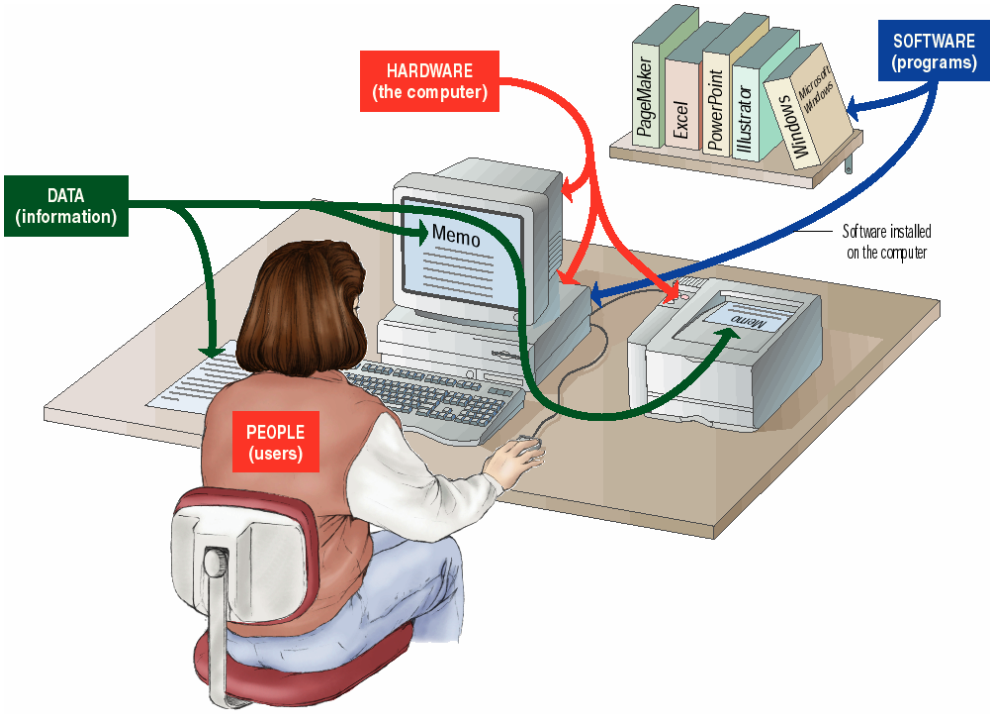
Introduction

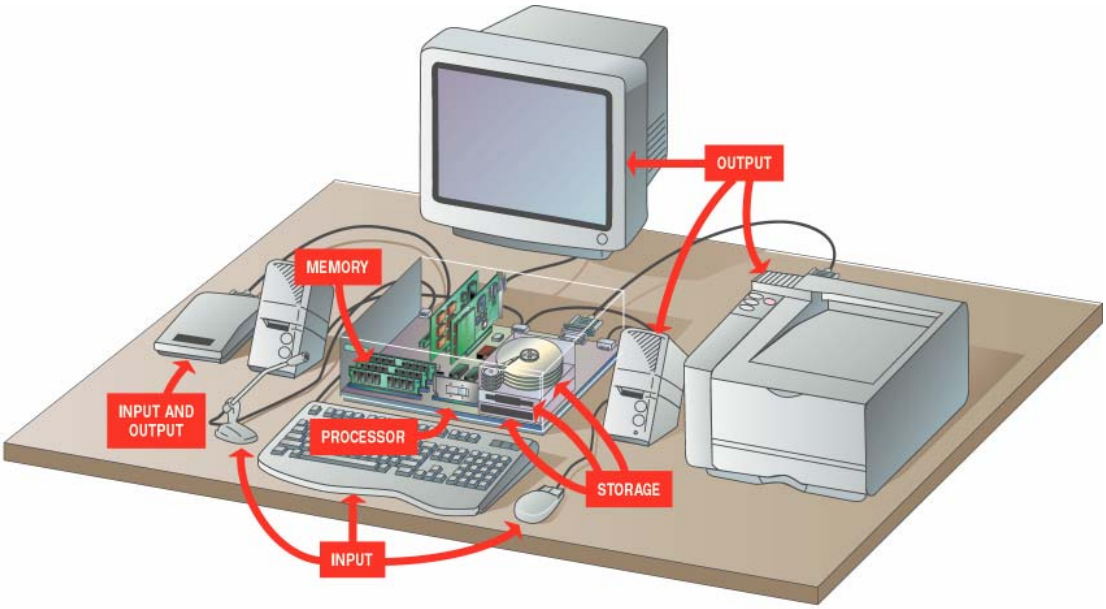
Computer is derived from the Latin word 'Computare' which means 'calculate'. So according to this definition, computer is a machine which can perform calculations at very high speed.

