Unit I

Introduction to Computer and History   15 Lectures

1.1 Definition of Computer

1.2 Basic Computer Organization

1.3 Characteristics of Computer

1.4 Generations of Computer

1.5 Types of Computer: - Microcomputer, Minicomputer, Mainframe Computer, workstations, Client and Server

What is Computer?

A computer is made up of multiple parts and components that facilitate user functionality. A computer has two primary categories:

➢ **Hardware**: Physical structure that houses a computer's processor, memory, storage, communication ports and peripheral devices

➢ **Software**: Includes operating system (OS) and software applications

A computer works with software programs that are sent to its underlying hardware architecture for reading, interpretation and execution. Computers are classified according to computing power, capacity, size, mobility and other factors, as personal computers (PC), desktop computers, laptop computers, minicomputers, handheld computers and devices, mainframes or supercomputers.

Definition

➢ **"A computer** is a machine or device that performs processes, calculations and operations based on instructions provided

by a software or hardware program"

➢ "**A Computer** is an electronic machine that can solve different problems, process data, store & retrieve data and perform calculations faster and efficiently than humans"

➢ "**A Computer is** programmed device with a set of instructions to perform specific tasks and generate results at a very high speed."

The word computer comes from the word "compute", which means, "to calculate" Thereby, a computer is an electronic device that can perform arithmetic operations at high speed

A computer is also called a *data processor* because it can store, process, and retrieve data whenever the activity of processing data using a computer is called *data processing*

Data

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Capture Data

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↓

Manipulate Data

↓

Output Results

↓
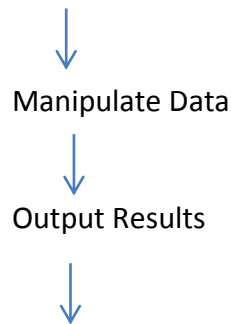
Information

Data is raw material used as input and *information* is processed data obtained as output of data processing

Characteristics of Computer

(Explain Characteristics of computer?)

1) **Automatic:** Given a job, computer can work on it automatically without human interventions.

2) **Speed:** Computer can perform data processing jobs very fast, usually measured in **microseconds**, **nanoseconds**, and **picoseconds.**

3) **Accuracy:** Accuracy of a computer is consistently high and the degree of its accuracy depends upon its design. Computer errors caused due to incorrect input data or unreliable programs are often referred to as *Garbage-In-Garbage-Out* (GIGO).

4) **Diligence:** Computer is free from monotony, tiredness, and lack of concentration. It can continuously work for hours without creating any error and without grumbling.

5) **Versatility:** Computer is capable of performing almost any task, if the task can be reduced to a finite series of logical steps.

6) **Power of Remembering:** Computer can store and recall any amount of information because of its secondary storage capability. It forgets or loses certain information only when it is asked to do so.

7) **NO I.Q:** A computer does only what it is programmed to do .it cannot take its own decision in this regard.

Five Basic operation of Computer

1. **Inputting**. The process of entering data and instructions into the computer system

2.Storing. Saving data and instructions to make them readily available for initial or additional processing whenever required

3. **Processing**. Performing arithmetic operations (add, subtract, multiply, divide, etc.) or logical operations (comparisons like equal to, less than, greater than, etc.) on data to convert them into useful information

4. **Outputting**. The process of producing useful information or results for the user such as a printed report or visual display.

5. **Controlling.** Directing the manner and sequence in which all of the above operations are performed.

Basic Organization of a Computer System

The Computer system consists of mainly three types that are central processing unit (CPU), Input Devices, and Output Devices .The Central processing unit (CPU) again consists of ALU (Arithmetic Logic Unit) and Control Unit. The set of instruction is presented to the computer in the form of raw data which is entered through input devices such as keyboard or mouse. A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer as shown in following Fig.
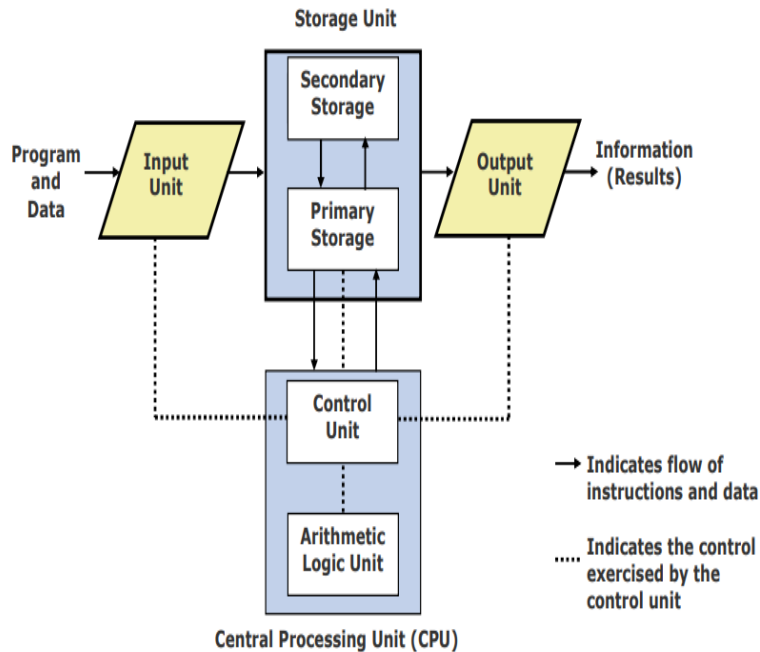
Fig:-Block Diagram of Computer

