IT Fundamentals

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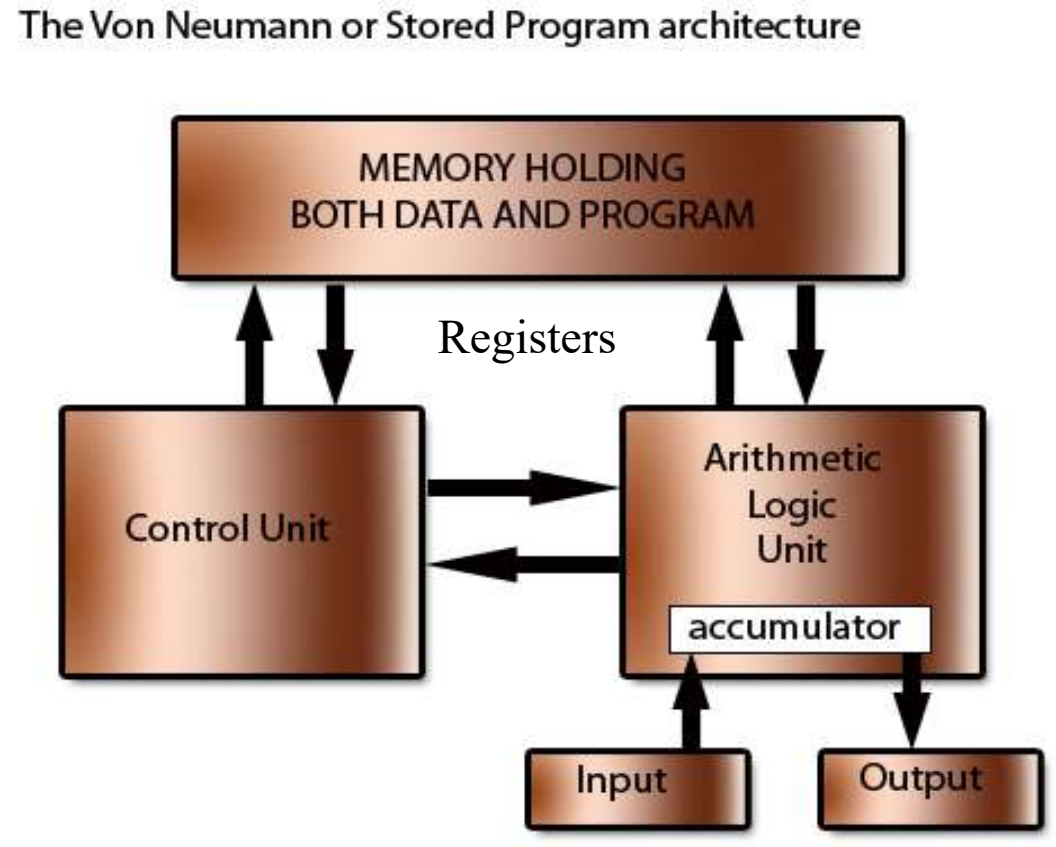
Outline

- Introduction.
- Machine level representation of data.
- Digital logic.
- Assembly level machine organization
- Hardware realizations of algorithms.
- Operating systems and virtual machines.
- Computing applications.
- Introduction to net-centric computing.

‘Stored-program' architecture
'Von Neumann' architecture.



The essential features of the Von Neumann

- The computer will have memory (RAM) that can hold both data and also the program processing that data.
- The **control unit** will manage the process of **moving data and program into and out of memory** and also deal with carrying out (**executing**) program instructions - one at a time. .
- Includes the idea of a **'register'** to **hold intermediate values**.

The essential features of the Von Neumann

- The 'one-at-a-time' phrase means that the von neumann architecture is a **sequential** processing machine.
- The arrows between components? This implies that information should flow between various parts of the computer, information passes along a **'bus'**.
- There are buses to identify locations in memory - an **'address bus'**. Also there are buses to allow the flow of data and program instructions - a **'data bus'**.

The essential features of the Von Neumann

- The Von Neumann model has been incredibly successful, with most modern computers following the idea.
- **CPU** of a personal computer holding a **control unit** and the **arithmetic logic unit** (along with some **local** memory) and the **main** memory is in the form of RAM chips located on the **motherboard**.

Registers

- A register is a **discrete** memory location within the CPU designed to hold **temporary** data and instructions.
- A modern CPU will hold **a number of registers**.
- There are a number of general purpose registers that the programmer can use to **hold intermediate results whilst working through a calculation or algorithm.**

Caches

- Caches live on the memory side.
- Loads and stores will treat cache just as they treat memory (only faster).
- Used by CPU to reduce the average time to access memory.
- Caches are addressed using memory addresses. And as far as the compute side knows, they're accessing memory.