- Basically, computer is defined as programmable machine which computes.
- Computer can be defined as a digital and automatic machine which takes input from the user, process it, stores it if necessary and gives output in the desired form.
- A computer is an electronic device used to process data, converting the data into information that is useful to the people.
- Computer is an electronic machine that can accept data: process it according to a set of predefined instructions and then gives the results.
  The main characteristics of a computer are:
  - It responds to a specific set of instructions in a well-defined manner.
  - It can execute a prerecorded list of instructions (called program).

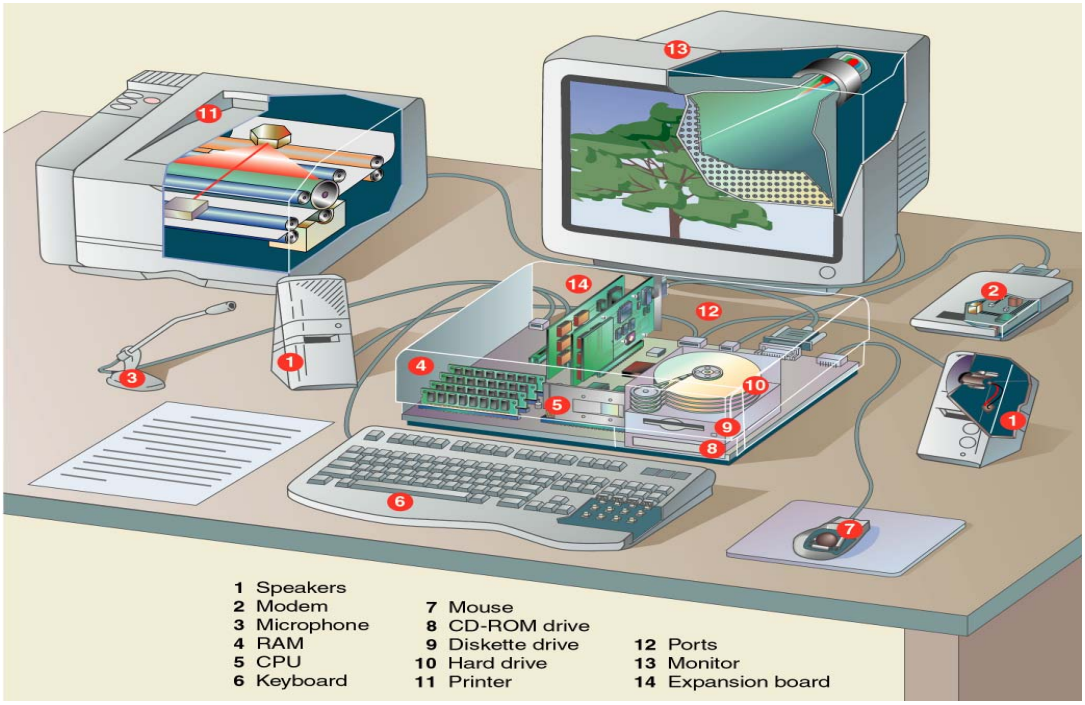


- Computer is a device, which is capable of doing almost all the works which can be programmed by the user.
- Computer can do jobs with 100% accuracy and in a very fast speed in comparison to any other devices or man.
- It is possible to show and do things, which are impossible for a man.
- Computer provides faster and cheaper communication with the use of internet.
- It can perform almost all the works but for that purpose man must provide program and hardware.

