

COMPUTER AWARENESS

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1. Introduction of Computer

The word ‘computer’ has been derived from the Latin word ‘computare’, which means ‘to calculate’. A computer is an electronic device that manipulates information or data according to the set of instructions called programs. It has the ability to store, retrieve and process data.

A computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It is designed to execute applications and provides a variety of solutions by combining integrated hardware and software components.

In general a machine which has capability to store large data value in its memory. It works using input (like keyboard) and output (like printer) devices. ... It allows us to make changes in the already stored data as well as store new data.

Data can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing, by human or electronic machine. Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+, -, /, *, = etc.)

Information is organized or classified data, which has some meaningful values for the receiver. Information is the processed data on which decisions and actions are based.

| Data | Information |
|---|--|
| The collection of raw facts and figures is called Data/input. | The processed form of data is called information/output. |
| Data is an input for computer. | Information is an output from computer. |
| Data is independent. | Information is dependent on data. |
| When data is lost, it can't be reproduced. | When information is lost, it can reproduce from data. |
| Data is meaningless and valueless. | Information is meaningful and valuable. |
| | |
| | |
| | |
| | |

For the Information to be meaningful, the processed data must qualify for the following characteristics –

Timely – Information should be available when required.

Accuracy – Information should be accurate.

Completeness – Information should be complete.

Input – In this step, the input data is prepared in some convenient form for processing. The form will depend on the processing machine.

Processing – In this step, the input data is changed to produce data in a more useful form.

Output – At this stage, the result of the proceeding processing step is collected. The particular form of the output data depends on the use of the data.

Full form of computer: COMPUTER stands for Common Operating Machine Purposely Used for Technological and Educational Research.

Functions of Computer

- 1. Input:** Information or data that is entered into a computer is called input. It sends data and instructions to the Central Processing Unit (CPU).
- 2. Processing:** It is the sequence of actions taken on data to convert it into information which is meaningful to the user. It can be calculations, comparisons or decisions taken by the computer.
- 3. Output:** It makes processed data available to the user. It is mainly used to display the desired result to the user as per input instructions.
- 4. Storage:** It stores data and programs permanently. It is used to store information during the time of program execution and possible to get any type of information from it.

Features of Computer

- 1. Speed:** The computer can process data very fast at the rate of millions of instructions per second.
- 2. Accuracy:** Computers provide a high degree of accuracy. They respond to the user as per the input instructions.
- 3. Storage Capacity:** Computers are capable to store huge amount of data, which depends on the capacity of hard disk.
- 4. Versatility:** Computers can do different types of work simultaneously. They can perform multiple tasks at a same time.
- 5. Diligence:** Unlike human beings, a computer is free from monotony, tiredness, lack of concentration, etc., and can work for hours without creating any errors.
- 6. Secrecy:** Leakage of information is reduced by creating login system with password protection.
- 7. Reliability:** Computers are more reliable than human beings. Computers always produce exact results. The possibility of errors occur only if the input is wrong, i.e. the computers never make mistakes of their own accord.
- 8. Plug and Play:** Computers have the ability to automatically configure a new hardware and software components.

With years its definition of computer changed to a machine that performs calculations. It can perform all type of mathematical and logical operations; it can accept data, store data, retrieve data, process data and produce output.

Charles Babbage was known as father of computer. He invented two machines in 1822 introduced **Difference Engine** and in 1834, introduced **Analytical engine**.

2. History of Computer

The first counting device was used by the primitive people. They used **sticks, stones and bones as counting tools**. As human mind and technology improved with time more computing devices were developed.

Some of the popular computing devices **starting with the first to recent ones** are described below.

Abacus (1602):

The history of computer begins with the birth of abacus which is **believed to be the first computer**. It is said that **Chinese** invented Abacus around 4,000 years ago.

- First mechanical calculating device. ■ A horizontal rod represents the one, tens, hundred, etc.

It was a **wooden rack which has metal rods with beads mounted** on them. The **beads** were moved by the abacus operator according to some rules **to perform arithmetic calculations**. ■ **Used for addition and subtraction operations**. ■ **Calculation of square roots** can also be performed.

Abacus is still used in some countries like China, Russia and Japan.

Napier's Bones (1617):

It was a **manually-operated** calculating device which was invented by **John Napier** (1550-1617) of Merchiston, **Scotland**.

In this calculating tool, he used **9 different ivory strips or bones** marked with numbers **to multiply and divide**. So, the tool became known as "Napier's Bones. It was **also the first machine to use the decimal point**.

- **Three** dimensional structure. ■ Holding numbers from **0 to 9 only**. ■ Represent graphical structure of calculating result. ■ Technology used for calculation **called Rabdologia**.

Pascaline (1642):

Pascaline is **also known as Arithmetic Machine or Adding Machine**. It was **invented between 1642 and 1644** by a **French** mathematician-philosopher **Biaise Pascal**. It is believed that **it was the first mechanical and automatic calculator**.

It could only perform addition and subtraction of two digit numbers. It was a **wooden box with a series of gear sand wheels**. When a wheel is rotated one revolution, it rotates the neighboring wheel. A series of windows is given on the top of the wheels to read the totals.

- First mechanical adding machine. ■ This machine worked on the principle of odometer and watch. ■ Mainly designed with regard to the pressure of liquid.

Stepped Reckoner or Leibnitz wheel (1673):

It was **developed by a German mathematician-philosopher Gottfried Wilhelm Leibnitz** in 1673. He improved Pascal's invention to develop this machine. It was a **digital mechanical calculator** which was called the stepped reckoner as **Instead of gears it was made of fluted drums**.

Jacquard's Loom 1801 Joseph Marie Jacquard (France) ■ It was first mechanical loom. ■ Used punched card for the sequence of operation. ■ Simplified the process of textiles.

Difference Engine (1822):

In the early 1820s, it was designed by Charles Babbage(London) who is known as "Father of Modern Computer". It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables.

Analytical Engine (1834):

This calculating machine was also developed by Charles Babbage in 1834. It was a mechanical computer that used punch-cards as input. It was capable of solving any mathematical problem and storing information as a permanent memory.

- First general-purpose computer.
- Stored program in the form of 'pegs' also called barrels.
- It was a decimal machine used sign and magnitude for representation of a number.

Charles Babbage's Calculating Engines (1792-1871)

Babbage invented the Difference Engine to solve algebraic expressions and mathematical tasks accurately. Later, he designed some improvements to his first computer. The modified machine is called the Analytical Engine. He intended to design a machine with a collection of the four basic arithmetic functions. The design principle of the Analytical Engine can be divided into Input, Output, Memory, Central Processing Unit. The parts and working principle of an Analytical engine are the same as today's computer. Hence, Charles Babbage is known as the Father of Computer.

Tabulating Machine (1890):

It was invented by Herman Hollerith, an American statistician. It was a mechanical tabulator based on punch cards. It could tabulate statistics and record or sort data or information. This machine was used in the 1890 U.S. Census. Hollerith also started the Hollerith's Tabulating Machine Company which later became International Business Machine (IBM) in 1924.

- it used punched cards for reading numbers.
- It was the first electro mechanical machine.
- It was used in the 1890 census.

A Hollerith machine was incorporated with the tabular and punched cards. The machine could census the punched holes, recognise the number and make the required calculation and store the data of census.

Punched Card System Punched Card System was invented by Herman Hollerith, an American Statistician. It was used for storing and retrieving data. In the form of punched holes, the system data could be stored.

Differential Analyzer:

It was the first electronic computer introduced in the United States in 1930. It was an analog device invented by Vannevar Bush. This machine has vacuum tubes to switch electrical signals to perform calculations. It could do 25 calculations in few minutes.

Z1 by Konrad Zuse World's first freely programmable computer.

MARK I (1944):

The next major changes in the history of computer began in 1937 when Howard Aiken (America) planned to develop a machine that could perform calculations involving large numbers. In 1944, Mark I computer was built as a partnership between IBM and Harvard. It was the first programmable digital computer.

The first electro-mechanical computing device was developed by Howard Hathaway Aiken. He used Hollerith's punch card and Babbage's statements to develop **Mark I computer with IBM.**

In Mark III computer, he used some electronic components and Magnetic drum memory.

In Mark IV computer, he used all electronic components and Magnetic drum memory & Magnetic core memory.

- Consists of interlocking panels of small glass, counters, switches and control circuits. ■ Data can be entered manually. ■ mainly used in the war effort during World War-II. ■ **Magnetic drums** are used for storage.

First Un-programmable Electronic Digital Computer (ABC)

The Atanasoff-Berry Computer (ABC) was the **first electronic computer**. It was designed by **John Vincent Atanasoff and Clifford E. Berry**. It was designed to solve systems of linear algebraic equations. **It was also the first to use capacitors for storage**

ENIAC (1946): Electronic Numerical Integrator and Calculator – ENIAC

- JP Eckert and JW Mauchly (America) ■ It is a combination of twenty accumulators. ■ **First electronic digital computer.**
- Used for weather prediction, atomic energy calculation and other scientific uses. ■ Used in IBM and other.

ENIAC was the first electronic computer used for general purposes, such as solving numerical problems.

EDVAC (1947): Electronic Discrete Variable Automatic Computer – EDVAC

- **John Von Neumann (America)** ■ Electronic digital computer ■ Logical design of a computer with a stored program

EDVAC was the successor of ENIAC. In this computer, Binary numbers were used for arithmetic operations and the internal storage of instructions was also written in digital forms.

EDSAC (1949): Electronic Delay Storage Automatic Calculator – EDSAC

- Maurice Wilkes (America) ■ it was the first computer which **provided storage capacity**. ■ First computer program was run on machine. ■ Capable of storing instructions and data in memory. ■ Used mercury delay lines for memory, vacuum tubes for logic.

EDSAC was the first practical general-purpose stored-program electronic computer. It was built according to the **von Neumann machine principles**.

UNIVAC (1951): Universal Automatic Computer - UNIVAC

■ J. Presper Eckert and John Mauchly (America) ■ First general-purpose electronic computer with large amount of input and output. ■ Used magnetic tapes as input and output. ■ Use for account work.

UNIVAC was the first commercially available computer. It was made by the Eckert-Mauchly Computer Company. **It represents the birth of the modern computers.**

IBM-650 Computer (1953):

■ IBM Company ■ Provided input/output units converting alphabetical and special characters to two-digit decimal code. ■ Payroll processing ■ Oil refinery design ■ Market research analysis

Micro processor-Intel4004 ■ by Intel ■ First commercially available microprocessor by Intel, a 4-bitCPU

In 1969, Intel Corporation designed the first general-purpose programmable processor INTEL 4004. **It was a set of four chips known as the MCS-4.** It included a central processing unit chip (the 4004) as well as a supporting read-only memory chip for the custom applications programs, a random-access memory (RAM) chip for processing data, and a shift-register chip for the input/output (I/O) port.

LISA (Local Integrated Software Architecture) ■ Apple Inc ■ First commercial personal computers to have a GUI

Dataphone ■ by AT&T ■ First AT&T Commercial modem

ARPANET ■ United States Department of Defence ■ Early packet switching network and the first network to implement the protocol suite TCP/IP.

NEXUS Browser (WorldWideWeb)

■ Tim Berners-Lee ■ First Web Browser was WorldWideWeb later named Nexus. ■ The first commonly available web browser with a graphical user interface was Erwise.

Six Degrees First social networking/ social mediasite

ENIAC was the first digital computer and it was invented by J. Presper Eckert and John Mauchly at the University of Pennsylvania and began construction in 1943. It uses 18000 vacuum tubes as a storing device. They were also founders of the first computer company, it was initially named Electronic Controls Company which was later changed to **Eckert– Mauchly Computer Corporation**, and released a series of mainframe electronic digital stored-program computer under the name of UNIVAC. **MIT introduces** the whirlwind machine (first computer with RAM) on March 8, 1955.

| Particulars | Name of Person/System |
|--|--|
| Father of Computer | Charles Babbage |
| Father of Modern Computer Science | Alan Tuning |
| First Non-programmable Electronic Digital Computer | Atanasoff Berry Computer (ABC) |
| First General Purpose Electronic Digital Computer | Electronic Numerical Integrator and Calculator (ENIAC) |
| First Micro Processor | INTEL 4004 |
| First Commercially Available Computer | Universal Automatic Computer |

3. Generation of Computer

Generations of Computer A generation refers to the state of improvement in the development of system. Each generation of computer is characterized by a major technological development that fundamentally changed the way, computers operate.

First Generation (1940-1956):

Hardware:

The hardware used in the first generation of computers was: Vacuum Tubes & Punch Cards.

Features:

It supported machine language.

It had slow performance

It occupied large size due to the use of vacuum tubes.

It had a poor storage capacity.

It consumed a lot of electricity and generated a lot of heat. Non Portable.

■ Used for scientific purpose. e.g. ENIAC, UNIVAC, MARK-1, etc.

Memory: The memory was of 4000 bits.

Data Input

The input was only provided through hard-wired programs in the computer, mostly through punched cards and paper tapes.

Examples

The examples of first generation computers are—ENIAC UNIVACTBM701 IBM-701 IBM-650

Second Generation (1956-1963):

Several advancements in the first-gen computers led to the development of second generation computers. Following are various changes in features and components of second generation computers –

Hardware: Transistors **Magnetic Tapes** **Memory:** was 32,000 bits. **Data Input:** provided through punched cards.

It had features like— Batch operating system, Faster and smaller in size, Reliable and energy efficient than the previous generation, Less costly than the previous generation.

The examples of second generation computers are –Honeywell400 CDC 1604 IBM 7030

Third Generation (1964-1971):

Following are the various components and features of the third generation computers—

Hardware: Integrated Circuits made from semi-conductor materials Large capacity disks and magnetic tapes

Features

Supports time-sharing OS Faster, smaller, more reliable and cheaper than the previous generations
Easy to access

Memory: The capacity of the memory was 128,000bits.

Data Input: The input was provided through keyboards and monitors.

Examples:-IBM360/370 CDC 6600 PDP 8/11

Fourth Generation (1972-2010):

Hardware:

- ICs with Very Large Scale Integration (VLSI) technology
- Semiconductor memory
- Magnetic tapes and Floppy

Features:

- Multiprocessing & distributed OS
- Object-oriented high level programs supported
- Small & easy to use; hand-held computers have evolved
- No external cooling required & affordable
- This generation saw the development of networks and the internet
- It saw the development of new trends in GUIs and mouse

Memory: The capacity of the memory was **100 million bits**.

Data Input: The input was provided through improved hand held devices, keyboard and mouse.

Examples: Apple II VAX 9000 CRAY 1 (super computers) CRAY-X-MP (Super Computer)

Fifth Generation (2010-Present):

These are the modern and advanced computers. Significant changes in the components and operations have made fifth generation computers handy and more reliable than the previous generations.

Hardware: ▪ Integrated Circuits with VLSI and Nano technology

- Large capacity hard disk with RAID support
- Powerful servers, Internet, Cluster computing

Features: • Powerful, cheap, reliable and easy to use.

- Portable and faster due to use of parallel processors and Super Large Scale Integrated Circuits.
- Rapid software development is possible.

Memory: The capacity of the memory is **unlimited**.

Data Input: The input is provided through CDROM, Optical Disk and other touch and voice sensitive input devices.

