COMPUTER ORGANIZATION

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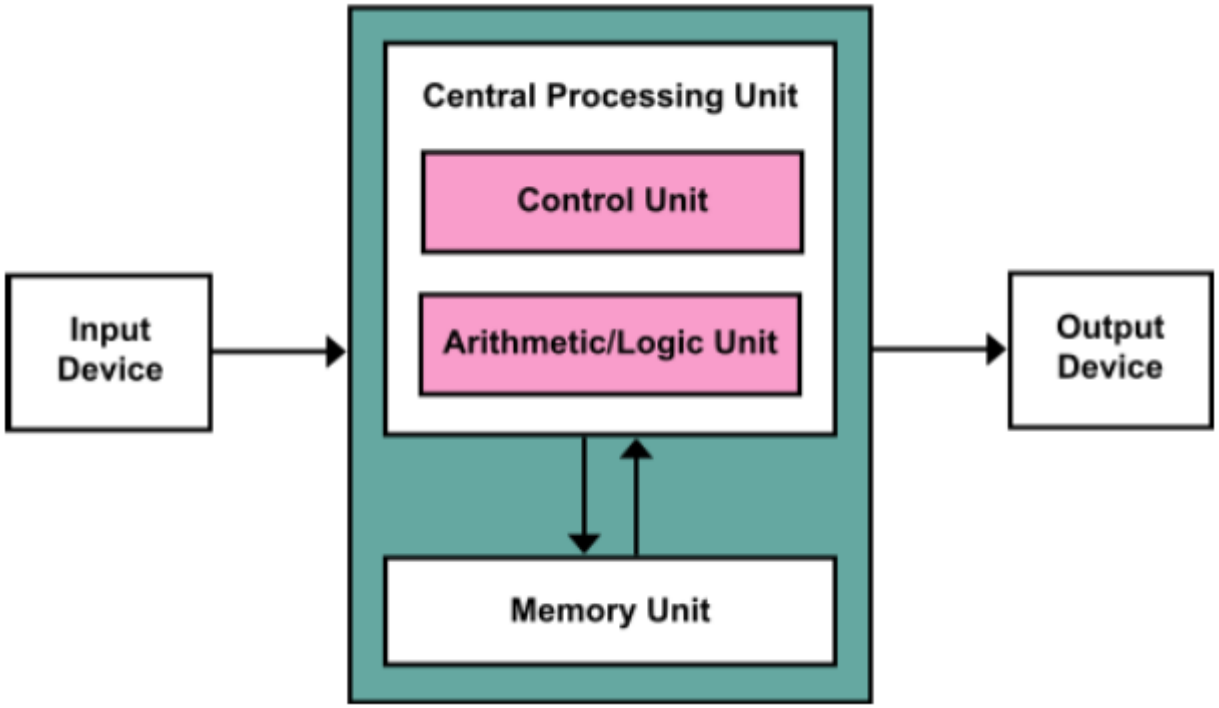
Von Neumann Architecture

- **The Von Neumann architecture (1945) describes a design architecture for an electronic digital computer**



Ref:https://en.wikipedia.org/wiki/Von_Neumann_architecture

Von Neumann Architecture

- The computer architecture is problem-independent
- Universal Computer has the following components:
- Arithmetic Logical Unit, Control Unit, Memory, Input Unit, Output Unit
- Program and data both reside in memory
- Each memory location has an address, through which its contents can be accessed
  - In general, program commands are stored in consecutive memory locations
- Data comes through Input, the CPU processes the data based on a program which is in Memory, and the result is either returned to Memory or is presented to the user as Output

Input Unit

- **An input unit of a computer perform the following functions**
  - **It accepts (or reads) instructions and data from outside world**
  - **It converts these instructions and data in computer acceptable form**
  - **It supplies the converted instructions and data to the computer for further processing**

Examples:

- **Keyboard – Mouse – Stylus - Game controller – Microphone - Touch screens - Touch sensitive pad - Biometric device - Card reader - Barcode reader – Scanner - Webcam**

Output Unit

- **An output unit of a computer performs the following functions**
  - **It accepts the results produced by the computer, which are in coded form and hence, cannot be easily understood by us**
  - **It converts these coded results to human acceptable (readable) form**
  - **It supplies the converted results to outside world**

Examples:

- **Monitors - LCD/LEDs - Touch screens – Printer – Speakers – Headphones – Projector - Force feedback controllers - Interactive whiteboards**

Storage Unit

- **A storage unit of a computer holds (or stores) the following**
  - **Data and instructions required for processing (received from input devices)**
  - **Intermediate results for processing**
  - **Final results of processing, before they are released to an output device**