Computer System



- The computer system consist of the following five components
  - Processor
  - Memory
  - Input Device
  - Output Device
  - Storage
- The procedure that transforms raw data into useful information is called processing. To perform this transformation, the computer uses two components : the processor and memory
- **Processor** – is the brain of the computer. It organizes and carries out instructions that come from either the user or the software. Microprocessor (chips) which are made up of silicon chips. CPU refers to a computer's processor.
- **Memory** – is like an electronic scratch pad inside the computer. When you launch a program it is loaded into and run from memory. Data used by the program is also loaded into memory for fast access. Common type of memory are RAM(Random Access Memory) and ROM (Read Only Memory)
- Computer would be useless if they did not provide interaction with users.
- **Input devices** – are those devices that accept data and instruction from the user or from another computer system (such as a computer on the internet). Examples are keyboard, mouse, joysticks, touch pads, scanners, digital camera, microphones etc.
- **Output devices** – are those devices that return processed data, back to the user or to another computer system. Examples are monitor, printers, speakers etc.
- **Storage** – is used to hold data. Allows a computer to permanently store large amounts of data. Common mass storage devices are disk drives, CD- drives and tape drives.



Terms used in Computer system

- **Hardware** – The mechanical devices that make up the computer are called hardware. Hardware is any part of the computer that you can touch. Hardware consists of interconnected electronic devices that you can use to control the computer's operation, input and output.
- **Software** – is a set of electronic instructions consisting of complex codes (also known as programs) that make the computer perform tasks. In other word, software tells the computer what to do. Some programs exist primarily for the computer's use and help the computer perform and manage its own tasks. Other types of programs exist primarily for the user and enable the computer to perform tasks.
- **Human ware** – people who operates the computer is known as human ware or users.
- **Firmware** – is a program or information written in ROM permanently by the manufacturer during the manufacturing of computers.
- **Data** – consists of raw facts, which the computer stores and reads in the form of numbers. The computer manipulates data according to the instructions contained in the software and then forwards it for use by people or another computer. Data can consists of letters, numbers, sounds or images however the computer converts it to numbers within the computer, data is organized into files.
- **A computer file** is simply a set of data or program instructions that has been given a name. A file that the user can open and use is often called a documents.
- **Program** – programs are the collection of many commands or instructions together in sequence and in logical way. A program is written for some specific purpose.
- **Information (Solutions)** – it is the collection of data in systematic way, so that it carries specific meaning when presented.

Type Of Computers

Computers can be generally classified by size and power as follows, though there is considerable overlap:

- **Personal computer:** A small, single-user computer based on a microprocessor.
- **Workstation:** A powerful, single-user computer. A workstation is like a personal computer, but it has a more powerful microprocessor and, in general, a higher-quality monitor.
- **Minicomputer:** A multi-user computer capable of supporting up to hundreds of users simultaneously.
- **Mainframe**: A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.
- **Supercomputer:** An extremely fast computer that can perform hundreds of millions of instructions per second.

Characteristics of Computer (Features)

1. **Speed, size and cost**
    - The speed of a computer is directly linked with the technology used to build it.
        - ENIAC → uses vacuum tubes
            - Speeds in milliseconds
            - 150 squares meters
            - Costs millions of dollars
        - Transistor
            - Speeds in microseconds
            - Size and Price are reduced
        - IC (Integrated Circuit)
            - Tens of millions of operations per seconds
            - Size 0.25 square cm
            - The cost was also reduced because of the enhancement in the technology
    - With the development in the computer technology the speed is going on increasing, the size and cost are decreasing.