Examples: IBM Pentium PARAM

| Generations | Switching Devices | Storage Devices/Speed | Operating Systems/ Programming Languages | Characteristics | Applications |
|---------------------------------------|--|--|--|--|--|
| First (1940-56) | Vacuum tubes | Magnetic drums (milli seconds) | Batch operating system /Machine language (Binary numbers 0's and 1's) | <ul style="list-style-type: none"> = Fastest computing device. = Generate large amount of heat. = Non-portable. | <ul style="list-style-type: none"> = Used for scientific purpose. e.g. ENIAC, UNIVAC, MARK-1, etc. |
| Second (1956-63) | Transistors (Made up of semiconductors) | Magnetic core technology (micro seconds) | Time sharing OS, Multitasking OS/ Assembly language, high level language | <ul style="list-style-type: none"> = More reliable and less prone to hardware failure. = Portable and generate less amount of heat. | <ul style="list-style-type: none"> = Used for commercial production. e.g. PDP-8, IBM-1401, etc. |
| Third (1964-71) | Integrated Circuits (ICs) (Made up of silicon) | Magnetic core as primary storage medium (nano seconds) | Real-time system/ High level language (FORTRAN, COBOL, ALGOL) | <ul style="list-style-type: none"> = Consumed less power. = Highly sophisticated technology required. | <ul style="list-style-type: none"> = Database management system e.g. NCR-395, B6500, etc. |
| Fourth (1971-Present) | Large Scale Integrated (LSI) circuit, microprocessor | Semi conductor memory, Winchester disc (pico seconds) | Time sharing /PASCAL, ADA, COBOL-74, FORTRAN IV | <ul style="list-style-type: none"> = More reliable and portable. = This generation leads to better communication and resource sharing. | <ul style="list-style-type: none"> = Electronic fund transfer, Distributed system, e.g. Intel 4004 chip, Macintosh. |
| Fifth (Present and Beyond) | Super Large Scale Integrated (SLSI) chips | Optical disc | Knowledge Information Processing System | <ul style="list-style-type: none"> = Parallel processing. = Intel core microprocessor is implemented. = Enables mega chips. | <ul style="list-style-type: none"> = Artificial intelligence e.g. Robotics. |

Generation of Computer

| Subject | 1 st generation | 2 nd generation | 3 rd generation | 4 th generation | 5 th generation |
|-----------------------------|----------------------------|---|---------------------------------|--|--|
| Period | 1940-1956 | 1956-1963 | 1964-1971 | 1971-present | present & beyond |
| Circuitry | Vacuum tube | Transistor | Integrated chips (IC) | Microprocessor (VLSI) | ULSI (Ultra Large Scale Integration) technology |
| Memory Capacity | 20 KB | 128KB | 1MB | Semiconductor type and very high | VLSI and ULSI |
| Processing Speed | 300 IPS inst. Per sec. | 300 IPS | 1MIPS(1 million inst. Per sec.) | Faster than 3 rd generation | Very fast |
| Programming Language | Assembly Language | High level language (FORTRAN, COBOL, ALGOL) | C,C++ | C,C++,Java | All the Higher level languages, Neural networks, |
| Example of computers | UNIVAC, EDVAC | IBM 1401, IBM 7094, CDC 3600,D UNIVAC 1108 | IBM 360 series, 1900 series | Pentium series Multimedia, Stimulation | Artificial Intelligence, Robotics |

Generation of Computers

First Generation Computers- (1946-1959)

The first-generation computers were used vacuum tubes as the electronic components. They occupied a very large space and performed computations in milliseconds. Machine languages are used.

Examples – EDSAC, EDVAC, UNIVAC, IBM-701, IBM-650.

Second Generation Computers – (1959-1965)

The second-generation computers replaced Vacuum Tubes with Transistors. They used assembly languages and batch processing operating system. Magnetic cores and magnetic tapes were used as storage.

Examples – IBM-1620, IBM -7094, CDC-1604, CDC-3600.

Third Generation Computers – (1965-1971)

The third-generation computers replaced transistors with integrated circuits (ICs). They performed computation in Nanoseconds. It used high-level languages like FORTRAN, COBOL, PASCAL, ALGO-68, BASIC was used. In this generation, remote processing, time-sharing, multi-programming operating system were used.

Examples - IBM-360 series, Honeywell-6000 series, PDP, IBM-370/168.

Fourth Generation Computers – (1971-1980)

The fourth-generation computers are used Very Large Scale Integrated (VLSI) circuits. Semi-conductor devices are used as primary memory. Magnetic disks are used as secondary storage. Problem-oriented fourth generation languages (4GL) are used. Multi-processing and multiprogramming operating systems are used.

Example – Apple series – I & II, IBM 4341, DEC 10, STAR 1000, PUP 11.

Fifth Generation Computers - (1980 - Present)

The fifth-generation computers use ultra large scale integrated (ULSI) chips that contain millions of components on a single chip. They are in the developmental stage which is based on the artificial intelligence. These computers can also respond to natural language input. Biochips will be used as memory devices and KIPS (Knowledge-based Information Processing System) architecture will be used.

Examples - Robots, Supercomputers.

4. Types of Computer

We can categorize computer by three ways:

- **Based on data handling capabilities** (Analog Computer, Digital Computer, Hybrid Computer)
- **Based on size** (Microcomputer, Minicomputer, Mainframe Computer, Supercomputer)
- **Based on Utility** (General Purpose Computer, Special Purpose Computer)

Based on data handling capabilities/operation

1. Analogue Computer: introduced by Lord Kelvin. Numerical data are represented by measurable physical variables such as electrical voltage, , pressure, temperature, speed, etc.

Analogue computers are designed to process the analogue data. Analogue data is continuous data that changes continuously and cannot have discrete values such as speed, temperature, pressure and current.

The analogue computers **measure the continuous changes in physical quantity and generally render output as a reading on a dial or scale.** Analogue computers directly accept the data from the measuring device *without first converting* it into numbers and codes. **Speedometer ,seismograph, and mercury thermometer are examples of analogue computers.**

Analog computer can perform several mathematical operations simultaneously. It uses continuous variables for mathematical operations and utilises mechanical or electrical energy.

2. Digital Computer:- accepts and process data in the form of numbers and all the character are converted into binary code 0s and 1s.

Digital computer is most commonly used , working with data represented in digital form, usually binary 0s and 1s,designed to perform calculations and logical operations at high speed and give more accurate results. It accepts the raw data as digits or numbers and processes it with programs stored in its memory to produce output. All modern computers like laptops and desktops that we use at home or office are digital computers.

A digital computer, not only performs mathematical calculations, but also combines the bytes to produce desired graphics, sounds. For example, Desktop (PC).They are extensively used for solving complex problems in the field of engineering & technology, design, research and data processing.

3. Hybrid Computer:-

Hybrid computer has features of both analogue and digital computer. It is fast like analogue computer and has memory and accuracy like digital computers. It can process both continuous and discrete data. So it is widely used in specialized applications where both analogue and digital data is processed.

In large industries and businesses, a hybrid computer can be used for logical operations as well as efficient processing of differential equations.

For example, a processor is used in **petrol pumps** that convert the measurements of fuel flow into quantity and price. Machines used in **hospitals** like ECG and DIALYSIS are the commonly used hybrid computers. You can see hybrid computer in **geological departments.**

Based on Utility /Purposes

1. General Purpose Computer:-A general purpose computer can perform an extensive variety of operations. It can store and execute different programs in its internal storage. **All mainframes, servers, laptop and desktop computers, smart phones and tablets are general-purpose devices.** For example, To make small database, calculations, accounting, etc.

2. Special Purpose Computer:-Special purpose computers are designed to solve specific problems. The instructions are pre-programmed permanently in the computer. It completely controlled by automated manufacturing processes. Example – Aircraft control system, Electronic voting machines etc. these are used to solve a single and dedicated type of problem. For example, **Automatic aircraft landing, multimedia computer**, etc.

Based on size

1. Microcomputer: - these are small relatively inexpensive computer designed for personal and office use. They are popularly used at homes for playing games and surfing the Internet.

It has lowest storing and processing speed. This type of computer is the **least powerful than other computers**, which are based on size, yet the most widely used and is **also called portable computer**.

Microcomputer is also known as **personal computer**. It is a general purpose computer that is **designed for individual use**. It has a microprocessor as a central processing unit, memory, storage area, input unit and output unit. **Laptops and desktop computers are examples of microcomputers.**

Some types of microcomputer are as follows

- **Desktop Computer or Personal Computer (PC):** is small and relatively economical computer sufficient to fit on a desk. This is based on the microprocessor technology (Integrated Circuit-IC).
- **Laptop Computer:** a **portable light weighted** , smaller in size than a desktop **computer** with rechargeable battery, and **integrated screen and keyboard**. It is generally computer and **larger than a notebook computer**. This computer is also known as **ultra book** or notebook.
- **Handheld or Palmtop Computer/Digital Diary /Notebook /PDAs:** This is the smallest and is designed to fit into the palm. So, this is also known as palmtop. a hand-sized computer. **Palmtops have no keyboard** but the **screen serves both** as an input and output device.

It is practical for certain functions such as phone books and calendars. It uses the pen for input instead of keyboard. For example, PDA (Personal Digital Assistant), tablets, etc.

➤ **Workstation:**- Workstation is a single user computer that is designed for technical or scientific applications. It has faster microprocessor, large amount of RAM and high speed graphic adapters. It generally performs a specific job with great expertise; accordingly, they are of different types such as **graphics workstation, music workstation and engineering design workstation.**

This computer is dedicated to a user or group of users engaged in business or professional work. It includes one or more high resolution displays and a **faster processor than a Personal Computer (PC)**.

2. Mini Computer:-

Minicomputers possess most of the features and capabilities of a large computer but are smaller in physical size. They are used as small or midrange operating business and scientific applications.

These are smaller in size, faster and cost lower than mainframe computers. Initially, the minicomputer was designed to carry out some specific tasks, like engineering and Computer Aided Design (CAD) calculations. **But now, they are being used as central computer which is known as server** and capable of **supporting from 2 to 200 users**.

The speed of minicomputer is between 10 to 30 MIPS (Million Instructions Per Second).

First minicomputer was PDP-8. Some examples of minicomputer are **IBM-17, DEC PDP-11, HP-9000, etc.**

3. Mainframe computer:-

Mainframe computers are designed to **support hundreds or thousands of users simultaneously**. They can support multiple programs at the same time. It means they can execute different processes simultaneously. These features of mainframe computers make them **ideal for big organizations like banking and telecom sectors**, which need to **manage and process high volume of data**. It is a midsize multiprocessing computer. It consists of two or more processors and can **support 4 to 200 users at one time**

These types of computer having very large internal memory storage, and used as a server (can support thousands of users) and comprehensive range of software.

It is considered as the heart of a network of computers or terminals that allow a large number of people to work at the same time. Some examples of mainframe computer are **IBM-370, IBM-S/390, UNIVAC-1110, etc.**

Mainframe computers are used in institutes and departments for the tasks such as billing, accounting and inventory management.

4. Supercomputer:-

Powerful, expensive and the fastest computers. They have architectural and operational principles from parallel and grid processing for performing billions and trillions of calculations per second. It has thousands of interconnected processors

They are designed to process huge amount of data because they have high processing speed compared to other computers.

Supercomputers are particularly used for highly calculation intensive tasks, in scientific and engineering applications such as weather forecasting, fluid dynamics, graphic design, scientific research laboratories. and nuclear energy research and military agencies.

The speed of supercomputers is measured in FLOPS (Floating Point Operations per Second).

Some examples of supercomputer are described below :

(i) CRAY-1 was the world's first supercomputer introduced by Seymour Roger CRAY (Father of Supercomputing) in 1976.

(ii) PARAM was the first supercomputer developed by Vijay Bhatkar in India in 1991.

(iii) PARAM Siddhi is the latest machine in the series of PARAM made by C-DAC and released on 16 November, 2020.

(iv) Pratyush, the first multi-peta flops supercomputer was unveiled at Pune based Indian Institute of Tropical Meteorology (IITM) in India.

(v) Fugaku is a claimed exascale supercomputer at the RIKEN Center for Computational Science in Kobe, Japan. It is scheduled to start operating in 2021. It has defended its title as the world's fastest supercomputer.

(vi) Frontier, the new number 1, is built by Hewlett Packard Enterprise (HPE) and housed at the Oak Ridge National Laboratory (ORNL) in Tennessee, USA. **Fugaku**, previously held the top spot.

(vii) Lumi is another HPE system and the new number 3, crunching the numbers in Finland.

(VIII) Fastest Super Computer in the world Summit by the USA

CDC 6600 was the first successful supercomputer.

Sunway TaihuLight of China is the fastest supercomputer in the world.

PARAM-8000 India's first Super Computer developed by CDAC Pune in 1998.

Pratyush-Fastest Super Computer in India

Shasra T is considered as India's fastest super computer, manufactured by Indian Institute of Science.

Servers are dedicated computers that serve the needs or request of other programs or computer.

Workstations serve usually one user only. Information appliances are computers specially designed to perform a specific "user-friendly" function—such as playing music, photography.

An **embedded system** is a computer system with a dedicated function within a larger system.

- **Charles Babbage** is known as the father of computer. **Alan Turing** is known as the father of the modern computer.
- **Siddhartha** was the first computer developed in India. First computer in India was installed in Indian Statistical Institute (ISI), Kolkata.
- Transistors were invented by Bell Laboratory.
- In 1958, Jack St. Clair Kilby and Robert Noyce invented the first IC (Integrated Circuit).
- ENIAC (Electronic Numerical Integrator and Computer) was the first electronic computer developed in Moore School of Engineering, USA.

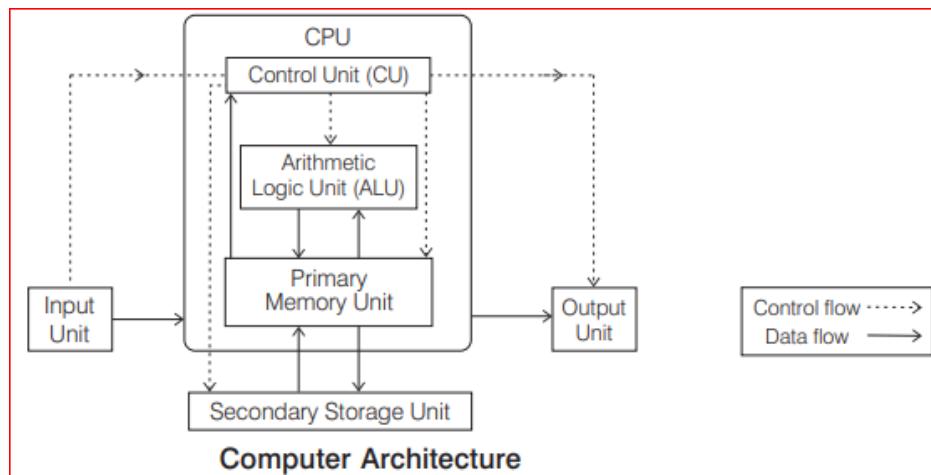
As of August 2023, the AIRAWAT supercomputer is the fastest supercomputer in India, having been ranked 75th fastest in the world at supercomputing conference Germany in the 61st edition of TOP500 supercomputer list.

AIRAWAT has been installed at the Centre for Development of Advanced Computing (C-DAC) in Pune.

Developed by Netweb Technologies.its operating system is Ubuntu 20.04.2 LTS.

5. Computer architecture and Components

Computer architecture deals with the functional behavior of a computer system as viewed by a programmer. It can also be described as the logical structure of the system unit that housed electronic components. **The first computer architecture was introduced in 1970, by John Von Neumann.**



Components of Computer

1. Input Unit
2. Output Unit
3. Central Processing Unit
4. Memory Unit

Note: System unit is a metal or plastic case that holds all the physical parts of the computer. The components that process data are located in it.

All types of computers follow the same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

| S.No. | Operation | Description |
|-------|-----------------------------|--|
| 1 | Take Input | The process of entering data and instructions into the computer system. |
| 2 | Store Data | Saving data and instructions so that they are available for processing as and when required. |
| 3 | Processing Data | Performing arithmetic, and logical operations on data in order to convert them into useful information. |
| 4 | Output Information | The process of producing useful information or results for the user, such as a printed report or visual display. |
| 5 | Control the workflow | directs the manner and sequence in which all of the above operations are performed. |

1. Input Unit:-

This unit contains devices with the help of which we enter data into the computer. **This unit creates a link between the user and the computer.** The input devices translate the information into a form understandable by the computer.

The computer accepts coded information through input unit by the user. This unit is used to give required information to the computer. For example, **keyboard, mouse, etc.**

An input unit performs the following functions:-

- It accepts the instructions and data from the user.
- It converts these instructions and data to computer acceptable format.
- It supplies the converted instructions and data to the computer system for further processing.

Output Unit:-

The output unit consists of devices with the help of which we get the information from the computer. This unit is a link between the computer and the users. Output devices translate the computer's output into a form understandable by the users.

This unit sends the processed results to the user. It is mainly used to display the desired result to the user as per input instructions. For example, monitor, printer, plotter, etc.

The following functions are performed by an output unit

It accepts the results produced by the computer which are in coded form and hence cannot be easily understood by user. **It converts these coded results to readable form which convenient to users.** It produces the converted results to the user..

3. CPU (Central Processing Unit):-

CPU is considered as the brain of the computer. CPU performs all types of data processing operations. It stores data, intermediate results, and instructions (program). It controls the operation of all parts of the computer.

The CPU is fabricated as a single Integrated Circuit (IC) and is also known as **microprocessor**.