There are two types of storage

- **Primary storage**
- **Secondary storage**

Storage Unit

Primary Storage

- **Also called RAM (Random Access Memory)**
- **Used to hold running program instructions, data and intermediate results**
- **Fast in operation**
- **Small capacity**
- **Expensive**
- **Volatile (looses data on power dissipation)**

Storage Unit

Secondary Storage

- **Also called ROM (Read Only Memory)**
- **Used to hold stored program instructions and data**
- **Slower than primary storage**
- **Large capacity**
- **Lot cheaper that primary storage**
- **Retains data even without power**
- **Secondary Storage Devices**
- **Magnetic Tape**
- **Magnetic Disk**
- **Optical Disk**
- **Flash Drive and Memory Cards**

Central Processing Unit

- CPU or Central Processing Unit is the brain of the computer
  - Made of silicon and copper
  - Carries out instructions from the program
- CPU itself consists of
  - Arithmetic and Logic Unit (ALU), Control Unit (CU), Registers
- Arithmetic & Logic Unit is the place where the actual executions of instructions takes place
- Control Unit manages and coordinates the operations of all other components of the computer
- Registers are devices that hold data inside the computer's memory long enough to execute a particular function, such as indexing, calculating, sorting or otherwise manipulating data
  - They are the CPU's own internal memory
  - It stores location from where instruction was fetched

CPU Instruction Cycle

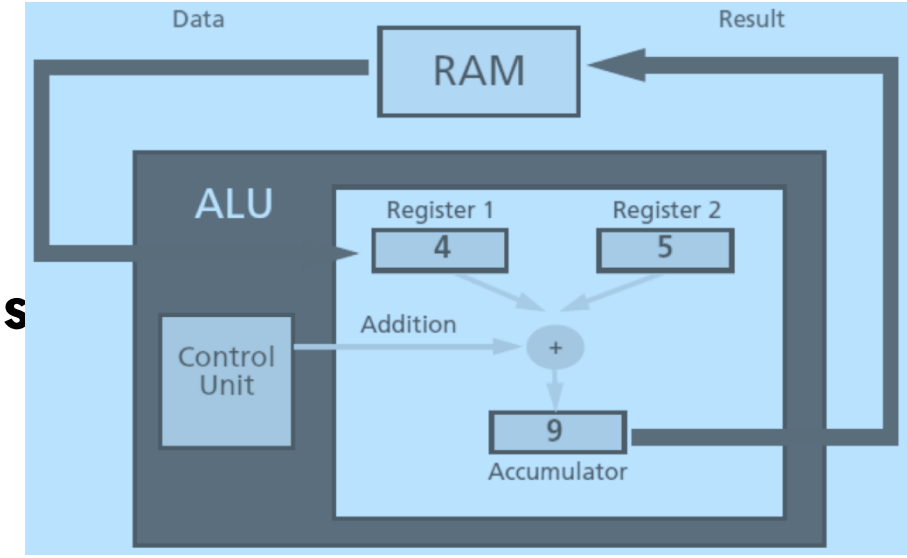
The CPU instruction cycle (machine cycle) has four steps

1. Fetch - Retrieve an instruction from the memory

2. Decode - Translate the retrieved instruction into a series of computer commands

3. Execute - Execute the computer commands

4. Store - Send and write the results back in memory



Parts of a Computer System

- **Hardware**
  - **Mechanical devices in the computer**
  - **Anything that can be touched (tangible)**
- **Software**
  - **Series of instructions that tell the computer what to do, also called a program**
  - **Thousands of programs exist (intangible)**

Computer Hardware

- **Motherboard**
  - **Main circuit board in a system unit, also called system board**
  - **It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory**
  - **It also provides connectors for other peripherals (adapter cards, processor chips, and memory chips)**

