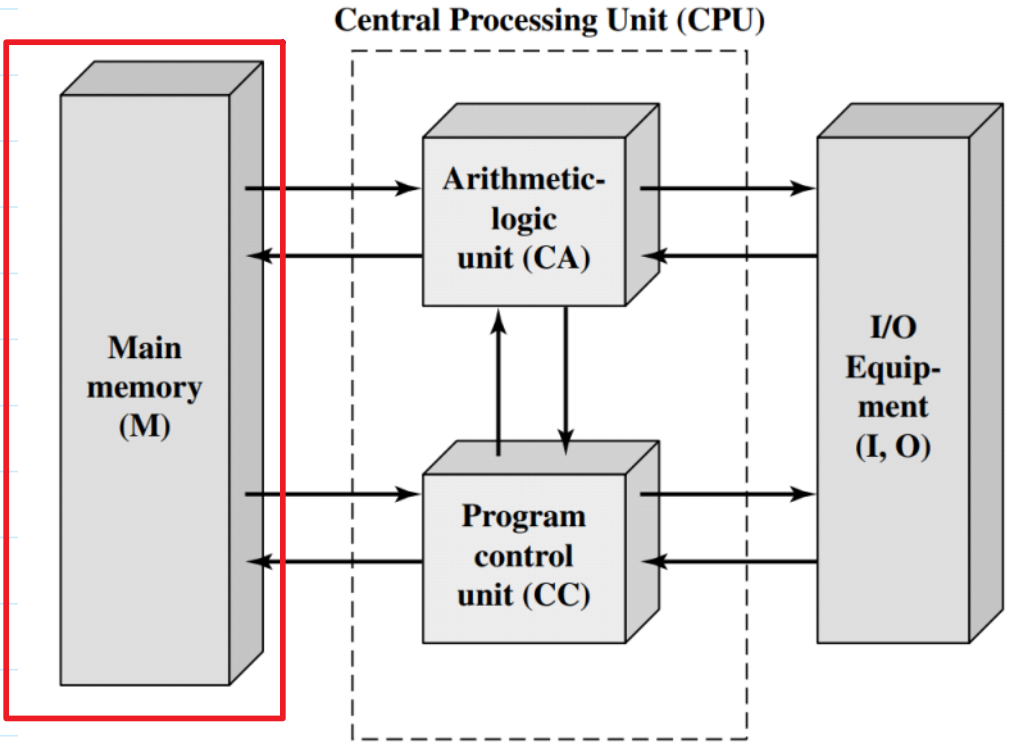
What are registers?
Registers are some storage unit, used to store data, then again we compute some operation and again store back that results into it. We store data for computation; and after the computation is performed, we also store back the data.





- Control Unit generates the signals that is necessary to perform the task.
- It acts as a nerve centre that senses the states of various functional units and send control signals to control the states.





Memory Unit:

Primary Memory: stores the active instructions and data for program being executed on the processor.

Secondary Memory: used as backup and stores all active and inactive programs and data typically the files.

Various different types of memory:
Random Access Memory, Read Only Memory, Magnetic Disk, Flash Memories.

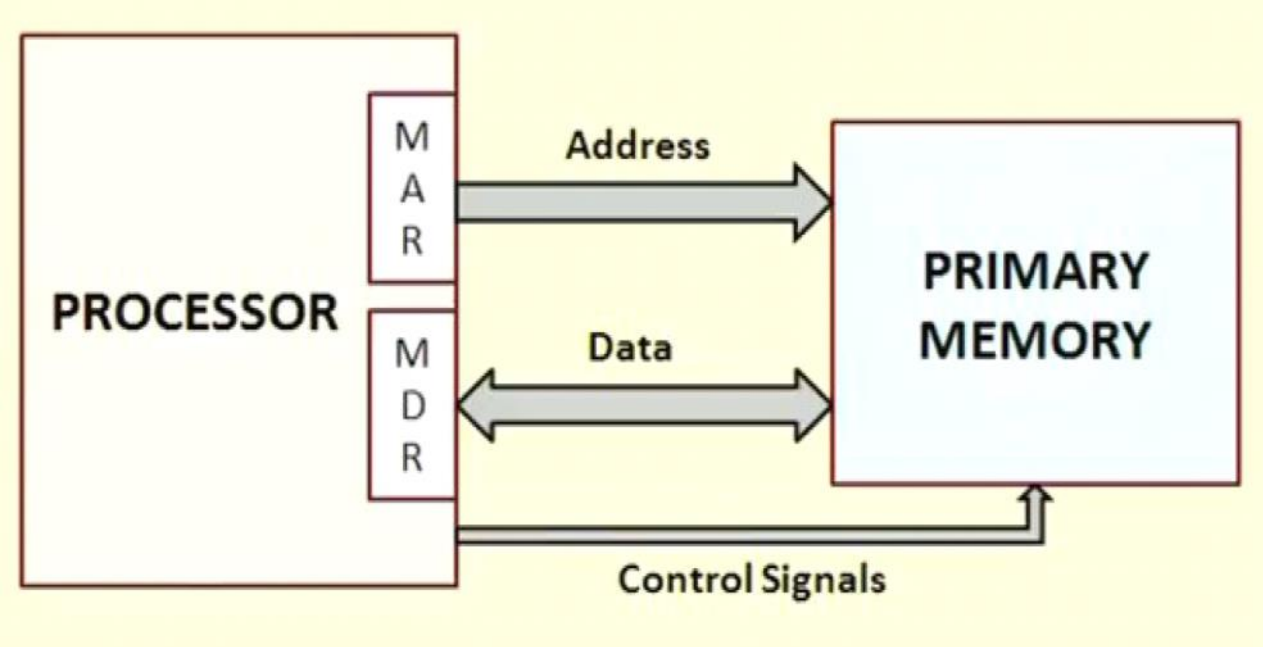
3. Basic Operation of a computer

Instructions and data are stored in memory. The data and instruction are brought to the processors to execute.

For this purpose, two special purpose registers called Memory Address Register(MAR) and Memory Data Register (MDR).

Memory Address Register (MAR) holds the address of a memory location to be accessed.

Memory Data Register (MDR) holds the data that is been written into memory or the data received when read out from the memory location.



Memory Address Register is connected with primary memory through address bus.

Memory Data Register is connected with primary memory through data bus.

Read from Memory:

1. Load the memory address into MAR.
2. Issue the control signal READ.
3. The data read from the memory is stored into MDR.

Write data into memory:

1. Load the memory address into MAR.
2. Load the data to be written into MDR.
3. Issue the control signal WRITE.