It consists a set of registers, arithmetic logic unit and control unit, which together interpret and execute instructions in assembly language.

The primary functions of the CPU are as follows:-

- The CPU transfers instructions and input data from main memory to registers.
- The CPU executes the instructions in the stored sequence.
- When necessary, CPU transfers output data from registers to main memory.
- A CPU controls all the internal and external devices and performs arithmetic and logic operations.

CPU itself has the following three sub-systems – ➤ ALU (Arithmetic Logic Unit) ➤ Memory Unit ➤ Control Unit

1. ALU (Arithmetic Logic Unit):- It represents the fundamental building block of the central processing unit (CPU) of a computer.

ALU contains the electronic circuitry that executes all arithmetic and logical operations on the available data.

ALU uses **registers** to hold the data that is being processed.

Most ALUs can perform the following operations

- (i) Logical operations (AND, NOT, OR, XOR).
- (ii) Arithmetic operations (addition, subtraction, multiplication and division).
- (iii) Bit-shifting operations (shifting or rotating a word by a specified number of bit to the left or right with or without sign extension).
- (iv) Comparison operations (=, <=, >, >=)

This (ALU) unit consists of two subsections namely, ➤ Arithmetic Section ➤ Logic Section

Logic Section:-

Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

Arithmetic Section:-

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Registers

These are used to quickly accept, store and transfer data and instructions that are being used immediately by the CPU.

These registers are the top of the memory hierarchy and are the fastest way for the system to manipulate data. The number and size of registers vary from processor-to-processor.

2. Memory or Storage Unit:-

This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed.

It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM). Its size affects speed, power, and capability

This unit is responsible to store programs or data **on a temporary or permanent basis**. It has **(main memory) and secondary memory (auxiliary memory)**.

The input data which is to be processed is brought into primary memory (main memory) before processing.

Secondary memory is used to permanently store data, programs and output. This unit does not deal directly with the CPU.

Functions of the memory unit are –

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory

3. Control Unit :

This unit controls the operations of all parts of the computer **but does not carry out any actual data processing operations.**

CU coordinates with the input and output devices of a computer.

It directs the computer to carry out stored program instructions by communicating with the ALU and the registers.

It organizes the processing of data and instructions.

The basic function of control unit is to fetch the instruction stored in the main memory, identify the operations and the devices involved in it and accordingly generate control signals.

Functions of this unit are – • It is responsible for controlling the transfer of data and instructions among other units of a computer. • It manages and coordinates all the units of the computer.

- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/output devices for transfer of data or results from storage. • It does not process or store data.

Microprocessor

The CPU is fabricated as a single Integrated Circuit(IC) chip. It is also known as the Microprocessor. **Multiprocessor** Computers uses two or more central processing units (CPUs) within a single computer system.

It is the **controlling element** in a computer system and is sometimes referred to as the **chip**.

Microprocessor is the **main hardware that drives the computer**.

It is a large Printed Circuit Board (PCB), which is used in all electronic systems such as computer, calculator, digital system, etc. **The speed of CPU depends upon the type of microprocessor used**.

Intel 4004 was the first microprocessor made by Intel in 1971 by scientist **Ted Hoff** and engineer **Frederico Faggin**.

Some of the popular microprocessors are **Intel, Intel Core i7, Intel Core i9, Dual Core, Pentium IV, etc.**

Motherboard

Personal computers use a number of chips mounted on a main circuit board called Motherboard. A motherboard is the physical arrangement in a computer that contains the computer's basic circuitry and components.

The main circuit board contained in any computer is called a motherboard. It is **also known as the main board or logic board or system board or planar board**.

All the other electronic devices and circuits of computer system are attached to this board like, ROM, RAM, expansion slots, PCI slots and USB ports. **It also includes controllers for devices like** the hard drive, DVD drive, keyboard and mouse.

Components on Motherboard (i) CMOS battery (ii) BIOS chip (iii) Fan (iv) Expansion slot (v) SMPS (vi) PCI slot (vii) Processor chip (viii) Buses

Interconnection of Units

CPU sends data, instructions and information to the components inside the computer as well as to the peripheral devices attached to it.

A bus is a set of wires used for interconnection, where each wire can carry one bit of data. In other words, **bus is a set of electronic signal pathways that allows information and signals to travel between components inside or outside of a computer.**

A computer bus can be divided into two types

1. **Internal Bus:** The internal bus connects components inside the motherboard like CPU and system memory. **It is also called the system bus.**

Internal bus includes following buses

(i) The command to access the memory or the I/O devices is carried by the **control bus**.

(ii) The address of I/O devices or memory is carried by the **address bus**.

(iii) The data to be transferred is carried by the **data bus**.

2. **External Bus:** It connects the different external devices; peripherals, expansion slots, I/O ports and drive connections to the rest of computer. It is also referred to as the **expansion bus**.

Instruction Cycle

It represents the sequence of events that takes place as an instruction is read from memory and executed.

A simple instruction cycle consists of the following steps

1. Fetching the instruction from the memory. 2. Decoding the instruction for operation. 3. Executing the instruction. 4. Storing in memory.

In above steps, steps 1 and 2 instructions are same and known as **fetch cycle** and steps 3 and 4 instructions are different and known as **execute cycle**.

- **UPS (Uninterruptible Power Supply)** is an electrical apparatus that provides emergency power to a load when the input power source or mains power fails.
- **Power strip** is an electrical device that is used to expand the capacity of a wall outlet in terms of the number of devices it can accommodate.
- **Instruction code** is a **group of bits** that instruct the computer to perform a specific operation.
- **Instruction Execution:** the program which is to be executed is a set of instruction which are stored in memory. The CPU executes the instructions of program to complete a task and this **execution takes place inside the CPU with the help of registers ALU (arithmetic logic unit) and CU(control unit)**. When the processor executes instructions, data is temporarily stored in small local memory location and **these are called registers**.
- **Accumulator Register:** which stores the immediate result of arithmetic and logical operations.
- **Memory address register (MAR) :-** which contain the address of memory location to which data is to be stored. Program counter :- which contain the address of the next instruction to process.
- **Instruction register:-** which contain the current instruction being processed

Computer Hardware and Software

Fundamentals of Computer

A computer system has four basic components.

- **Hardware** - It represents the physical and tangible components of the computer (keyboard, mouse, monitor etc.)
- **Software** – It is a set of electronic instructions called programs that make the computer perform tasks.
- **Data** – It is a set of facts, which the computer stores and reads in the form of numbers.
- **Users** - Users are the people who make use of a computer to obtain certain results/ outcomes.

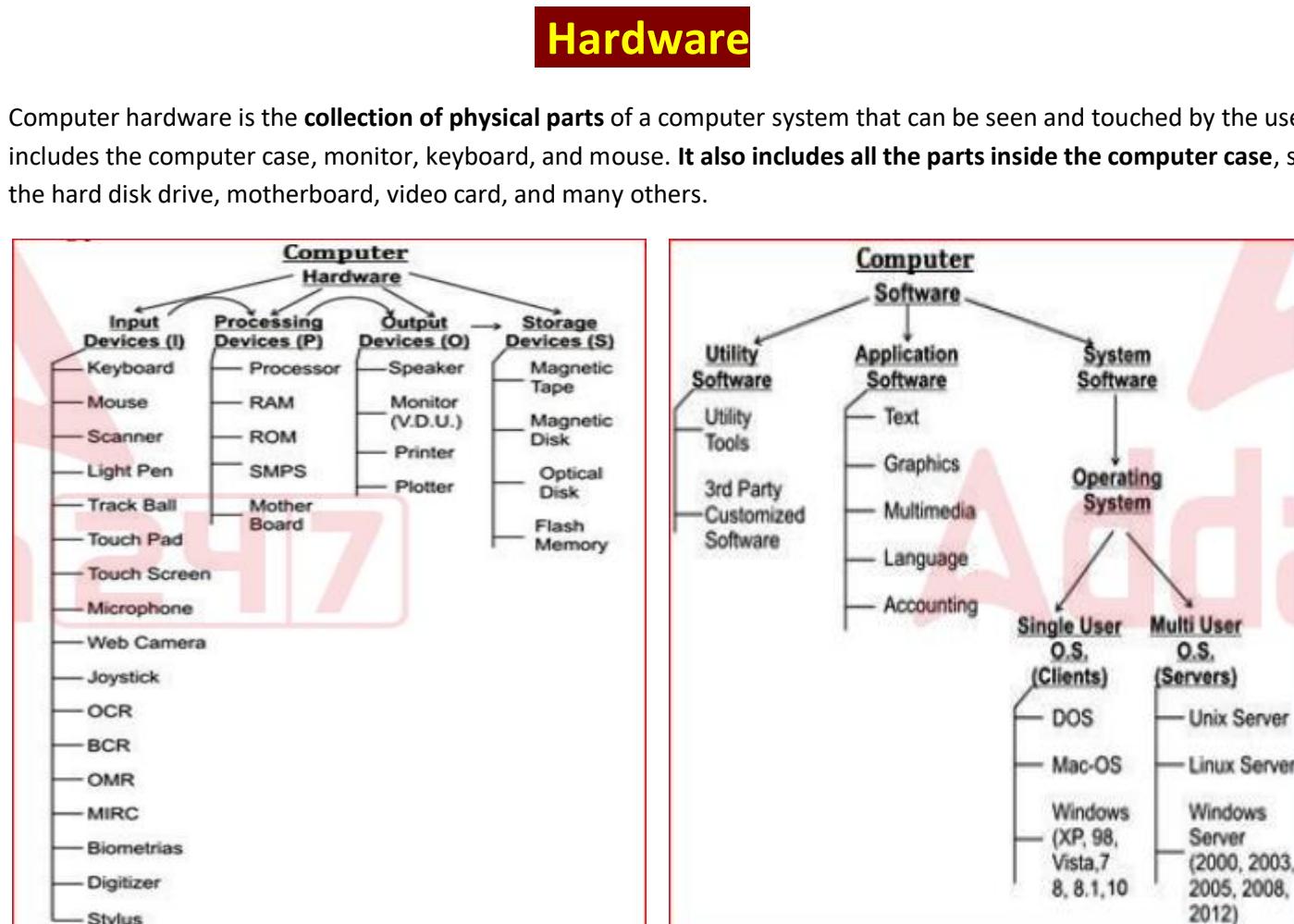
Motherboard: The motherboard serves as a **single platform to connect all of the parts of a computer together**. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. **It can be considered as the backbone of a computer.**

It is the main printed circuit board of a computer that carries (CPU) chip, (ROM), (RAM) and the basic input output system (BIOS) chip.

Computer Peripheral

A peripheral device links to a computer system to enhance the functionality of the computer. **It is not part of the core computer architecture.**

Input devices, output devices, and storage devices are the types of peripheral devices.



Input Devices:-

INPUT:- The data that is fed into a computer processor, received into the computer by a keyboard or other sources is called Input.

Input Devices:- An electro-mechanical device that serve as a link between a user and the computer. It allows the user to feed instructions and data into the computer for processing, display, storage and/or transmission.

This data is useful for analysis and storage and to give commands to the computer. The data is entered into the main memory through these input devices. They accept instructions from the user and convert these accepted instructions into machine language.

Examples of input devices include :-

keyboards, mouse, joysticks, Track Ball , scanners, Barcode Reader, Magnetic Ink Character Recognition (MICR), Optical Character Recognition (OCR), Optical Mark Recognition (OMR), Digitizer, Touch Screen, Microphone, Web Camera , digital cameras, Light Pen, Biometric Sensor, and Smart Card Reader, A point of sale terminal (POS terminal)

1. Keyboard:-

The keyboard is a basic input device that is used to enter data or information into a computer system or any other electronic device which may be in numeric form or alphabetic form by pressing keys. It has different sets of keys for letters, numbers, characters, and functions

When key is pressed, keyboard interacts with a keyboard controller and keyboard buffer. Keyboard controller stores the code of pressed key in keyboard buffer. The user can type text and command using this device.

A keyboard is a typewriter-style device, which uses an arrangement of buttons or keys, to act as mechanical levers or electronic switches. Most of the commonly available personal computers have a keyboard, popularly known as **Qwerty**.

There are different types of keyboard such as QWERTY, DVORAK and AZERTY.QWERTY keyboard contains total 104 keys.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

Keyboards are connected to a computer through USB or a Bluetooth device for wireless communication.

Some important keys in a keyboard are:

Alphanumeric Keys include the alphabet keys (A- Z) and number keys (0- 9).

Numeric Keys are located at the right hand side of the keyboard. They consist of **digits** and **mathematical operators (+-*./)**

Cursor Control Keys:- These keys provide cursor and screen control. It include four directional (left, right, up, down) arrow keys that are arranged in a inverted T formation between the alphanumeric and numeric keypad.

Apart from the above arrow keys, **there are four more keys to control the cursor which are as follows:**

1. Home:- It is used to return the cursor to the beginning of the line or the beginning of a document.

2. End: - It moves the cursor to the end of line.

3. Page Up: - When it is pressed, the page view will move up one page and cursor goes to the previous page.

4. Page Down:- When it is pressed, the page view will move down one page and cursor goes to the next page.

Control keys: - also include **Insert, Delete, Control (Ctrl), Alternate (Alt), Escape (Esc)**

Modifier Keys - It is a special key (key combination) that temporarily modifies the normal action of another key when pressed together. Shift, Alt, Ctrl, Fn are modifier keys.

1. Shift Key Some keys on the keyboard like numeric keys have a **symbol** printed on their upper portion. **Shift key is used to print these symbols.** This key is **also called combination key**, because it is always used with other keys. For example, Shift + a, converts small 'a' into capital 'A'.

2. Alt(Alternate) - used in combination with the numeric keys and the Control key for entering keyboard shortcuts.

3. Control Key It performs a special operation as the combination with other keys. For example, Ctrl + C is used for copying.

4. Function (Fn) - Other functions such as **brightness and volume control**.

Toggle Keys It is used to change the input mode of a group of keys on a keyboard. **Caps Lock, Num Lock, Scroll Lock** are toggle keys.

1. Caps Lock Key It is used to type the alphabet in capital letters. It enables or disables all the letters from being typed in capital letters.

2. Num Lock Key It is used to enable and disable the numeric keypad.

3. Scroll Lock - Allows the arrow keys to scroll through the contents of a window.

Windows Key It is used to open the Start menu.

Spacebar Key It provides space between two words. It is the **longest key on the keyboard**.

Tab Key It is used to move the cursor over the right to a pre-set point. In Word document, **tab is used to indent a paragraph**.

Caps Lock and Num Lock keys are called as '**toggle keys**' because when they are pressed, they toggle or change their status from one state to another.

Shift, Ctrl and Alt keys are also known as **modifier keys**.

Escape Key (Esc) It allows a user to cancel or abort operations, which are executing at present. It opens Start menu with the combination of **Ctrl key**. It is located in the upper left corner of a computer keyboard. It is often used to quit, cancel, or abort a process which is running on a computer.

Function Keys - A key on a computer keyboard, distinct from the main alphanumeric keys, to which software can assign a function. F1 - F12 keys are known as function keys and each key performs a different function. It may be used as single key commands (e.g., F5) or combined with one or more modifier keys (e.g., Alt+F4).

Backspace Key It is used to erase anything typed.

Delete Key It is used to erase information from the computer's memory and characters on the screen.

Enter Key It is used to finish an entry and begin a new entry in the document. It is an alternative to press OK button.

Insert Key

Pointing Device

A pointing device is used to communicate with the computer by pointing to the location on the monitor. Movements of the pointing device are echoed on the screen by movements of the pointer. Some commonly used pointing devices are **described below**

2. Mouse

Mouse is a small handheld **pointing and cursor-control device** having two buttons on its upper side and also has a small wheel between these buttons. It was invented by **Douglas Engelbart** at **Stanford Research Centre in 1963**. It is designed to be used on a flat surface.

A round ball at its base senses the movement of a mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Drag and Drop refers to the action of clicking and holding down the mouse button, while moving the mouse and then releasing the mouse button.

It provides to input data and commands **in graphic form** through moving an arrow called pointer on monitor.

The mouse may be used to position the cursor on screen, move an object by dragging or select an object by clicking.

Four types of mouse are as follows

1. Cordless or Wireless mouse
2. Mechanical mouse
- 3.Optical mouse
4. Trackball Mouse

Four actions of mouse are as follows

1. **Click or Left Click** It selects an item on the screen.
2. **Double Click** It is used to open a document or program.
3. **Right Click** It displays a list of commands on the screen. Right click is **used to access the properties** of the selected object.
4. **Drag and Drop** It is used to move an item on the screen.