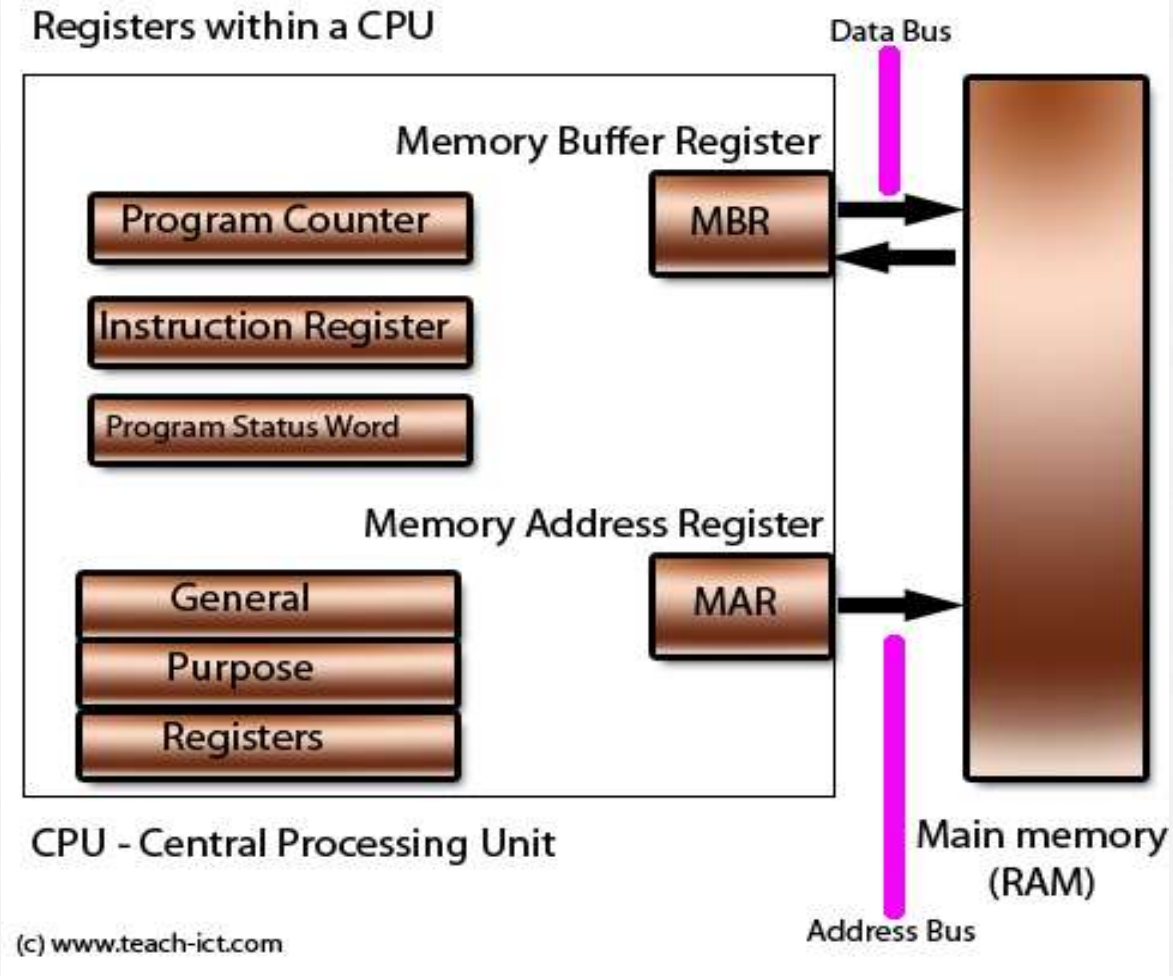
Memory Address Register (MAR) page 99

- data and program instructions have to fetched from memory.
- holds the location in memory (address) of the next piece of data or program to be fetched (or stored).

Memory Buffer Register (MBR)

- or Memory Data Register (MDR).
- When the data or program instruction is fetched from memory, it is temporarily held in the 'Memory Buffer Register' or MBR for short sometimes also called the Memory Data Register or MDR.
- A 'buffer' describe memory designed to hold data that is on its way to somewhere else.

Registers within a CPU



Von Neumann drawbacks

- carry out instructions one after another, in a single linear sequence, and they spend a lot of time moving data to and from the memory.
- This slows the computer -- a problem called the von Neumann bottleneck.
- One way to circumvent the von Neumann bottleneck is to build the computer so it performs operations in parallel (so-called parallel processing).

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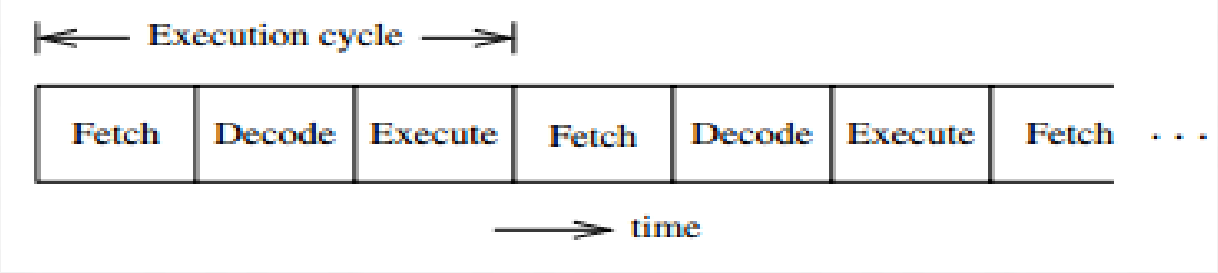
- Basic machine organization



- The processor acts as the controller of all actions or services provided by the system. 1. **Fetch** an instruction from the memory; 2. **Decode** the instruction (i.e., identify the instruction); 3. **Execute** the instruction (i.e., perform the action specified by the instruction). the fetch-decode-execute cycle, or simply the execution cycle.

The System Clock (CP)

- is used to synchronize the timing of hardware components.
- The speed of the computer's processor, measured in MHz or GHz, refers to its number of clock pulse cycles per second.


End


Thank You