1. Input Unit

The set of instruction or information is provided to the computer system or PC with the help of input devices such as (keyboard, mouse, scanners etc.). The Instruction or data presented to computer system is converted into binary form then it is supplied to computer system for further processing

An input unit of a computer system performs the following functions:

1. It accepts (or reads) instructions and data from outside world
2. It converts these instructions and data in computer acceptable form
3. It supplies the converted instructions and data to the computer system for further processing

2. Output Unit

Output devices of computer produce or generate results with the help of devices or gadgets such as printer, monitor etc. primarily these instruction or data provided to computer system is in binary code so to produce or generate the desired output the system has to convert this data into human-readable form, to do so it has to first present the data or instruction to computer system for further processing or handling. With the help and assistance of output devices, the system is linked or connected with outside world.

1. It accepts the results produced by the computer, which are in coded form and hence, cannot be easily understood by us
2. It converts these coded results to human acceptable (readable) form
3. It supplies the converted results to outside world

3. Storage Unit

The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts.

The storage unit of a computer system holds (or stores) the following

1. Data and instructions required for processing (received from input devices)
2. Intermediate results of processing
 3. Final results of processing, before they are released to an output device

Two Types of Storage

1. Primary storage

Used to hold running program instructions

Used to hold data, intermediate results, and Results of on-going processing of job(s)
 Fast in operation
 Small Capacity
 Expensive
 Volatile (loses data on power dissipation)

2. Secondary storage

Used to hold stored program instructions
Used to hold data and information of stored jobs
Slower than primary storage
Large Capacity
Lot cheaper that primary storage
Retains data even without power

FUNCTIONAL UNITS

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are

1. Arithmetic Logic Unit (ALU)

Arithmetic Logic Unit of a computer system is the place where the actual executions of instructions take place during processing operation.

2. Control Unit (CU)

The control Unit or CU Controls or coordinates all activities performed in a computer system. It receives information or instruction or directions from the main memory of computer

Control Unit of a computer system manages and coordinates the operations of all other components of the computer system.

3. Central Processing Unit (CPU)

The CPU is the heart | Brian of a computer because without the necessary action taken by the CPU the user cannot get the desired output.

Arithmetic Logic Unit (ALU) +Control Unit (CU) = **Central Processing Unit (CPU)**
It is the brain of a computer system
It is responsible for controlling the operations of all other units of a computer system

Generations of Computer

"Generation" in computer talk is a step in technology. It provides a framework for the growth of computer industry. Originally it was used to distinguish between various hardware technologies, but now it has been extended to include both hardware and software.

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Now days, generation includes both hardware and software, which together make up an entire computer system.

There are five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. In the following table, approximate dates against each generation have been mentioned, which are normally accepted.

1. First generation (1942-1955)

Technology-Vacuum tube based.

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions.

First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.

The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951
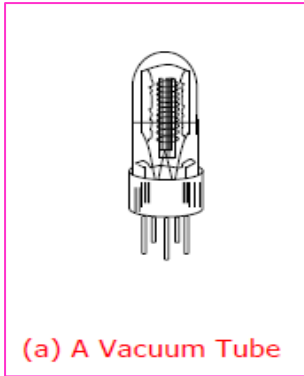
(a) A Vacuum Tube

The main features of the first generation are −

1. Vacuum tube technology

2. Unreliable

3. Supported machine language only

4. Very costly

5. Generated a lot of heat

6. Slow input and output devices

7. Huge size

8. Need of AC

9. Non-portable

10. Consumed a lot of electricity

2. Second generation (1955-1964)

Technology:-Transistors, Magnetic cores memory, Magnetic tapes, Disks for secondary storage.