Laptop computers come with a touchpad that works as a mouse. It lets you control the movement of cursor or pointer by moving your finger over the touchpad.

3. Trackball

Trackball is another pointing device which is **an alternative to a mouse**. Trackball is also used to control cursor movements and actions on a computer screen. It is **used on CAD/CAM workstations** and sometimes seen on computerised special purpose workstations such as **radar consoles in an air-traffic control room and sonar equipment on a ship or submarine**.

It is mostly used in notebooks or laptops. It is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.

4. Joystick Joystick is a device that moves in all directions and controls the movement of the cursor. It is used to move the cursor position on a monitor screen.

Joysticks are used in flight simulators, Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) system and playing games on the computer. It can also be helpful as an input device for people with movement disabilities.

A joystick is similar to a mouse except that the movement of the cursor on screen stops as soon as the user stops moving the mouse. But with a joystick, the pointer continues moving in the previously pointing direction. **Joystick allows movements in all directions (360°)**.

5. Light Pen

Light pen is a handheld electro-optical pen shaped pointing device. It is used for making drawings, graphics and menu selection. **The pen contains a photocell in a small tube.** It senses the light from the screen when it becomes closer and generates a pulse and is used to point at spots on a video screen.

The tip of the light pen is light sensitive tip that detects the object location and sends the corresponding signals to the CPU.

Light pen is used especially in Personal Digital Assistants (PDA). It is very useful in identifying a specific location on the screen. However, **it does not provide any information when held over a blank part of the screen.**

6. Touch Screen

Touch screen is an input device that accepts input when the user places a fingertip on the computer screen. Touch screens **have an infrared beam** that **criss-cross** the surface of screen. Touch screen is generally used in applications like ATM, hospitals, airline reservation, supermarkets, etc.

It is a type of display screen device that is placed on the computer monitor to allow direct selection or activation of the computer when the user touches the screen. **It acts as both input and output device.** **It can be touched by a finger or stylus.** Touch screen records the event and sends it to a controller for processing.

7. Barcode Reader

Barcode reader is an input device used for reading printed barcodes (Universal Product Code) available on products to be sold. A light sensor in the barcode reader can read the barcode at both the ends of the image and **translates optical impulses into electrical impulses** to store the data into the computer

A perfect example of a barcode reader is, to use it in a super market where barcode scanner reads the price of a product which is in the form of barcode. Also It is an important tool for warehouse management and operations.

A barcode is a machine readable representation of information in the form of stripes of dark and light ink. represented by parallel vertical lines with varying widths. For reading these bar-coded data, a device is used, which is known as a Bar Code Reader (BCR)

8. Magnetic Ink Character Recognition (MICR)

MICR reads the characters by examining their shapes in a matrix form and the information is then passed on to the computer. The characters are printed using a special ink (**contains iron oxide**) that can be **magnetised**.

It provides a high level of security and is therefore used in banks to process the cheques for recognizing the magnetic encoding numbers printed at the bottom of a cheque. It is also used in organizations where security is a major concern.

It is used to verify the legitimacy or originality of paper documents, especially cheques. Information can be encoded in the magnetic characters. It provides a secure, high-speed method of scanning and processing information

9. Optical Mark Reader (OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked.

It is an electronic method that scans the document and reads the data from the marked fields by using a beam of light that is reflected on the paper with marks, to capture presence and absence of data (marks) and results can be transmitted into the computer without using a keyboard for storage, analysis and reporting.

It uses a beam of light that is reflected on the paper with marks, to capture presence and absence of data (marks). It enables a high-speed reading of large quantities of data and transferring these data to the computer

OMR is widely used to read the answer of objective type tests to detect marks on a paper, voting applications and other evaluation studies.

10. Optical Character Recognition (OCR)

OCR is a technique for scanning a scanned or photographed images , handwritten, typewritten or printed page, translating it and then using the OCR software to recognise the image as **ASCII** text that is editable text file.

It translates the array of dots into text that the computer can interpret as words and letters. OCR is a widely used technique for acquiring textual data from image.

It is used in many applications such as telephone bills, electricity bills, insurance premium, etc. It is widely used in offices and libraries to convert documents and books into electronic files.

It is being developed for greater accurate recognition **and is also known as Intelligent Character Recognition (ICR).**

11. Smart Card Reader

It is a device which is used to access the microprocessor of a smart card.

There are two kinds of smart card reader which are as follows

Memory cards are the cards which contain **only non-volatile** memory storage components and some specific security logic.

Microprocessor cards contain **volatile** memory and microprocessor components. The card is made-up of **plastic, generally PVC**. Smart cards are used in large companies and organizations for stronger security authentication.

12. Point of sale terminal (POS terminal) is an electronic device used to process card payments at retail locations.

13. Biometric Sensor

Biometric Sensor is a device which recognizes physical traits of the individual. Biometric sensors are used for marking attendance of employees/ students in organizations/ institutions.

14. Scanner

Scanner is an optical input device which uses light as an input source to convert an image into an electronic form that can be stored on the computer. It is used to convert the data and image on paper into the digital form. It captures images from printed material and converts it into a digital format

Scanners can be used for storing the documents in their original form that can be modified and manipulated later on. Scanner stores images in **both gray scale and color mode.**

The most common types of scanners are as follows (i) Handheld scanners (ii) Flatbed scanners (iii) Drum scanners (iv) , Sheetfed scanner

15. Microphone (Mic)

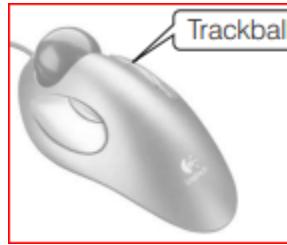
The microphone is a computer input device that is used to input the sound .A mic receives the sound vibrations and converts them into audio signals or sends to a recording medium. The audio signals are converted into digital data and stored in the computer which is called Digitised Sound or Digital Audio.

To convert a voice into digital form, you need an additional hardware known as **Sound Card**. Sound is used most often in **multimedia**.

For example, we can make our presentations more attractive using recorded narration, music or sound effects. Now-a-days, microphones are also used with speech recognition software. This means that we do not have to type, rather just have to speak and the spoken words appear in our document.

16. Webcam (Web Camera) It is a video capturing device. Webcam is a digital camera attached to computer and can be used for video conferencing, online chatting, etc. Now-a-days, webcams are either embedded into the display with laptop/computer or connected via USB or firewire port or Wi-Fi to the computer.

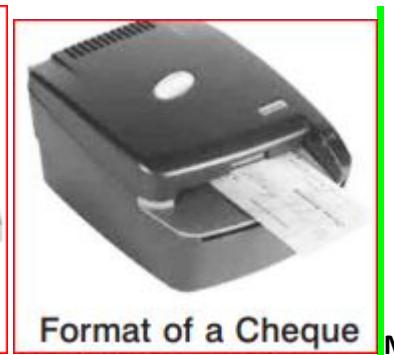
17. Digitizer: Digitizer is a computer input device that has a flat surface and usually comes with a stylus. It enables the user to draw images and graphics using the stylus as we draw on paper with a pencil. The images or graphics drawn on the digitizer appear on the computer monitor or display screen. The software converts the touch inputs into lines and can also convert handwritten text to typewritten words. **These kinds of tablets typically designed for CAD/CAM professionals**



Biometric Sensor



Joystick



Format of a Cheque

MICR



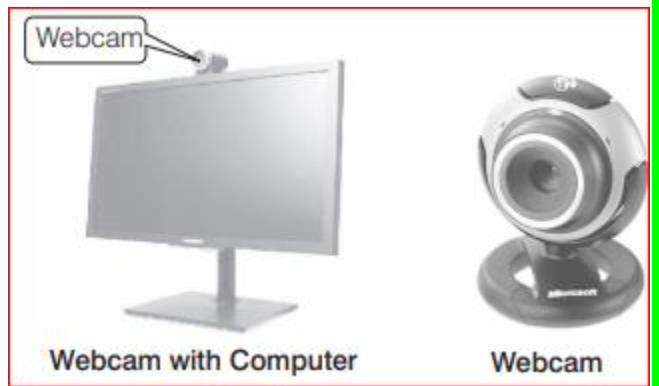
Optical Mark Reader



Barcode Reader



Smart Card Reader



Webcam with Computer



Webcam



digitizer

Optical Character
Recognition



OPTICAL MARK READER



MICR



Light Pen

Output Devices

Output Devices:

The output device displays the result of the processing of raw data that is entered in the computer through an input device. There are a number of output devices that display output in different ways such as **text, images, hard copies, and audio or video.**

An output device is any piece of computer hardware equipment which converts information into human-readable form

Some of the commonly used output devices are:- •Monitor • Printers • Graphic Plotter • Speaker • Headphones • Digital Projector etc.

1. Monitor:

Monitors, **commonly called as Visual Display Unit (VDU)**, are the **main output device** of a computer. It **forms images from tiny dots, called pixels that are arranged in a rectangular form**. The **sharpness of the image depends upon the number of pixels**.

A Monitor is a TV-like display attached to the computer on which the output can be displayed and viewed. **It can either be a monochrome display or a color display.** **The number of pixels displayed on a screen is known as Resolution.**

A monitor is of two kinds; monochrome display monitor and colour display monitor.

A monochrome display monitor **uses only one colour to display text** and **colour display monitor can display 256 colours** at a time.

The clarity of image depends on three factors which are as follows

1. Resolution of Screen: - Resolution refers to the **number of pixels in horizontal and vertical directions**. The resolution of a monitor is higher when the pixels are **closer** together.

2. Dot Pitch: - It refers to the **diagonal distance between two coloured pixels**. The smaller the dot pitch, the better the resolution.

3. Refresh Rate: - The refresh rate of your display refers to **how many times per second the display is able to draw a new image**. The higher the refresh rate, the more solid the image looks on the screen. The refresh rate of monitor is measured in Hertz (Hz).

There are two kinds of viewing screen used for monitors. ➤ Cathode-Ray Tube (CRT) ➤ Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor:

It is a typical rectangular shaped monitor that you see on a desktop computer. The CRT **works in a same way as a television**. **CRT has a vacuum tube**. CRT tube creates an image on the screen **using a beam of electrons**. The **screen of CRT is covered with a fine layer of phosphorescent elements, called phosphors**.

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. **Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.**

There are some disadvantages of CRT – • Large in Size • High power consumption

Flat-Panel Display Monitor:

The flat-panel display refers to a class of video devices that have **reduced volume, weight and power requirement** in comparison to the CRT. You can **hang them on walls or wear them on your wrists**.

Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

The flat-panel display is divided into two categories –

> Emissive Displays: Emissive displays are devices that **convert electrical energy into light**. For example, **plasma panel** and **LED (Light-Emitting Diodes)**.

> Non-Emissive Displays: Non-emissive displays **use optical effects to convert sunlight or light from some other source into graphics patterns**. For example, **LCD (Liquid-Crystal Device)**.

Liquid Crystal Display (LCD):- These screens are used in laptops and notebook sized PCs. A special type of liquid is sandwiched between two plates. It is a thin, flat and light weight screen made up of any number of color or monochrome pixels arranged in front of a light source.

LCD monitors **use compact fluorescent tubes** to illuminate and brighten the image on the screen and produce good image quality, resolution and contrast levels.

Light Emitting Diode (LED):- It is an electronic device that **emits light when electrical current is passed through it**. LEDs usually produce red light, but today's LEDs can produce RGB (Red, Green and Blue) light and **white light as well**.

LED monitors use new backlighting technology to improve picture quality. The LED monitor is more lifelike and accurate due to the improved contrast ratios and colour saturation over LCD.

3-D Monitor:- It is a television that **conveys depth perception to the viewer**. When 3-D images are made interactive then user feels involved with the scene and this experience is **called virtual reality**.

Thin Film Transistor (TFT):- It is a type of field effect transistor that is **usually used in a LCD**. This type of display features a TFT for each individual pixel. These TFTs act as individual switches that allow the pixels to change state rapidly, making them turn ON and OFF much more quickly.

Organic Light Emitting Diode (OLED) Monitor – This type of monitor made up of some organic material (containing carbon, like wood, plastic or polymers) that is used to convert the **electric current into light**. They are directly used to produce the correct colour and **there is no need for backlight** which saves power and space

Plasma monitor

A Plasma monitor panel uses minuscule colored fluorescent lights that produce image pixels. Each pixel is composed of three red, green, and blue fluorescent lights, which resemble small neon lights. along with the intensity of these lights. A plasma display is thinner because it is flat rather than slightly curved, like an LCD. However, plasma monitors are heavier and produced in small quantities.

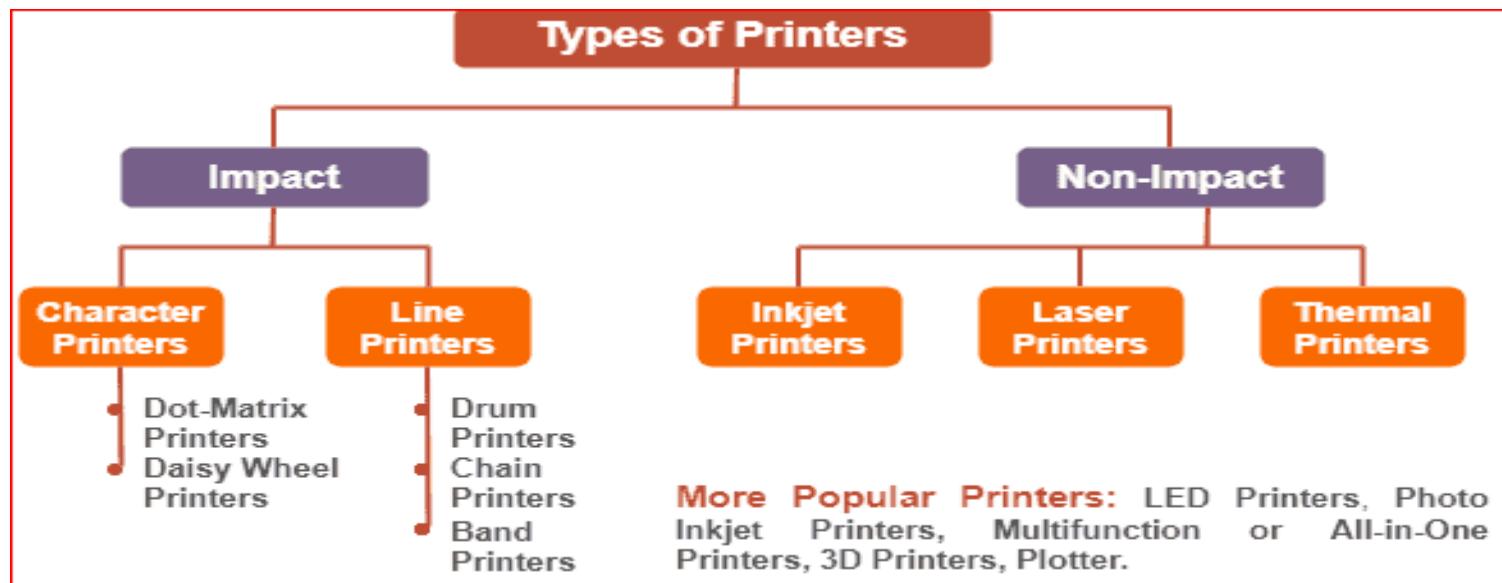
2. Printer:

A printer prints information and data from the computer onto a hard copies of the processed data. It enables the user, to print images, text or any other information onto the paper. It can print documents in colour as well as in black and white. **The quality of a printer is determined by the clarity of the print.**

The speed of a printer is measured in **Characters Per Second (CPS)**, **Lines Per Minute (LPM)** and **Pages Per Minute (PPM)**.

Printer resolution is a numerical measure of print quality that is measured in Dots Per Inch (DPI).

Based on the printing mechanism, the printers are of two types: Impact Printers and Non-impact Printers.



Impact Printers:

The impact printer uses a hammer or print head to print the character or images onto the paper. The hammer or print head strikes or presses an ink ribbon against the paper to print characters and images like a typewriter.

Impact printers are further divided into two types. • Character Printers • Line printers

> Character Printers:-

Character printer prints a **single character at a time or with a single stroke** of the print head or hammer. **It does not print one line at a time.** Dot Matrix printer and Daisy Wheel printer are character printers.