2. **Accuracy and Reliability**
    - Computer can do a lot of work without any mistake and tiredness
    - The output of the computer is only as reliable as the instructions (the program) used and the data supplied
    - Almost all the computer errors are because of errors in programming or because of invalid data fed to the computer.

3. **Vast Storage Capacity**
    - A computer system can store and retrieve massive amounts of data.
    - Computer's storage can be divided as primary storage and secondary storage.

4. **Automatic**
    - Computer is an automatic machine.
    - Everything that is given to computer are processed and done by computer automatically to the instruction provided.

5. **Diligent**
    - The ability of computer to perform a work repeatedly again and again without getting tired and bored is called diligence.

6. **Versatile**
    - A computer can perform more than one work having different characteristics.

7. **Electronic**
    - Computer totally depends on electricity. All its parts especially memory, processor are electrical devices and most of the computer parts are made up of electronic circuits therefore, computer is a electronic device.

8. **Non – Intelligent**
    - Computer can't do simple of the simple work, if it is not given input in terms of data, instruction or program by the user.

9. **Word Length**
    - A digital computer operates on binary digits – 0 and 1. It can understand information only in binary digits (bits). The number of bits that a computer can process at a time in parallel is called word length. Commonly used word lengths are 8, 16, 32 or 64 bits. Word length is the measure of the computing power of a computer.

Computer Uses:

- Computer are used almost in every field that you can think
- Computer or IT is finding wide applications in industries, hospitals, research labs, offices, domestic gadgets and for personal use.
- Today, computer – based information and control system are performing a variety of important functions in several areas. Such as Business, customer services, education, research, entertainment, government, home, medical, industries, engineering, office automation system, transportation system, etc.

Limitations of computer

The computer can outperform human beings in speed, memory and accuracy but still the computer has limitations. There are following limitations of a computer.

Programmed by human:
Though computer is programmed to work efficiently, fast and accurately but it is programmed by human beings to do so. Without a program, computer is nothing. A program is a set of instructions. Computer only follows these instructions. If the instructions are not accurate the working of computer will not accurate.

Thinking:
The computer can not think itself. The concept of artificial intelligence shows that the computer can think. But still this concept is dependent on set of instructions provided by the human beings.

Self Care:
A Computer can not care itself like a human. A computer is dependent still to human beings for this purpose.

Retrieval of memory:
A computer can retrieve data very fast but this technique is linear. A human being's mind does not follow this rule. A human mind can think randomly which a computer machine can not.

Feelings:
One of the main limits in the computer is of feeling. A computer can not feel about some like a human. A computer can not meet human in respect of relations.

Human can feel, think and caring but a computer machine itself can not.

Chapter 2: Classification Of Digital Computers

Computer Systems are classified as Microcomputers, Minicomputers, Mainframes and Supercomputers.

1. Micro Computer

- Are the smallest computer systems on the basis of size
- Are called micro computer because microprocessor is used as its CPU which are very small
- Are also called PC(Personal Computers) or home computers
- Smallest are laptop, notebook and palmtop computers.
- Examples: IBM Pentium PC, Apple/Macintosh etc

Characteristics:

- Smallest in term of size
- Speed and cost is also less as compared with other super, mainframe and mini computers.
- Since a single user system is used, storage devices and memory are smaller size.

Microcomputers are of two types: Personal Computers and Workstations

1.1 Personal Computers (PCs)

It can be defined as a small, relatively inexpensive computer designed for an individual user. In price, personal computers range anywhere from a few hundred pounds to over five thousand pounds. All are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. PCs are used for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is for playing games and recently for surfing the Internet.

Personal computers first appeared in the late 1970s. One of the first and most popular personal computers was the Apple II, introduced in 1977 by Apple Computer. During the late 1970s and early 1980s, new models and competing operating systems seemed to appear daily.

1.2 Workstation

It is a type of computer used for engineering applications, desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution graphics screen, at large amount of RAM, built-in network support, and a graphical user interface. The most common operating systems for workstations are UNIX and Windows NT. Like personal computers, most workstations are single-user computers. However, workstations are typically linked together to form a local-area network, although they can also be used as stand-alone systems. The most powerful workstations are called supermicros.