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words.
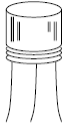
(b) A Transistor

The main features of second generation are –

1. Use of transistors

2. Reliable in comparison to first generation computers

3. Smaller size as compared to first generation computers

4. Generated less heat as compared to first generation computers

5. Consumed less electricity as compared to first generation computers

6. Faster than first generation computers

7. Still very costly

8. AC required

9. Supported machine and assembly languages

3. Third generation (1964-1975)

Technology: - ICs with SSI and MSI technologies, Larger magnetic cores memory.

The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.

The computers of third generation used Integrated Circuits (ICs) in place of transistors. A single IC has many transistors, resistors, and capacitors along with the associated circuitry.

(c) An IC Chip

The IC was invented by Jack Kilby. This development made computers smaller in size, reliable, and efficient. In this generation remote processing, time-sharing, multiprogramming operating system was used.

The main features of third generation are –

1. IC used

2. More reliable in comparison to previous two generations

3. Smaller size

4. Generated less heat

5. Faster

6. Lesser maintenance

7. Costly

8. AC required

9. Consumed lesser electricity

10. Supported high-level language

4. **Fourth generation (1975-1989)**

Technology: - ICs with VLSI technology, Microprocessors; semiconductor memory.

Computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements with their associated circuits on a single chip made it possible to have microcomputers of fourth generation.

Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to Personal Computer (PC) revolution. In this generation, time sharing, real time networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc., were used in this generation.

The main features of fourth generation are −

1. VLSI technology used

2. Very cheap

3. Portable and reliable

4. Use of PCs

5. Very small size

6. Pipeline processing

7. No AC required

8. Concept of internet was introduced

9. Great developments in the fields of networks

10. Computers became easily available

5. Fifth generation (1989-Present)

Technology: - ICs with ULSI technology, larger capacity main memory, hard disks with RAID support, Optical disks as portable read-only storage media

In the fifth generation, VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components.

This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets the means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc., are used in this generation.

The main features of fifth generation are −

1. ULSI technology

2. Development of true artificial intelligence

3. Development of Natural language processing

4. Advancement in Parallel Processing

5. Advancement in Superconductor technology

6. More user-friendly interfaces with multimedia features

7. Availability of very powerful and compact computers at cheaper rates

Types of Computer

Computers can be broadly classified by their speed and computing power.

1. Super Computer
2. Microcomputer
3. Minicomputer
4. Mainframe Computer
5. Workstations
6. Client and Server

1. Super Computer

It is an extremely fast computer, which can execute hundreds of millions of instructions per second.

Supercomputers are one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require immense amount of mathematical calculations

For example, weather forecasting, scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data.

2. **Microcomputer**

A microcomputer is a small, relatively inexpensive computer; a microcomputer is a complete computer on a small scale, designed for use by one person at a time. A microcomputer is smaller than a mainframe or a minicomputer.

3. **Minicomputer**

It is a multi-user computer system, capable of supporting hundreds of users simultaneously.

It is a midsize multi-processing system capable of supporting up to 250 users simultaneously.

4. **Mainframe Computer**

Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports many simultaneous executions of programs.

5. **Workstations**

Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities.

Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have mass storage device such as a disk drive, but a special type of workstation, called diskless workstation, comes without a disk drive.

6. **Client and Server**

A client and server networking model is a model in which computers such as servers provide the network services to the other computers such as clients to perform a user based tasks. This model is known as client-server networking model.

The application programs using the client-server model should follow the given below strategies
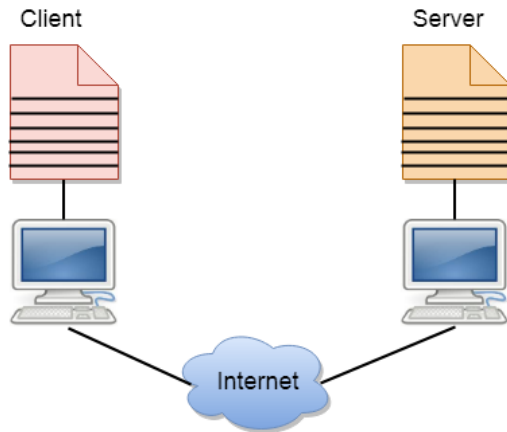
Client

A client is a program that runs on the local machine requesting service from the server. A client program is a finite program means that the service started by the user and terminates when the service is completed.

Server

A server is a program that runs on the remote machine providing services to the clients. When the client requests for a service, then the server opens the door for the incoming requests, but it never initiates the service

Advantages of Client-server Model

1. **Centralized:** Centralized back-up is possible in client-server networks, i.e., all the data is stored in a server.

2. **Security:** These networks are more secure as all the shared resources are centrally administered.

3. **Performance:** The use of the dedicated server increases the speed of sharing resources. This increases the performance of the overall system.

4. **Scalability:** We can increase the number of clients and servers separately, i.e., the new element can be added, or we can add a new node in a network at any time.