1. Dot Matrix Printer:

Dot Matrix Printer is an impact printer. It forms characters using rows of pins which impact the ribbon on top of the paper **therefore also called pin printers.**

The characters and images printed by it are the patterns of dots. These patterns are produced by striking the ink soaked ribbon against the paper with a print head.

Dot matrix printer prints one character at a time. The print head contains pins that produce a pattern of dots on the paper to form the individual characters. The dot-matrix printer uses **print heads containing from 9 to 24 pins.** **The speed of Dot Matrix printers is around 200-500 characters per second.**

Many dot matrix printers are **bi-directional**, that is they can print the characters from either direction, i.e. left or right.

2. Daisy Wheel Printer:

It consists of a wheel or disk that has spokes or extensions and looks like a daisy, so it is named Daisy Wheel printer.

At the end of extensions, molded metal characters are mounted. To print a character the printer rotates the wheel, and when the desired character is on the print location the hammer hits disk and the extension hits the ink ribbon against the paper to create the impression.

In daisy wheel printers, characters are **fully formed on the petals**, like typewriter keys. These printers produce high resolution output and are more reliable than dot matrix. **The speed is very low around 25-55 characters per second**

> Line printers:-

Line printer, also known as a bar printer, is a high-speed printer (**print 500 to 3000 lines per minute**) capable of **printing an entire line of a text at once** instead of one or more characters at a time. **Drum printer and chain printer are examples of line printers.**

1. Drum printers:- Drum printer is a line printer that is made of a rotating drum to print characters. The drum has circular bands of characters on its surface. It has a separate hammer for each band of characters. When you print, the drum rotates, and when the desired character comes under the hammer, the hammer strikes the ink ribbon against the paper to print characters.

It receives an image from the laser and transfers it onto the paper. The drum is coated with photoreceptor materials.

2. Chain printers:- Chain printer is a line printer that uses a rotating chain to print characters. The characters are embossed on the surface of the chain. The chain rotates horizontally around a set of hammers, for each print location one hammer is provided, i.e., the total number of hammers is equal to the total number of print positions.

3. Band printer:- Band printer has a steel band divided into five sections of 48 characters each.

Non-impact printers:

They print characters and images without direct physical contact between the paper and the printing machinery. These printers can print a complete page at a time, **so they are also known as page printers.**

This type of printer uses electrostatic chemicals and inkjet technologies. They do not hit or impact a ribbon to print. It can produce high quality graphics and often a wide variety of fonts than impact printer.

They are of following types: • Laser printers • Inkjet printers • Thermal Printer • Electromagnetic Printer • Electrostatic Printer

• Laser printers:-

A laser printer is a non-impact printer that **uses a laser beam to print the characters**. The laser beam hits the drum, which is a photoreceptor and draws the image on the drum by altering electrical charges on the drum. The drum then rolls in toner, and the charged image on the drum picks the toner. The toner is then printed on the paper using heat and pressure.

• Inkjet printers:-

The inkjet printer is a non-impact printer that prints images and characters by spraying extremely small droplets of ionized drops of ink onto paper to create an image, to form characters and prints high quality text and graphics..

The print head has tiny nozzles to spray the ink. The printer head moves back and forth and sprays ionized drops of ink on the paper, which is fed through the printer. These drops pass through an electric field that guides the ink onto the paper to print correct images and characters.

•Thermal Printer It uses heat on chemically treated paper to form characters.

•Electromagnetic Printer These printers are also known as **Electrographic or electrophotographic printers**. These are very fast printers and fall under the category of page printers. The electrographic technology has developed from the paper copier technology.

•Electrostatic Printer These printers are generally used for large format printing. They are favoured by large printing shops because of their ability to print fast and making low cost.

Note:- Chuck Hull, the engineer designed and created the first 3D printer in 1984. These printers can be used to print almost anything into a real life model.

Other Types

Solid Ink Printer It is a type of colour printer. It works by melting the solid ink that applies the images to the paper. It is non-toxic and convenient to handle.

LED Printer - This type of printer uses a light emitting diode instead of a laser. It starts by creating a line-by-line image of the page.

3. Plotter

A plotter is a special kind of output device like a printer that produces hard copies of large graphs and designs on paper, such as construction drawings, architectural plans, and business charts, blueprints for mechanical objects, AUTOCAD, CAD/CAM etc.

It uses a pen, pencil, marker or other writing tools for making **vector graphics**. Unlike a regular printer, the plotter can draw continuous point-to-point lines directly from vector graphics files or commands.

Plotters usually come in two forms as follows :-1. Flatbed plotter 2. Drum plotter

Flatbed plotter - It plots on paper that is spread and fixed over a rectangular flatbed table. It is used in the design of cars, ships, aircrafts, buildings, highways etc. It is also known as Table Plotter.

Drum plotter – It is a pen plotter that wraps the paper around a drum with a pin feed attachment. The drum then rotates the paper as pens move across it and draw the image. It is used to produce continuous output, such as plotting of earthquake activity. It is also known as Roller Plotter.

4. Speaker:-They are **transducers**. It is an output device that receives sound in the form of electric current. It needs a sound card connected to a CPU that generates sound by converting electromagnetic waves into sound waves.

These are attached internally or externally to a computer system. These are used for listening music, for being audible in seminars during presentations, etc.

5. Headphones These are a pair of small loudspeakers or less commonly a single speaker, held close to a user's ears and connected to a signal source such as an audio amplifier, radio, CD player or portable media player. They are also known as **stereo phones, headsets or cans**.

6. Digital Projectors Projector is a device that connects with a computer and projects the output onto a large surface such as a big screen or wall so it can be viewed by a large group of people simultaneously.

It uses light and lenses to produce magnified texts, images, and videos. Projectors are widely used for classroom training or conference halls with a large audience. It provides a temporary output display. **There are mainly two types of projectors;** LCD (Liquid Crystal Display) projector and DLP (Digital Light Processing) projector

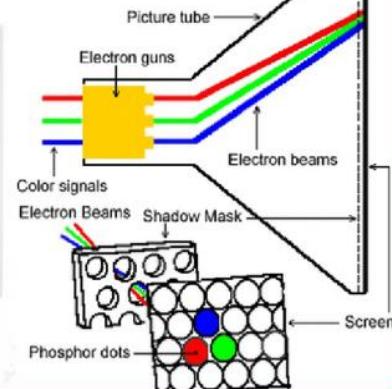
DLP PROJECTORS



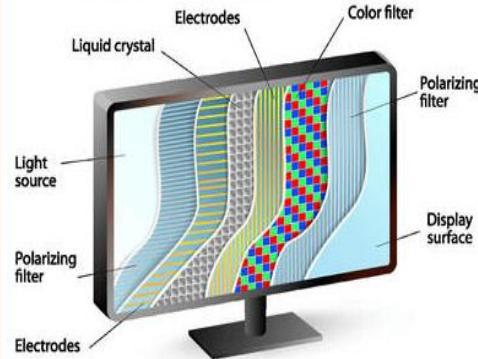
LCD PROJECTORS



Cathode Ray Tube



LIQUID CRYSTAL DISPLAY



How an LCD works

FLAT PANEL DISPLAY

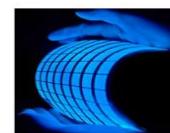


LED Monitor



What is OLED?

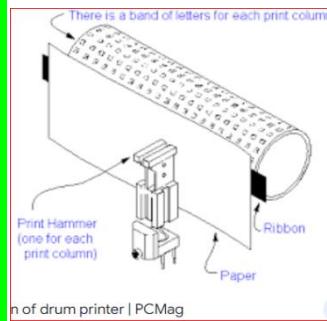
- **Organic Light Emitting Diode**
- Thin-film device with an organic layer
- emits light itself without back light units
- when a current flows at **fluorescent organic compounds**
- **Next-generation display** using organic light-emitting diodes
- Television screen, Computer monitor,
Portable system (mobile phone, handheld games console, PDA)
 - Flexible display
- White OLED devices for use in solid-state lighting applications



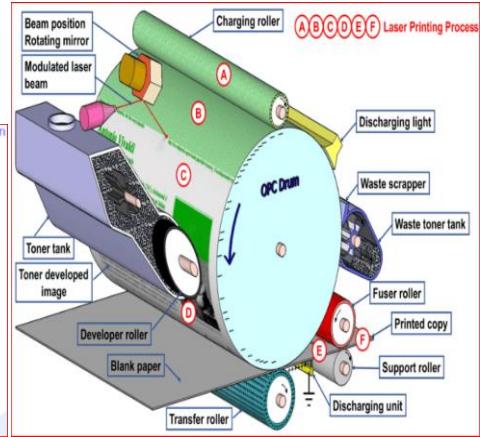
Dot Matrix Printer



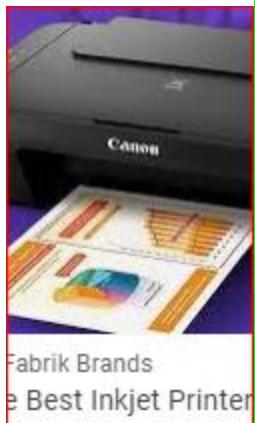
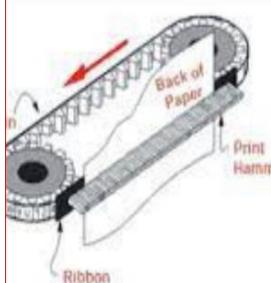
Daisy Wheel Printer



n of drum printer | PCMag



CHAIN PRINTER



Flatbed Plotter



Drum Plotter

■ **MP3** is an audio coding format for digital audio, which uses a form of lossy data compression.

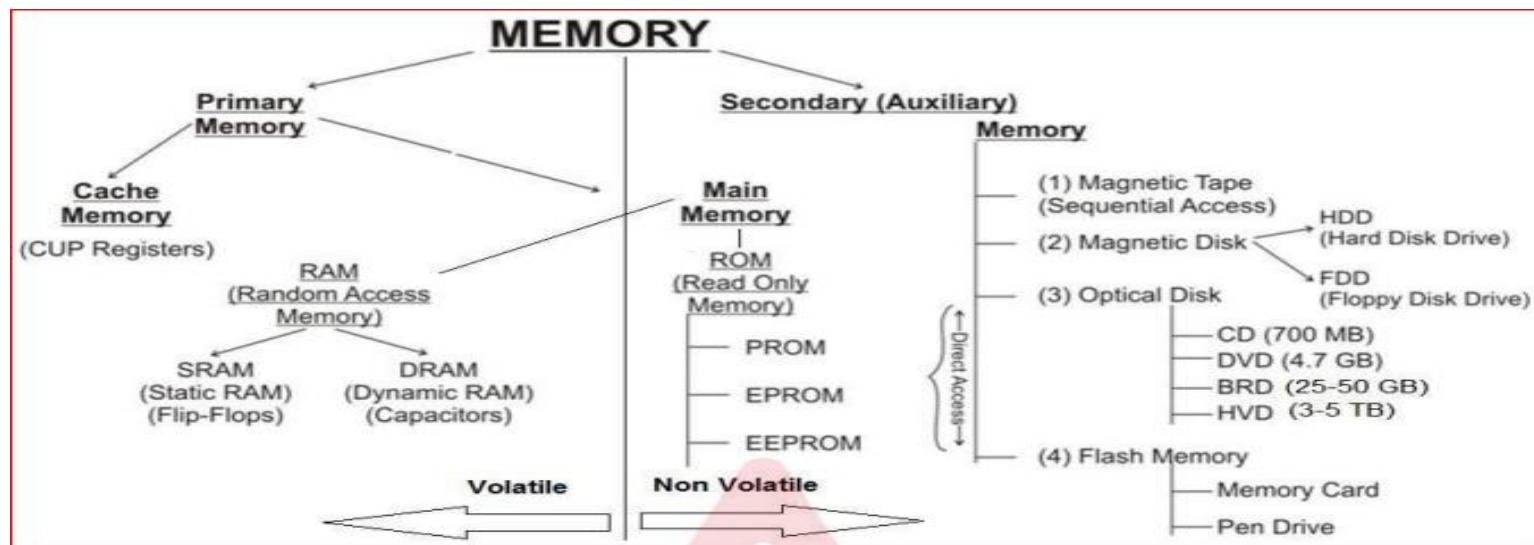
■ The I/O devices that are attached, externally to the computer machine are also **called peripheral devices**.

■ **Speech recognition software** can interpret voice data into words that can be understood by the computer.

■ **A dumb terminal** is simply an output device that accepts data from the CPU.

Computer Memory

Computer memory stores data and instructions required during the processing of data and output results. It also relates to many devices that are responsible for storing data on a temporary or a permanent basis. The performance of computer mainly based on memory and CPU. Memory is internal storage media of computer that has several names such as majorly categorized into two types, 1. Main memory/ Primary Memory 2. Secondary Memory



| | Access Time | Storage Capacity | Cost per bit of storage |
|-------------------------|--------------------|-------------------------|--------------------------------|
| Primary memory | Faster | Smaller | High |
| Secondary memory | Slower | Higher | Low |

| Primary memory | Secondary memory |
|--|---|
| 1. The primary memory is categorized as volatile(RAM) & nonvolatile(ROM) memories | 1. The secondary memory is always a nonvolatile memory. |
| 2. These memories are also called internal memory/main memory | 2. Secondary memory is known as a Backup memory or Additional memory or Auxiliary memory . |
| 3. Data is directly accessed by the processing unit. | 3. Data cannot be accessed directly by the processor . It is first copied from secondary memory to primary memory. Only then CPU can access it |
| 4. It holds data or information that is currently being used by the processing unit. Capacity is usually in 16 to 32 GB | 4. It stores a substantial amount of data and information. Capacity is generally from 200GB to terabytes |
| 5. Primary memory can be accessed by the data bus . | 5. Secondary memory is accessed by I/O channels . |
| 6. Primary memory is costlier than secondary memory | 6. Secondary memory is cheaper than primary memory . |
| 7. Semi-conductor chips are used to store information in primary memory. | Magnetic disk and Optical disk are used to store data/information |
| 8. Data operated and stored in uniform manner | Not stored in uniform manner |
| Examples:-RAM, ROM, Cache Memory, PROM, EPROM, EEPROM, Registers | Examples:-Magnetic tape, Optical disc, Floppy Disks, Flash Memory(USB drives), Paper tape, Punch cards etc. |

1. Primary Memory:

The memory unit that communicates directly with the CPU is called main memory or internal memory or primary memory.

The primary memory allows the computer to store data for immediate manipulation and to keep track of what is currently being processed.

It is a volatile memory i.e. when the power is turned OFF; the contents of this memory are lost forever.

It has limited storage capacity. It is generally made up of the semiconductor device.

Primary memory is computer memory that a processor or computer accesses first or directly.

It allows a processor to access running execution applications and services that are temporarily stored in a specific memory location.

The two types of primary memory are (RAM) & (ROM).

> Random Access Memory (RAM):

It is a **volatile memory**. It means it **does not store data or instructions permanently**. RAM is used for the temporary storage of input data, output data and intermediate results.

It is read/write memory (allows CPU to read as well as write data and instructions into It.) which **stores data till the machine is working**.

It allows the computer to store data for immediate manipulation and to keep track of what is currently being processed

When you switch on the computer and perform some task the data and instructions from the hard disk are stored in RAM. CPU utilizes this data to perform the required tasks. **As soon as you shut down the computer the RAM loses all the data.**

RAM categorized into following types:

1. Dynamic RAM (DRAM)
2. Static RAM (SRAM)
3. SDRAM (**Synchronous Dynamic Random-Access Memory**)

1. DRAM-

It is made up of memory cells where each cell is composed of **one capacitor and one transistor**.

The data on DRAM continues to move in and out of the memory as long as power is available and Dynamic memory must be constantly refreshed, or it loses its contents.

This type of memory is more economical. Occupies less space on the computer's motherboard.

2. SRAM-

It uses multiple transistors for each memory cell. **It does not use capacitor**.

SRAM is faster and less volatile than DRAM but requires more power and is more expensive. It does not need to be refreshed like a DRAM.

SRAM retains data as long as power is provided to the memory chip and need not be refreshed periodically. **It is often used as CPU Cache memory** due to its high speed.

3. SDRAM (Synchronous Dynamic Random-Access Memory) - A type of DRAM that can run at much higher clock speeds.

> Read Only Memory (ROM):

It is a **non-volatile memory or permanent storage**. It means it does not lose its data or programs that are written on it at the time of manufacture (contents are retained even after the power is switched off).