N.B.: In networking, workstation refers to any computer connected to a local-area network. It could be a workstation or a personal computer.

1.3 Portable Computers

Computers are becoming smaller yet more powerful. Portable computer are gaining rapid popularity and can be easily carried around. There are three categories of portable computers viz. **Laptops or Notebook PCs, Subnotebooks and Personal Digital Assisstants.**

Laptop

SubNotebook

PDA

2. Minicomputers

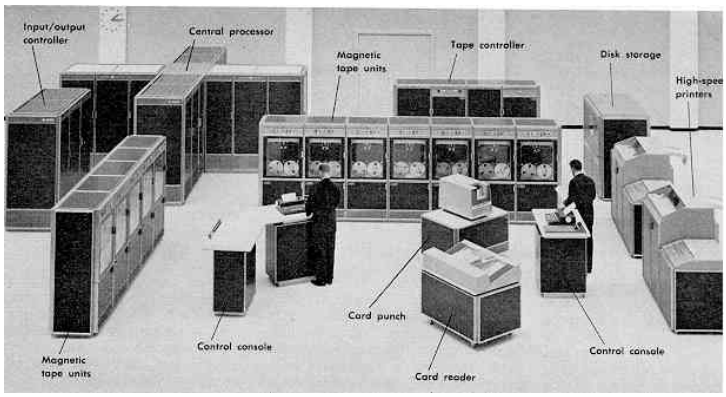
- Are medium sized computers on the basis of size
- A centrally located server or CPU is connected with more than 50 terminals.
- Examples: Prime 9755, Vax 36 etc.

Characteristics:

- Medium size
- More than 50 terminals and large capacity storage devices than micro computers.
- Used for general purpose.
- Used in medium sized organizations and corporation for their database administration.

3. Mainframe Computer

- Are the largest types of computers
- Are used in large organizations like insurance companies, banks where people need frequent access to the same data, which is usually organized into one or more huge databases.



- Examples: IBM 1401, ICL 2950/10 , IBM S/390 etc

Characteristics:

- Very large in size.
- Central processor , central administration
- More than 100 terminals, large capacity storage devices used
- Fastest and more expensive system.
- Used by large agencies and government for large scale data processing.

4. Super Computer

- Are the most sophisticated and powerful computers.
- They are large in size
- These systems are built to process he amount of data and the fastest supercomputer can perform more than 1 trillion calculations per second.
- Some super computers are Cray T90, Super Cray, Cyber 205 and Super SXI.
- These can house thousand of processor
- These speed and power make supercomputers ideal for handling large and highly complex problems that require extreme calculating power.
- Used in weather forecasting, nuclear fusion, study of DNA structures.
- Can cost tens of millions of dollars and consume enough electricity to power dozen of homes.
- They are often housed in protective rooms with special cooling systems, power protection and other security features.
- Because of their size and cost, super computers are relatively rare, used only by large corporations, universities and government agencies that can afford them.
- Super computing resources are often shared to give researchers access to these precious machines.

5. Network Computers

- Is a less power full version of personal computers, with minimal processing power, memory and storage
- Network computers are designed to be connected to a network, a corporate intranet or to the Internet.
- The Network computers relies on the network for software and data storage and many even use the network's server to perform some processing tasks.
- If you want to use only the Internet, for example, or if your job involves data entry, then you may not need the processing power, memory and storage capacity of a fully equipped PC.

A fast simultaneous look to the different categories of computer is as follows.