Computer Hardware

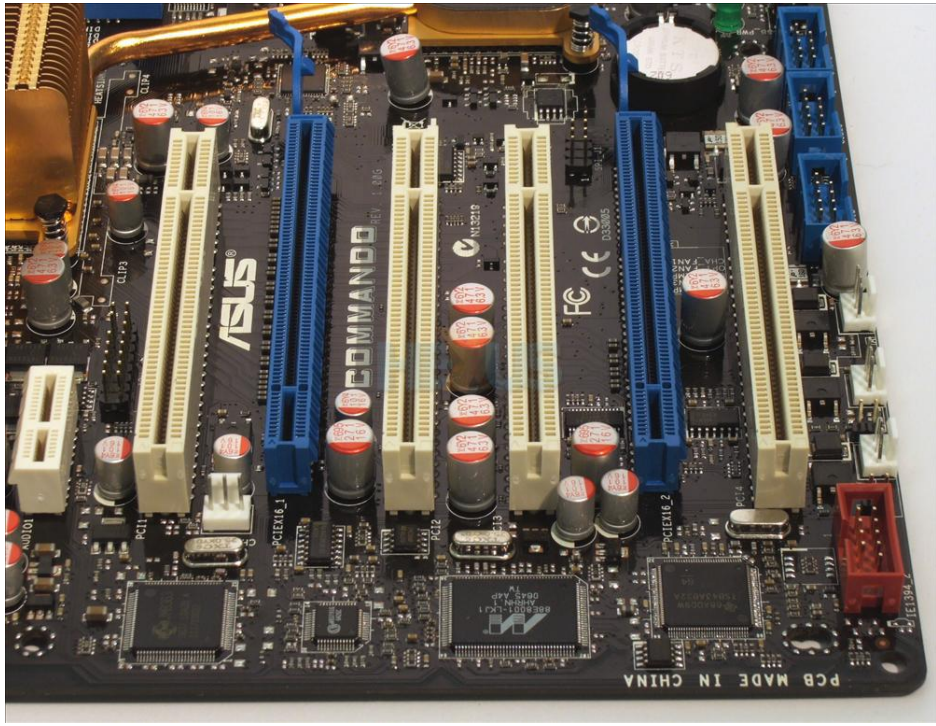
Adapter card

- Also called an expansion card or accessory card
- Enhances the functionality to a computer system or provides connections to external devices

Computer Hardware

Expansion slot

- Also called expansion port is an opening, or socket, on the motherboard where an expansion card can be inserted
- With Plug and Play, the computer automatically configures cards and other devices as you install them



Computer Hardware

Bus

- **Channel (wire) that allows devices inside computer to communicate with each other (system bus connects processor and RAM)**
- **Bus width determines number of bits transmitted at one time**
- **Word size is the number of bits processor can interpret and execute at a given time**

Computer Hardware

Ports and Connectors

- **Port connects external devices to system unit**
- **Connector joins cable to peripheral**
- **Both male and female ports**
- **Serial port**
  - **Transmits one bit of data at a time, one after the other**
  - **Connects slow-speed devices, such as mouse, keyboard**
- **Parallel port**
  - **Can transfer more than one bit at a time**
  - **Connects devices such as a printer**

Computer Hardware

USB port

- **USB (Universal Serial Bus) port is the most common port you find on a computer**
- **Used for data transfer between devices, attaching and charging peripherals and can connect up to 127 different peripherals together with a single connector type**

Video: Dissecting a computer: https://www.youtube.com/watch?v=4GMCghYExZM

Ref: http://www.insidemylaptop.com

Computer Software

- **Software runs the machine (computer)**
  - **Tells the computer what to do**
  - **It is the main reason people purchase computers**
- **There are two types of software available**
  - **System software**
  - **Application software**

Computer Software

- **System Software**
  - **A set of programs that control the operations of the computer**
  - **Serves as the interface between the user, the application software, and the computer's hardware**
  - **It is the most important software, a bridge between user and machine**
  - **Also called the Operating System**
  - **Windows 10, Ubuntu, MacOS**
- **Application software**
  - **Most common type of software that is designed to accomplish a specific task**
  - **Software that makes users more productive**
  - **Covers most common uses of computers**
  - **MS Word, Windows Media Player, Internet Explorer**

Computer Software

Software Distribution Methods

- **Packaged software, mass-produced by large organizations**
- **Custom software, performs functions specific to a business or industry**
- **Open source software, provided for use, modification, and redistribution**
- **Shareware, distributed free for trial period**
- **Freeware, copyrighted software provided at no cost**
- **Public-domain software, freeware with no copyright restrictions**

Computer Software

Types of Software

- **Business software**
  - **Software that assists people in becoming more effective and efficient**
  - **Examples of business software are;**
  - **Microsoft Word, Microsoft Access, Oracle, Microsoft Project, QuickBooks, Peachtree, SAP**
- **Word processing software**
  - **Allows users to create and manipulate text and graphics**
  - **What is spreadsheet software?**
  - **Organizes data**
  - **Performs calculations and recalculates when data changes**

Computer Software

Types of Software

- **Database software**
  - **Allows you to create and manage data**
  - **Add, change, delete, sort, and retrieve data**
- **Presentation/graphics software**
  - **Used to create visual aids for presentations**
  - **A presentation is sometimes called a slide show**
- **Project management software**
  - **Allows you to plan, schedule, track, and analyze the events, resources, and costs of a project**

Computer Software

Types of Software

- **Accounting software**
  - **Helps companies record and report their financial transactions**
  - **Enterprise computing software**
  - **Large organizations require special computing solutions**
  - **Each functional unit has specialized software requirements**