So it is a **permanent memory** that contains all important data and instructions needed to perform important tasks like the **boot process**. ROM is non-volatile and the.

ROM can write data and instructions to it **only one time**. Once a ROM chip is programmed at the time of manufacturing, it cannot be reprogrammed or rewritten. So, it has only **read capability, not write**.

ROM memory has several models such names are following.

0. MROM (Masked ROM) - The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kinds of ROMs are known as masked ROMs which are inexpensive.

1. PROM: Programmable Read Only Memory (PROM)

Maintains large storage media **but can't offer the erase features** in ROM. This type of RO maintains PROM chips to **write data once and read many**. The programs or instructions designed in PROM **can't be erased by other programs**.

It is also non-volatile in nature. Once a PROM has been programmed, its content can never be changed. It is one-time programmable device. The user can buy a blank PROM and enter the desired contents using a PROM program.

This type of memory is found in video game consoles, mobile phones, implantable medical devices and high definition multimedia interfaces.

The difference between a PROM and a ROM (read-only memory) is that a PROM is manufactured as blank memory, whereas a ROM is programmed during the manufacturing process. To write data onto a PROM chip, you need a special device called a PROM programmer or PROM burner.

2. EPROM : Erasable Programmable Read Only Memory

Designed for recover the problems of PROM and ROM. Users can **delete the data of EPROM thorough pass on ultraviolet light**, then rewritten or **reprogrammed**. So, it is also known as **Ultraviolet Erasable Programmable ROM (UVEPROM)**.

EPROMs have a Quartz window in the package to expose the chip to UV light. They were widely used as the BIOS (Basic Input Output System) chips in computer motherboards.

3. EEPROM: Electrically Erasable Programmable Read Only Memory similar to the EPROM but it uses electrical beam to erase the data of ROM. then rewritten electrically and the burning process is reversible by exposure to electric pulses.

It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 milliseconds. **They were also used as BIOS chips.**

It is the most flexible type of ROM and is now commonly used for holding BIOS.

Some other memories that help to primary memory, which are as follows

❖ **Register Memory:** Register memory is the smallest and fastest memory in a computer. It is located in the CPU in the form of registers. A register temporarily holds frequently used data, instructions and memory address that can be quickly accessed by the CPU.

❖ **Cache Memory:** It is small in size but faster than the main memory. The CPU can access it more quickly than the primary memory. It holds the data and programs frequently used by the CPU. So if the CPU finds the required data or instructions in cache memory it doesn't need to access the primary memory (RAM). Thus, it speeds up the system performance.

Cache memory is a very high speed memory placed in between RAM and CPU. It increases the speed of processing.

❖ **Semi-volatile memory:** A third category of memory is "semi-volatile". The term is used to describe a memory which has some limited non-volatile duration after power is removed, but then data is ultimately lost. A typical goal when using a semi volatile memory is to provide high performance/durability/etc. associated with volatile memories, while providing some benefits of a true non-volatile memory.

❖ **Virtual memory:** Virtual memory is a system where all physical memory is controlled by the operating system. When a program needs memory, it requests it from the operating system. The operating system then decides in what physical location to place the program's code and data.

One major advantage of this memory is that **programs can be larger than main memory**.

❖ **Protected memory:** Protected memory is a system where each program is given an area of memory to use and is not permitted to go outside that range. Use of protected memory greatly enhances both the reliability and security of a computer system.

❖ **Flash Memory** It is a kind of semiconductor based non-volatile rewritable memory, used in digital camera, mobile phone, printer, etc.

2. Secondary Memory:

The storage devices in the computer or connected to the computer are known as secondary memory of the computer. The CPU can't directly access the secondary memory. First the secondary memory data must be copied into primary memory i.e. RAM then CPU can access it.

It is non-volatile in nature so permanently stores the data even when the computer is turned off. Secondary memory stores data on a long-term basis. The data remain in the secondary storage as long as it is not overwritten or deleted by the user.

It is the slower and cheaper form of memory than primary memory.

Secondary memory devices include

Magnetic disks like hard drives, floppy disks and Magnetic Tape,

Optical disks such as CDs, DVDs AND Blu-ray Disc

Solid State Storage and such as (i) Pen/Thumb Drive (ii) Memory Cards, **USB memory sticks**

➤ **Solid state storage devices (such as USB memory sticks):** Solid state storage is also faster than traditional hard disk drives because the data is stored electrically in silicon chips called cells. Within the cells, the binary data is stored by holding an electrical current in a transistor with an on / off mode.

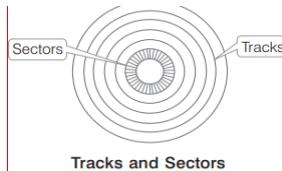
➤ **Optical storage devices (such as CD, DVD and Blue-ray discs):** Optical devices use a laser to scan the surface of a spinning disc made from metal and plastic. The disc surface is divided into tracks, with each track containing many flat areas and hollows. The flat areas are known as lands and the hollows as pits.

1. Magnetic Disk storage devices

It is the manipulation of magnetic fields on a medium in order to record audio, video or other data. It includes hard disk drive, floppy disk and magnetic tape, which are described below

Magnetic devices such as hard disk drives use magnetic fields to magnetise tiny individual sections of a metal spinning disk. Each tiny section represents one bit. A magnetized section represents a binary '1' and a demagnetized section represents a binary '0'.

Hard Disk Drive (HDD):



It is a non-volatile and random access digital data storage device.

HDD is a data storage device used for storing and retrieving digital information using rotating disks (platters) coated with magnetic material.

All programs of a computer are installed in hard disk.

It is a fixed disk, i.e. cannot be removed from the drive. It is a non-removable storage device containing magnetic disks or platters rotating at high speeds. The hard drives store data in segments of **concentric circles**. It may spin at 5,400 to 15,000 RPM.

It consists of a spindle that holds non-magnetic flat circular disks **called platters**, which hold the recorded data.

Each platter requires two read/write heads, that are used to write and read information from a platter.

All the read/write heads are attached to a single access arm so that they cannot move independently.

The information is recorded in bands; each band of information is **called a track**.

Each platter has the same number of tracks and a track location that cuts across all platters is **called a cylinder**. The tracks are divided into pie-shaped sections **known as sectors**.

- **Track**- concentric division of disk
- **Sector**- subdivision of track
- **Platter**- circular magnetic disk which store magnetic data
- **Head**- which perform read write data
- **Spindle** -Spindle is the axis on which the hard disk spin
- **Disk** -Formatting- division of disk into track and sector is known as Disk formatting
- **Speed of disk**- speed of disk is measured in revolution per minute (RPM)

Floppy Disk (Diskette):

Floppy disk is composed of a thin, flexible magnetic disk sealed in a square plastic carrier. Floppy disk is round in shape and a thin plastic disk **coated with iron oxide**.

Floppy disks were widely used to distribute software, transfer files, and create backup copies of data. To read and write data from a floppy disk, a computer system must have a **floppy disk drive (FDD)**.

It is used to store data but it can store small amount of data and it is slower to access than hard disks.

Floppy disk is removable from the drive. Floppy disk is available in three sizes; 8 inch, 5 1by 4 inch and 3 1by 2 inch.

Zip Disks – An advanced version of the floppy disk is known as Zip Disks. It was developed by Iomega. Zip disks are available in 100 and 250-MB and 750 MB capacities and they are used to store, share and back up large amounts of data.

Magnetic Tape: Magnetic tape used in recording sound, pictures, or computer data.

These tapes are made of a plastic film-type material coated with magnetic materials to store data permanently. **Data can be read as well as write**. It is usually 12.5 mm to 25 mm wide and 500 m to 1200 m long.

Magnetic tapes hold the maximum data, which can be accessed sequentially. They are generally used to store backup data or that type of data, which is not frequently used or to transfer data from one system to another.

Optical disk: an electronic data storage medium that can be written to and read using a low-powered laser beam.

It includes CD, DVD and Blu-ray disc, which are described below

1. Compact Disc (CD):- It is the most popular and the least expensive type of optical disc.

A CD is capable of being used as a data storage device along with storing of digital audio.

CD is categorized into three main types as follows

- **CD-ROM:** "Read only" (used for distribution of commercial software, for example) Standard storage capacity is 640MB.
- **CD-R (or CD-WORM):** "Write Once Read Many" times
- **CD-RW:** rewritable multiple times

Write once read many (WORM) describes a data storage device in which information, once written, cannot be modified

2. Digital Video Disc (DVD): It is also known as Super Density Disc (SDD) or Digital Versatile Disc (DVD).

It is an optical disc similar to CD, but with significantly larger storage capacity (4.7GB) while having the same dimensions.

Depending upon the disc type, DVD can store several gigabytes of data (4.7 GB-17.08 GB).

DVDs are primarily used to store music or movies and can be played back on your television or computer too. **They are not rewritable storage device.**

DVDs come in three varieties are as follows

DVD-ROM (Digital Video Disc-Read Only Memory)

DVD-R (DVD-Recordable)

DVD-RW (DVD-Re-Writable)

3. Blu-ray Disc It is an optical disc storage medium designed to re-capture the data normally in DVD format.

Blu-ray disc (BD) contains 25 GB (23.31 GB) per layer space.

The name Blu-ray disc refers to the blue laser used to read the disc, which allows information to be stored at a greater density than the longer-wavelength red laser used in DVDs.

Blu-ray can hold almost 5 times more data than a single layer DVD.

4. Holographic Versatile Disc (HVD) – It is a holographic storage format and has a maximum capacity of 3.9 terabytes.

The variations in the formats are as follows

BD-ROM (Read only)

BD-R (Recordable)

BD-RW (Rewritable)

BD-RE (Rewritable)

3. Solid State Storage

It is a type of storage technique that employs storage devices built using silicon microchip based storage architecture.

It includes pen/flash drive, memory card, which are described below

(i) flash drive:-THEY ARE ALSO KNOW AS Pen/Thumb Drive/ or jump drives

A flash drive is a data storage device that consists of flash memory (key memory) with a portable USB (Universal Serial Bus) interface.

USB flash drives are typically removable, rewritable and much smaller than a floppy disk.

Today, flash drives are available in various storage capacities as 256MB, 512MB, 1GB, 4GB, 16GB upto 64 GB.

They are widely used as an easy and small medium to transfer and store the information from the computers.

Flash memory: a kind of memory that retains data in the absence of a power supply.

(ii) Memory Cards

These are the data storage devices in chip shaped. They are commonly used in many electronic devices, including digital cameras, mobile phones, laptop, and computers.

They are small, re-recordable, easily portable and very light weighted.

Memory can also be categorized on the basis of their material:

Semiconductor memory: such as RAM ROM, EPROM, and flash memory.

Magnetic memory: such as hard disk Drive (HDD), floppy disk Drive (FDD) and magnetic tapes.

Optical memory: such as CDs, DVDs, HVD and blue-ray disk.

Flash Memory:- Pen drive, Memory card etc (EEPROM Technology devices)

Memory unit

Memory unit is the **amount of data that can be stored in the storage unit**. This storage **capacity is expressed in terms of Bytes**.

| Unit | Description |
|-------------------|--|
| Bit(Binary Digit) | A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit. |
| Word | A computer word is a group with a fixed number of bits processed as a unit. The length of a computer word is called word-size or word length and it may be either 8 bits or 96 bits . A computer stores the information in the form of computer words. |
| Nibble | 4 bits = Nibble. |
| Byte | 8 bits = 1 Byte = 2 Nibble. A byte is the Smallest unit which can represent a data item or a character.. A byte is also known as an Octet. |
| Kilo byte(KB) | 1024 Bytes = 1 KB |
| Mega byte(MB) | 1024 KB = 1 MB |
| Giga Byte(GB) | 1024 MB = 1 GB |
| Tera Byte(TB) | 1024 GB = 1 TB |
| Peta Byte(PB) | 1024 TB = 1 PB |
| Exa Byte | 1024 PB = 1 EB |
| Zetta Byte | 1024 EB = 1 ZB |
| Yotta Byte | 1024 ZB = 1 YB |
| (BrontoByte) | 1024 YB = 1 BB (Bronto Byte) |
| (GeopByte) | 1024 BB = 1 GB (Geop Byte) |

Bit < Nibble < Byte < KB < MB < GB < TB < PB < EB < ZB < YB

Note:- Bit is the smallest memory measurement unit. GeopByte is the highest memory measurement unit.

A byte can represent **256** (0-255 or 2⁸) distinct values.

BUS

A bus, in computing, is a set of physical connections (cables, printed circuits, etc.) which can be shared by multiple hardware components in order to communicate with one another.

The address bus (sometimes called the memory bus) transports memory addresses which the processor wants to access in order to read or write data. It is a unidirectional bus.

The data bus transfers instructions coming from or going to the processor. It is a bidirectional bus.

The control bus (or command bus) transports orders and synchronisation signals coming from the control unit and travelling to all other hardware components. It is a bidirectional bus, as it also transmits response signals from the hardware.

Software

Software: Software is a **set/ group of instructions, data or programs used to operate computers** and execute specific tasks. It enables the user to interact with a computer.

A set of instructions that tells the computer about the tasks to be performed and how these tasks are to be performed, **is known as Software**.

The set of instructions, which control the sequence of operations, are known as Program. It is a sequence of instructions, written to perform a specified task with a computer.

Opposite of hardware, which describes the physical aspects of a computer, **software refer to applications, scripts and programs that run on a device.**

Software is of two types: system software and application software.

1. System Software: System software is the **main software** that runs the computer. When you turn on the computer system software activates the hardware and controls and coordinates their functioning. *The application programs are also controlled by system software. It is also known as background software.*

It consists of several programs, which are directly responsible for controlling, integrating and managing the individual hardware components of a computer system.

BIOS:- The Basic Input/Output System (BIOS) is commonly known as System BIOS. BIOS controls various electronic components within the main computer system. The initial function of BIOS is to initialise system devices such as RAM, hard disk, CD/DVD drive, video display card and other hardwares.

Four types of system software are the following. • Operating System • Utility Programs • Device drivers • Language translators.

1. Operating System -

Operating system (OS) is the program that acts as an interface between the user and computer hardware and application software. After the boot program, OS manages all the other programs in a computer.

Examples - MS-DOS, Linux, UNIX, Microsoft Windows XP/2000/98, etc.

Operating system performs the following functions

- (i) It recognizes input from keyboard and sends output to the display screen.
- (ii) It makes sure that programs running at the same time do not interfere with each other.
- (iii) It is also responsible for security and ensures that unauthorized users do not access the system.

2. Utility Programs -

Utility Programs help to manage, maintain and control computer resources. They are **also known as service programs**. Examples of utility programs are **antivirus software, backup software, disk defragment, backup, disk clean** etc.

A. Disk Compression:- It increases the amount of information that can be stored on a hard disk by compressing all information stored on it. For example, DiskDoubler, SuperStor Pro, Double Disk Gold , etc.

B. Disk Fragmenter:-It detects computer files whose contents are broken across several locations on the hard disk and moves the fragments to one location to increase efficiency. It can be used to rearrange files and unused space on your hard disk. For example, MyDefrag, Diskeeper, Defraggler, etc.

C. Backup Utilities:- It can make a copy of all information stored on a disk and restore either the entire disk or selected files.

D. Disk Cleaners:- It is used to find files that have not been used for a long time. This utility also serves to increase the speed of a slow computer. For example, Bleach Bit cleaner, etc.

E. Anti-virus:- It is the utility which is used to scan computer for viruses and prevent the computer system and files from being corrupt. For example, Kaspersky, AVG, McAfee, Avira, etc.

F. Text Editor:- It is a program that facilitates the creation and correction of text. A text editor supports special commands for text editing, i.e. you can write, delete, find and replace words, lines, paragraphs, etc. For example, MS-Word, WordPad, Notepad, etc., in which Notepad is the most popular text editor.

3. Device Drivers – It is software, which is written with the objective of making a **device** functional when it is **connected** to the computer is called device driver.

A device driver is It is a system software that are designed to enable interaction with hardware devices. It controls a device that is attached to your computer.

Every device, whether it is a printer, monitor, mouse, keyboard, CDROM readers, Disk **drives has a driver program** associated with it for its proper functioning.

2. Application Software:

Applications software is a set of programs designed to perform a specific task. It is a group of program designed for fulfill the demand of end user e.g. MS office, PowerPoint, Windows Media Player.

It does not control or coordinate the working of computer.

A computer can run without application software.

Application software can be easily installed or uninstalled as required.