Type of computer	Word length (bit)	Speed (insth/sec)	Internal memory(KB)
Super computer	64 and above	Above 1,00,00,000	8,000 to 64,000
Mainframe	32 to 64	10,00,000 to 1,00,00,000	2,000 to 16,000
Minicomputer	16 to 32	5,00,000 to 10,00,000	250 to 2,000
Micro computer	8 to 16	80,000 to 1,00,000	32 to 640

Functions and Components of A Computer

A computer does mainly the following functions:

Receive Input: Accept raw data through various input device like keyboard, mouse
Process Information: perform arithmetic and logical operations on any piece of information
Produce Output: Display information through output devices monitor, printer
Store Information: Store information in storage devices like hard disk, CDs for future reference

All the above listed functions are performed smoothly in presence of both the hardware and the software.

Hardware:

Hardware is a general term that refers to the physical, mechanical and electronic artifacts of a technology which can be touched, seen and felt. They are the devices capable of accepting and storing computer data, executing a systematic sequence of operations on computer data, or producing control outputs. Such devices can perform substantial interpretation, computation, communication, control, or other logical functions.

Software:

Software is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. They are the programs that enable a computer to perform a specific task. This includes application software such as a word processor, which enables a user to perform a task, and system software such as an operating system, which enables other software to run properly, by interfacing with hardware and with other software.

Central Processing Unit (CPU)

A central processing unit (CPU), or sometimes simply processor, is the component in a digital computer that interprets instructions and processes data contained in computer programs. CPUs provide the fundamental digital computer trait of programmability, and are one of the necessary components found in computers of any era, along with primary storage and input/output facilities.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor. Since the 1970's the microprocessor class of CPUs has almost completely overtaken all other CPU implementations.

A CPU has two parts – the Control Unit (CU) and the Arithmetic and Logic Unit (ALU)

Control Unit

The control unit tells the computer system how to carry out a program instruction. It is a typical component of the CPU that implements the microprocessor instruction set. It extracts instructions from memory and decodes and executes them, and sends the necessary signals to the ALU to perform the operation needed. Control Units are either hardwired or micro-programmed.

Arithmetic and Logic Unit (ALU)

The arithmetic and logic unit is the part of a computer that performs all arithmetic computations, such as addition, subtraction, multiplication and division. It also performs the logical operations like comparison between data. Besides these operations some processors also supports operations which check if particular bits are on or off.

Memory

Memory, also known as the primary storage, is the storage point in the computers that holds data for processing, instructions for processing the data (the program) and information (processed data). The content of primary memory is volatile and stored until there is a supply of electricity.

Registers

These are the additional memory locations in the CU and ALU to make processing more efficient. They are the special hi-speed storage areas that hold data and instructions temporarily during processing. The important registers within CPU the are, Program Counter (PC) that keeps track of next instruction to be executed and the Instruction Register(IR), which holds instruction to be decoded by the control unit.

Addresses

The characters of data or instructions in the main memory of the computers are stored in certain locations known as the address designated by a unique number. Each cell in memory has an address, which is used to refer to that cell. To get data from memory, a program gives the address of the cell that holds the data. To put data into memory, a program gives the address of the cell which will hold the data.

How do the CPU and memory work?

1. The control unit recognizes that the program has been loaded into memory and begins to execute the first step of the program.
2. The program tell the user to enter the first number.
3. The user enters 10 from the keyboard. An electronic signal is sent to the CPU.
4. The control unit recognizes this signal and routes the signal to a memory address – 7.
5. After completion of the above instruction, the next instruction tells user to enter another number.
6. The user enters 4 from the keyboard. An electronic signal is sent to the CPU.
7. The control unit recognized this signal and routes the signal to a memory address – 8.
8. The next program instruction is executed – Multiply 1st and 2nd numbers.
9. To execute this instruction, the control unit informs the ALU that two numbers are coming and the ALU is to multiply them. The control unit next sends to the ALU a copy of the contents of addresses 7 (10) and 8 (4).
10. ALU performs the multiplication: 10 x 4= 40
11. The control unit sends a copy of the multiplication result (40) back to memory to address 9.
12. The next program instruction is executed: "Print the result"
13. To execute this instruction, the control unit sends the contents of the address 9 (40) to the monitor.
14. Monitor displays the value 40
15. Final Instruction is executed: "End" The program is complete.