Application software's are also called the end-user programs. These programs do the real work for users

Microsoft Office Suite, Adobe Photoshop and any other software like payroll software or income tax software are application software.

There are two types of application software:- Basic application software and Specific Purpose Software

1. Basic application software:- Basic application software is **also known as general purpose applications** and productivity applications. These programs are widely used in every discipline and occupation. Allow people to do simple computer tasks.

Some of the general purpose software is as follows

1. Word processors:- capable of creating, storing and printing of documents. Have ability to create a document and make changes anywhere in the document. For example, **Microsoft Word**, WordPerfect (Windows only), AppleWorks (Mac only), OpenOffice.org Writer, etc.

2. Electronic Spreadsheets:- Spreadsheet applications are the computer programs that **accept data in a tabular form** and allow you to create and manipulate spreadsheets electronically. For example, **Microsoft Excel**, Corel Quattro Pro, Lotus 1-2-3, OpenOffice.org Calc, etc.

3. Presentation Software: - used for creation of the slides and to display the information in the form of presentation of slides. For example, **Microsoft PowerPoint**, Corel Presentations, Lotus Freelance Graphics, OpenOffice.org Impress, etc.

4. Database Management System (DBMS):- A DBMS refers to the software that is **responsible for sorting, maintaining and utilizing a database**. For example, **Microsoft Access**, Corel Paradox, **MySQL**, OpenOffice.org Base, etc.

5. Desktop Publishing (DTP):- Software It is a **tool for graphic designers and non-designers to create visual communications** for professional or desktop printing as well as for online or on screen electronic publishing. For example, Quark XPress, **Adobe PageMaker**, 3B2, CorelDraw, Corel Ventura, Illustrator, etc.

6. Graphics Software (Image Editing):- It enables a person to manipulate visual images on a computer system. Most graphics softwares have the ability to import and export one or more graphics file formats. For example, DirectX, **Adobe Photoshop**, piZap, **Microsoft Publisher**, **Picasa**, etc.

7. Multimedia Software:- Multimedia includes a combination of text, audio, still images, animation, video or interactivity content forms. For example, **Macro-Media Flash**, Xilisoft Video Converter, **VLC Media Player**, Nimbuzz, etc.

2. Specialized application software:-

Specialized application software is designed for a specific task rather for a wide application area. This type of application software generally has one purpose to execute

Graphics programs, audio and video editors, multimedia creation programs, web authoring, and virtual reality programs are common types of specialized software.

Some of the Special purpose softwares are as follows:-

1. Inventory Management System and Purchasing System :-

Inventory is a list of goods and materials available in a stock. Inventory management system is generally used in departmental stores or in an organisation to keep the records of the stock of all the physical resources. Example, Fishbowl, AdvancePro, etc.

2. Payroll Management System

It is used by all modern organisations to encompass every employee of the organisation who receives a regular wages or other compensation. For example, Namely, UltiPro, etc.

3. Hotel Management System

It refers to the management techniques used in the hotel sector. These can include hotel administration, accounts, billing, marketing, housekeeping, front office or front desk. For example, Djubo, Aatithya HMS, Hotelogix PMS, etc.

4. Reservation System

A reservation system or Central Reservation System (CRS) is a computerised system used to store and retrieve information and conduct transactions related to air travel, hotels, car rental or other activities. Today, number of websites like www.yatra.com, www.makemytrip.com provide online booking for tourists.

5. Report Card Generator

It is an application software which is commonly used in schools by the examination department to prepare and generate the report cards of the students. For example, E-report card.

6. Accounting Software

It is an application software that records and processes accounting transactions within functional modules such as accounts payable, accounts receivable, payroll and trial balance. For example, Tally. ERP9, HDPOS, MARG, Profit book etc.

7. Billing System

It refers to the software that is used to perform the billing process. It handles the tracking of labeled products and services delivered to a customer or set of customers. For example, Billing Manager, Billing Tracker, kBilling, etc.

Open Source Software (OSS):- Open source refers to **something that can be modified and shared** as its designed are **publicly accessible**. Open Source Software (OSS) is any computer software that is distributed with its source code available for modification.

Examples of Open Source Software are Linux, Unix, MySQL, etc.

To be considered as open source software by the software development industry, certain criteria must be met are as follows

- Software must be available free or at a low cost.
- Source code must be included.
- Anyone must be allowed to modify the source code.
- Modified versions can be redistributed.

The distribution terms of open source software must comply with the following criteria:-

- 1. Free Re-distribution:**-The license shall not restrict any party from selling or giving away the software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.
- 2. Source Code:**- The program must include source code and allows distribution with source code as well as a compiled form. The source code must be in the preferred form in which a programmer would modify the program.
- 3. Integrity of the Author's Source Code:**- The license may restrict source code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time.

Proprietary Software

It is software that is owned by an individual or a company.

There are always major restrictions on it to use and its **source code is always kept secret**.

Proprietary software is **copyrighted and bears limits against use, distribution and modification** that are imposed by its publisher, vendor or developer.

Main Barriers for Using Proprietary Software

1. Licenses and maintenance of proprietary software is very expensive.
 2. It is developed for a single purpose, applications are separately packaged.
 3. Vendor support is conditional to maintenance subscription.
 4. Users have to dependent on the developer of proprietary software for all updates, support and fixes.
 5. Low level of customization and adaptability.
- **Adobe Page Maker** is a typesetting tool which is used for desktop publishing.
 - **Fully Backup** contains a copy of every program, data and system file on a computer.
 -is a combination of software and hardware. e.g. ROMs, PROMs and EPROMs.
 - **Freeware** is commonly used for copyrighted software that is given away for free by its owner.

Hardware

Physical parts of the computer are called hardware.

You can touch, see and feel hardware

Hardware is constructed using physical materials or components.

Computer is hardware, which operates under the control of software. The operations of computer are controlled through software

If hardware is damaged, it is replaced with new one

Hardware is not affected by computer viruses

User cannot make new duplicate copies of the hardware

Hardware cannot be transferred electronically through network.

Software

A set of instructions given to the computer is called software

you cannot touch and feel software

Software is developed by writing instructions in programming language

Software is affected by computer viruses

User can make many new duplicate copies of the software

Software can be transferred from one place to another

Operating system, Types and its functions

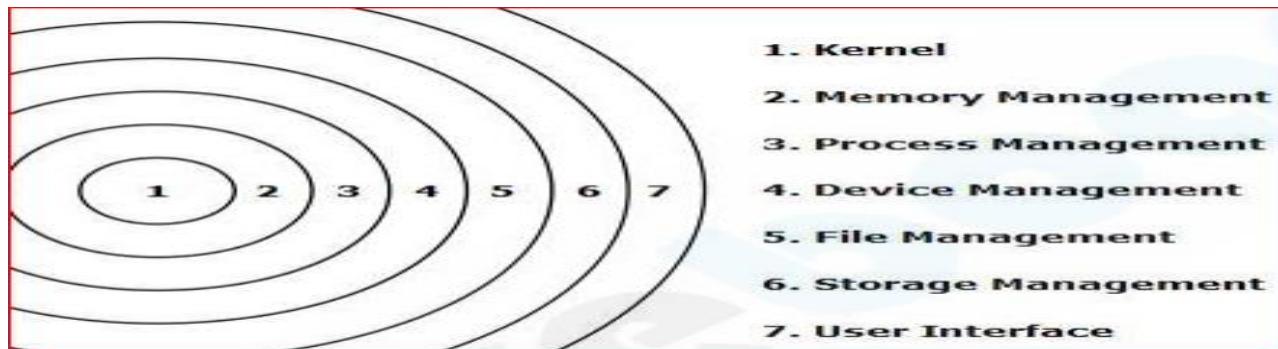
An Operating System (OS) is an interface between computer user and computer hardware. It helps in controlling and managing the hardware and the software resources of a computer system.

An operating system is software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Operating system is an organized collection or integrated set of specialized programs that controls the overall operations of a computer. **It is a program that must be on any computer for proper booting.**

Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc. **Apple's latest operating system, macOS Mojave, version 10.14.**

1. Layered Structure of a Computer System:



2. Functions of operating system:

- Following are some of important functions of an operating System.
- Memory Management • Processor Management • Device Management • File Management
 - Security • Control over system performance • Job accounting • Error detecting aids
 - Coordination between other software and users

Memory Management:-

It refers to management of Primary Memory or Main Memory.

Main memory is a large array of words or bytes where each word or byte has its own address. Main memory provides a fast storage that can be accessed directly by the CPU. **For a program to be executed, it must be in the main memory.**

Memory management is the process of **controlling and coordinating computer memory**, conveying **memory blocks** to **various running programs** to enhance overall system performance.

An Operating System does the following activities for memory management –

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part is not in use.
- In multiprogramming, the OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management:-

It is a process by which operating system can **control the planning, monitoring and performance of a CPU.**

In multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is **called process scheduling.**

An Operating System does the following activities for processor management –

- Keeps tracks of processor and status of process. The program responsible for this task is **known as traffic controller.**
- Allocates the processor (CPU) to a process. • De-allocates processor when a process is no longer required.

Device Management:-

It is a process of managing the **operation and maintenance of input/output devices.** It also facilitates the interface between all the connected devices.

This is called the Input/output controller and it decides which process gets the device, when, and for how long.

An Operating System manages device communication **via their respective drivers.**

It does the following activities for device management –

- Keeps tracks of all devices.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

File Management:- It is the main function of operating system. It manages all data files in a computer system.

At the time of execution of a program, the operating system also performs the task of copying files from secondary memory to primary memory.

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.

File Management **allocates and de-allocates the resources.** It keeps track of information, location, uses, status etc. The collective facilities are **known as a file system.**

An Operating System does the following activities for file management –

- Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who gets the resources. • Allocates the resources. • De-allocates the resources.

Other Important Activities

Following are some of the important activities that an Operating System performs –

- ❖ **Security** – By means of password and similar other techniques, it prevents unauthorized access to programs and data.
- ❖ **Control over system performance** – Recording delays between request for a service and response from the system.
- ❖ **Job accounting** – Keeping track of time and resources used by various jobs and users.

- ❖ **Error detecting aids** – Production of dumps, traces, error messages, and other debugging and error detecting aids.
- ❖ **Coordination between other software and users** – Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

3. Types of Operating System:

- Batch Operating System
- Multi-Programming Operating System
- Timesharing/Multitasking Operating System
- Distributed Operating System
- Real-Time Operating System
- Single-user operating System

Batch operating/Processing system: Here data and program that need to be processed are bundled and collected as a batch and executed together.

The users of a batch operating system **do not** interact with the computer directly.

Each user prepares his job **on an off-line device** like punch cards and submits it to the computer operator.

To speed up processing, jobs with similar needs are batched together and run as a group.

The programmers leave their programs with the operator and the operator then sorts the programs with similar requirements into batches.

This operating system is responsible for scheduling the jobs according to priority and the resource required. e.g. **Unix**.

Disadvantages

- ✓ Lack of interaction between the user and the job
- ✓ the speed of the process is slow. Hence Output is time taking
- ✓ The CPU is in idle condition

Multiprogramming Operating System:

Multiprogramming is an **extension to the batch processing** where the **CPU is kept always busy**. The processes which are running exist in main memory at a time.

Each process needs two types of system time: **CPU time and IO time**. In multiprogramming environment, for the time a process does its I/O, The CPU can start the execution of other processes. Therefore, multiprogramming improves the efficiency of the system.

Disadvantages ✓ The waiting time for the job is high ✓ Complicated schedule handling

It allows the instruction and data from two or more separate process to reside in primary simultaneously.

Multiprogramming system are multitasking multiuser and multiprocessing operating system.

Time-sharing/Multi-tasking operating systems:

Time-sharing is a technique which **enables many people, located at various terminals, to use a particular computer system at the same time**. **Time-sharing or multitasking is a logical extension of multiprogramming.**

Processor's time which is shared among multiple users simultaneously is termed as time-sharing. **Only a little CPU time is needed for each user.** It also allows the user to switch between the running applications.

Disadvantages ✓ Less Reliability ✓ Problem of Data Communication

Multi-tasking OS further classified into two types

(i) **Preemptive Multitasking OS** It is a type of multitasking OS that allows computer programs to share operating system and underlying hardware resources.

(ii) **Cooperative Multitasking OS** It is the simplest form of multitasking. In it, each program can control the CPU for as long as it needs it.

Single User Operating System

It is a type of operating system which **allows only one user at a time**. Operating system for Personal Computer (PC) is a single user OS. They are designed to manage **one task at a time**. e.g. MS-DOS, Windows 9X.

Single keyboard and Single monitor are used for interaction. Several programs can also run by a single user in this operating system.

Multiprocessing Operating System:

In Multiprocessing, parallel computing is achieved. There are more than one processors present in the system which can execute more than one process at the same time. This will increase the throughput of the system.

Distributed operating System:

Distributed systems use multiple central processors to serve multiple real-time applications and multiple users. **Data processing jobs are distributed among the processors accordingly.**

It is the one which manages a collection of independent computers and makes them appear to the user of the system as a single computer.

The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as **loosely coupled systems or distributed systems**.

Advantages ✓ Potential Operation ✓ Better service to the customers. ✓ the load on the host computer is reduced ✓ Delays in data processing are reduced

Real Time operating System:

A real-time system is defined as a data processing system in which the time interval required to process and respond to inputs is so small that it controls the environment.

The time taken by the system to respond to an input and display of required updated information is termed as the response time. So in this method, the **response time is very less as compared to online processing**.

They are often used in applications such as flight reservation system, military applications, etc.

This type of operating system increases the availability and reliability of the system. **Examples – VRTX, RT Linux, Lynx etc**

There are two types of real-time operating systems.

➤ **Hard real-time systems:**

Hard real-time systems guarantee that all the tasks are required to be completed within the specified time limit.

In hard real-time systems, **secondary storage is limited or missing** and the **data is stored in ROM**. In these systems, **virtual memory is almost never found**. Examples – Industrial control applications, Robots, etc

➤ **Soft real-time systems:**

Soft real-time systems are less restrictive. A critical real-time task gets priority over other tasks and retains the priority until it completes.

Soft real-time systems have limited utility than hard real-time systems. For example, multimedia, virtual realities, Advanced Scientific Projects like undersea exploration and planetary rovers, etc.

Advantages ✓ It can be used in an embedded system ✓ Error-free ✓ Better memory allocation

Disadvantages ✓ Algorithm is complex

Network operating System:

A Network Operating System runs on a server and provides the server the capability to manage data, users, groups, security, applications, and other networking functions. The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), a private network or to other networks.

Android - Android is the name of the operating system used on many smart phones and tablets. **It is owned and maintained by Google**. The recent version of Android is **Android 11**.

Mobile OS: Windows 10 Mobile is the latest name for Microsoft's phone and tablet operating system. Google's latest's version of its android OS is **Nougat** and iOS i.e. iPhone Operating System's latest version is **iOS10**.

User Interface:- The system which provides the facility to the user to interact with the computer is called user interface. It allows users to easily access and communicates with the applications and the hardware.

The user can interact with the computer by using mainly two kinds of interface

1. Graphical User Interface (GUI):- It is a computer program that enables a person to communicate with a computer through the use of symbols, visual metaphors and pointing devices. It is best known for its implementation in Apple products. The first graphical user interface was designed by Xerox Corporation in 1970s. GUIs can be found in handheld devices such as MP3 players, portable media players, gaming devices, etc.

2. Character User Interface (CUI):- It is also known as Command Line Interface (CLI). CUI is a mechanism of interacting with a computer system or software by typing commands to perform specific tasks.

CUI only uses text types one after another just as commands used in MS-DOS.

Batch processing: Batch processing is a technique in which an Operating System collects the programs and data together in a batch before processing starts

Multitasking:

Multitasking is when multiple jobs are executed by the CPU simultaneously by switching between them. Switches occur so frequently that the users may interact with each program while it is running. A program that is loaded into memory and is executing is commonly referred to as a process.

Spooling:

Spooling is an acronym for simultaneous peripheral operations on line. Spooling refers to putting data of various I/O jobs in a buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices.

Booting: Booting is starting up a computer or computer appliance until it can be used.

It can be initiated by hardware such as a **Start button** or by Software command.

When the computer starts, the **operating system is first loaded** (as it is essential for running all other programs), this process is known as booting.

Cold Boot: When a computer is turned ON after it has been completely shutdown is called Cold Booting.

Warm Boot: When a computer is restarted by pressing the combination of Ctrl + Alt + Del keys or by Restart button is called Warm Booting.

Firmware: Firmware is a software program that is written to a hardware device. It allows the hardware to be updated. The contents are saved when a hardware device is turned off or loses its external power source.

Middleware: Middleware is a software layer situated between applications and operating systems. It enables communication and data management for distributed applications.

Some popular operating systems are as follows

1. UNIX The first version of Unix was developed in 1969 by Ken Thompson and Dennis Ritchie. It is primarily used to a server rather than a work station and should not be used by anyone who does not understand the system.

2. Apple Macintosh (Mac OS) It was introduced in January, 1984 by Steve Jobs and was initially named as system software, which was later renamed as Mac OS. Versions of Mac OSX are Yosemite, Mavericks, Mountain Lion, Tiger, Tiger Panther, Jaguar, etc.

3. LINUX The first Linux Kernel was released in September, 1991 by Linus Torvalds. It is an open source software. Linux is similar to Unix in operations. It is difficult to understand by anyone. Kernel is the core of the operating system that supports the process by providing a path to the peripheral devices.

4. Microsoft Windows It is an operating system, based on GUI, developed by Microsoft. Microsoft first introduced an operating environment named Windows in November 1985.

MS-DOS (Microsoft-Disk Operating System)

The DOS OS was developed by Microsoft in 1980 for micro computers. MS-DOS was the first operating system that run on PC developed by IBM Corporation in 1981. DOS is a single user operating system. It is the only operating system which can be loaded in the main memory of the computer using a single disk.

Structure of DOS four essential programs associated with the control of computer and the way it interacts with them

1. Boot Record It includes loading the operating system into main memory. It is the main program of MS-DOS.
2. Basic Input/Output System (BIOS. sys) It provides an interface between the hardware and programs.
3. The MS-DOS. sys Program It is a collection of program routines and data tables that provide high level programs such as application programs.
4. The Command.com Program It provides a standard set of commands that gives users access to file management, configuration and miscellaneous functions.

Types of MS-DOS Commands

There are two types of MS-DOS commands as follows

1. Internal Commands These commands are automatically loaded into main memory when the booting process gets completed. e.g. DATE, TIME, VER, VOL, DIR, COPY, CLS, etc.

2. External Commands These commands require external files to be loaded in the computer to run. e.g. Checking disk, comparing disk, formatting, etc.

Configuration of DOS Config. sys, Autoexec. bat and their files provide the environment to computer to set commands

(i) Config. sys It adjusts the system according to commands.

(ii) Autoexec.bat When the system is powered ON, this file executes in automatically command line.

Mobile Operating System This OS operates on Smartphones, Tablets and Digital Mobile devices. It controls mobile devices and its design supports wireless communication and different types of mobile applications. It has built-in support for mobile multimedia formats.

Some popular mobile operating systems are as follows

1. Android:- It is a mobile OS developed by Google, which is based on Linux (main part of operating system). It is basically designed for touch screen mobile devices like Tablets, Smartphones, etc. Now-a-days, it is most widely used in mobile phones. The latest version of Android is Android 11, which was released on 8th September, 2020.

2. Symbian:-It is the OS developed and sold by Symbian Ltd. It is an open source mobile OS designed for Smartphones. It has been used by many major handset manufacturers including Motorola, Nokia, Samsung, Sony, etc. The latest version of Symbian is Nokia Belle, which was released on 2 October, 2012.

3. iOS:- It is the popular mobile operating system developed by Apple Incorporation. This operating system is commonly used in Apple iPhone, iPod Touch, iPad, etc. The latest version of iOS is iOS 14.3, which was released on 14 December, 2020.

4. Black Berry:- It is the most secure operating system used in leading Smartphones developed by Black Berry company. It also supports WAP 1.2. The latest version of BlackBerry is Black Berry OS 7.1.0, which was released in 2013.

5. Windows Phone:- It is a mobile operating system developed by Microsoft in 2010, for smartphones. It is a commercial proprietary software. Its latest version is 8.1, which was released on 2 June, 2015.

Important Extensions and their Meanings

| Extensions | Meanings | Extensions | Meanings |
|---------------|--|------------|-----------------------------------|
| .exe | Executable files | .db/.dbf | Database file |
| .com | Command files | .sql | SQL Database file |
| .bat | Batch files | .tar | Linux / Unix tarball file archive |
| .doc | Document files | .bak | Backup file |
| .txt | Notepad text file/text files | .tmp | Temporary file |
| .prg | Program files | .bin | Binary file |
| .ovr | Over lays | .wsf | Windows Script file |
| .sys | System files | .mp3 | MP3 audio file |
| .docx | MS-Word document | .wma | Windows media audio file |
| .rtf | WordPad document | .wpl | Media Player Playlist |
| .exe | Executable file | .mpg/.mpeg | MPEG Video file |
| .eml | E-mail file | .avi | Audio Video Interleave file |
| .xlsx | MS-Excel file | .flv | Adobe Flash video file |
| .htm or .html | HTML file (Web page) | .mp4 | MPEG-4 video file |
| .pptx | MS-PowerPoint presentation | .pdf | PDF file |
| .apk | Android Package file | .js | JavaScript file |
| .wks / .wps | Microsoft Works Word Processor Document file | .jpg/.jpeg | JPEG image |
| .ods | OpenOffice Calc spreadsheet file | .cfg | Configuration file |
| .jsp | Java Server Page file | .php | PHP Source file code |
| .gif | Graphical Interchange Format image | .max | 3ds Max Scene File |
| .png | Portable Network Graphic image | .psd | Adobe Photoshop Document image |
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| Word | |
|------------------------|-----------|
| XML file type | Extension |
| Document | .docx |
| Macro-enabled document | .docm |
| Template | .dotx |
| Macro-enabled template | .dotm |

| Excel | |
|-------------------------|-----------|
| XML file type | Extension |
| Workbook | .xlsx |
| Macro-enabled workbook | .xlsm |
| Template | .xltx |
| Macro-enabled template | .xltm |
| Non-XML binary workbook | .xlsb |
| Macro-enabled add-in | .xlam |

| PowerPoint | |
|----------------------------|--------|
| XML file type | Extens |
| Presentation | .pptx |
| Macro-enabled presentation | .pptm |
| Template | .potx |
| Macro-enabled template | .potm |
| Macro-enabled add-in | .ppam |
| Show | .ppsx |
| Macro-enabled show | .ppsm |
| Slide | .sldx |
| Macro-enabled slide | .sldm |
| Office theme | .thmx |

Programming Languages

Program:-

It can be defined as a set of instructions that need to be executed to accomplish a computing task. A person who writes or performs the program is known as programmer.

Programmer uses some specific languages to write program which is known as programming languages. e.g. C++, Java, etc.

High level language programmer can write code in simple easy language, it is user friendly .E.g. C, JAVA

Note:-Ada Lovelace is regarded as the world's first programmer.

Programming language:-

It is a set of commands, instructions and other syntax **use to create a software program**. Programming language must be simple, easy to learn and use. It must be consistent in terms of syntax and semantics.

The computer system is simply a machine and hence it cannot perform any work; therefore, in order to make it functional different languages are developed, which are known as programming languages **or simply computer languages**.

Languages come with its own set of vocabulary and rules, better known as **syntax**.

The three major types of programming languages are:- Low-Level Languages, Medium Level Language and High-Level Languages.

Low Level Language (LLL)

It is a programming language that deals with a computer's hardware and its configuration. It is very close to the computer's native language.

These programming languages are **more difficult to understand**. It is designed to operate and handle the entire instruction set of a computer system directly which are generally used to write the system software. **These are coded in a form which is easy to understand by the processor**.

There are two types of low level language, which are as follows

1. Machine Language Machine language is dependent programming language.

it is also a type of low level language these can be develop in binary language (0 and 1) or Bits. It is first generation programming language. The program is written in machine is called object code.

It has two part –

Opcode – Operation code – an opcode is a single instruction that can be executed by the CPU.

Operand (address part) – operands are manipulated by opcode

It is the only language understood by the computers. Sometimes, it referred to as **machine code or object code or binary language**. It is a **collection of binary digits (0 or 1) or bits** that the computer reads and interprets. It can directly understand by the computer and **does not need a translator program**.

Advantages ➤ Programs run fast. ➤ **No translation program is required.**

Disadvantages ➤ Difficult to program ➤ Debugging is also an issue

2. Assembly Language

It used mnemonic code in place of binary language. It is 2ndGEN programming language. A combination of letters and numbers forms the Assembly Language and a translator program is required to translate to the machine language.

It is a low level programming language which is **used as an interface with computer hardware**. It uses **structured commands as substitutions for numbers**, allowing humans to read the code easier than looking at binary codes. **It is written as 'MOVA.'**

The operation codes and operands are given in the form of alphanumeric symbols which are known as **mnemonic codes** and **can combine in a maximum of five-letter combinations** e.g. ADD for addition, SUB for subtraction etc. **This is also known as Symbolic Programming Language.**

Advantages ➤ Easier to understand and minimizes effort. ➤ Finding and correcting the errors are easy.

Disadvantages ➤ It is machine dependent (program written for one computer might not run in other computers with different hardware configuration) ➤ Writing of code is time-consuming.

Medium Level Language (MLL)

It serves as the **bridge between raw hardware and programming layer** of a computer system. It is designed to improve the translated code before it is executed by the processor. e.g. C.

High Level Language (HLL)

It is independent programming language. third Generation programming language

It is an advanced computer programming language that is not limited to one computer, designed for a specific job and is **easier to understand. The program is written in high level is called source code.**

Higher level languages are simple languages that use English and mathematical symbols like +, -, %, / for its program construction. **FORTAIN was first high level language.**

The main advantages of high level languages over low level languages are that they are easier to read, write and understand. E.g. FORTRAN, COBOL, BASIC, C,C++ , Java, Python, etc.

Following are the major categories of Programming Languages –

1. Machine Language 2. Assembly Language 3. High Level Language 4. System Language 5. Scripting Language

➤ **Machine Language or Code** this is the language that is written for the computer hardware. Such language is effected directly by the (CPU) of a computer system.

➤ **Assembly Language** It is a language of an **encoding of machine code** that makes simpler and readable.

➤ **High Level Language** The high level language is simple and easy to understand and **it is similar to English language**. For example, COBOL, FORTRAN, BASIC, C, C+, Python, etc.

Some High Level Languages and Their Application Areas

| Language | Year | Developer | Application Area | Nature |
|---|------|--|--|--------------------------|
| FORTRAN (Formula Translation) | 1957 | A team of programmers at IBM | Calculation | Compiled |
| ALGOL (Algorithmic Language) | 1958 | A committee of European and American computer scientists | Scientific purpose | Compiled |
| LISP (List Processing) | 1958 | John McCarthy at the Massachusetts Institute of Technology (MIT) | Artificial intelligence | Compiled and Interpreted |
| COBOL (Common Business Oriented Language) | 1959 | Grace Hopper | Business management, String oriented | Compiled |
| BASIC (Beginner's All purpose Symbolic Instruction Code) | 1964 | John G. Kemeny and Thomas E. Kurtz at Dartmouth College in New Hampshire | Programming for educational purpose | Interpreted |
| Pascal | 1970 | Niklaus Wirth | Education | Compiled |
| C | 1972 | Dennis Ritchie at Bell Labs | System programming | Compiled |
| C ++ | 1985 | Bjarne Stroustrup at Bell Labs | System object programming | Compiled |
| Python | 1991 | Guido Van Rossum | Multimedia, Mobile app, Image processing | Interpreted |
| Java | 1995 | James Gosling at Sun Microsystems | Internet oriented programming | Compiled and Interpreted |
| Java Script | 1995 | Brendan Eich | Games, animated 2D and 3D graphics | Compiled and Interpreted |

Language Translator/ processor –

Language Translator helps in converting /translates the **high-level language programming language (input)** into an **equivalent machine language program (output)**. It also detects and reports the error during translation.

Programmers write their program in one of the high level language because it is much easy to code in these language but computer does not understand any of these language so it is necessary to convert program into a machine language so translator do this work.

The translated program is called the **object code**.

Types of a Language Translator: - Assembler, Compiler, Interpreter

Assembler – It is used for **converting the code**/ a program written in **low level language (assembly language)** into **machine level language**. Assembly language consists of mnemonic codes, which are difficult to learn and are machine dependent.

Compiler – It also **converts/translates the program from high level language to machine language** which can be understood by the processor and **reports all the errors of the program along with the line numbers**.

It is very fast because it converts the **whole** program into machine language. For each high level language, the machine requires a separate compiler.

A compiler creates a unique object program, i.e. if a source program is compiled; there is no need of that source program because output can be obtained by executing that object program.

C, C++ use compilers

Interpreter – It converts the programs from high-level language to low-level language. It is very slow because it converts program line by line and consumes less memory space.

It reports the error once after completing the translation process. It gives better error diagnostics than a compiler because If there is any error in any line, it stops the execution of the program immediately. Program execution cannot resume until the error is rectified by the user.

Interpreter is very useful for de-bugging and suitable for novice programmer. This is a slow process [Python, BASIC, and Ruby use interpreters](#).

Linker It is a system program that links together several object modules and libraries to form a single and coherent program (executable). The main purpose of linker is to resolve references among files.

Loader It is a kind of system software which is responsible for loading and relocation of the executable program in the main memory. It is a part of operating system that brings an executable file residing on disk into memory and starts its execution process.

Debugger - A debugger is a software utility that is designed to locate errors within a program's source code.

Spooling - Spooling is a process in which data is temporarily held to be used and executed by a device, program or the system. Data is saved in storage until the program requests it for execution.

Language Processor – Language Processor is a software designed to perform tasks such as processing program code to machine code. Language processors are found in languages such as Fortran and COBOL.

Fortran: known as formula translation. used for scientific and engineering application. It was first high-level language. introduced by John Backus in 1957.

COBOL (Common Business Oriented Language): used for record keeping and data management in business organizations. developed in the year 1959. by Grace Hopper.

BASIC (Beginner's All Purpose Symbolic Instruction Code): first language designed for non-professional programmers. It was developed for students to write simple computer programs. It was **designed by John Kemeny and Thomas Kurtz in 1963.**

PASCAL: it is developed as a teaching tool for programming concepts. Pascal is an imperative and procedural programming language, designed by Niklaus Wirth.

C language: it is a **middle** level programming language and also known as procedural language C++ (developed by Bjarne Stroustrup) is **high** level language **that uses the OOPS concept.** C was developed at Bell Labs by Dennis Ritchie

ALGOL - ALGOL is a short form of algorithmic Language. It is a family of portable programming languages for scientific computations. First appeared in 1958. ALGOL language designed by: Friedrich L. Bauer, Hermann Bottenbruch

PROLOG - Prolog is used widely for artificial intelligence applications, particularly expert systems.

Simula was the first object-oriented programming language.

BASIC(Beginner's All-purpose Symbolic Instruction Code):- In 1964, John G. Kemeny and Thomas E. Kurtz designed the original BASIC language at Dartmouth College. developed in the mid-1960s to provide a way for students to write simple computer programs.

| Computer Languages | Father/Inventor/Designed by |
|---------------------------|------------------------------------|
| C/C++ | Dennis Ritchie |
| Java | James Gosling |
| JavaScript | Brendan Eich |
| PHP | Rasmus Lerdorf |
| Python | Guido van Rossum |
| HTML | Tim Berners-Lee |
| .NET (Framework) | Microsoft Corporation |
| C# | Microsoft Corporation |
| Perl | Larry Wall |
| Ruby | Yukihiro Matsumoto |

Object-Oriented Programming

Object-oriented programming (OOP) is a software programming model built around objects.

This model classifies data into objects and describes object contents and performance through the declaration of classes.

Simula is the first object-oriented programming language.

The examples of object-oriented programming languages are Java, Python, JavaScript, C++, C#, PHP, Perl, .NET, Ruby, Curl, Visual Basic, Smalltalk, Delphi, and Eiffel.

Java - designed especially for use in distributed appn on corporate networks and Internet. introduced by James Gosling.

> PERL(Practical Extraction and Reporting Language) Perl is a general-purpose programming language originally developed for text manipulation. developed by Larry Wall in 1987. Stand for "Practical Extraction and Reporting Language"

Java is used for developing Mobile, Desktop, web, server-side and dynamic web applications.

JavaScript - JavaScript is designed for styling HTML Pages, interactivity to HTML Pages, Server-Side Scripting Operation, executing query related to DB on Serve.

Python - by Guido van Rossum. general-purpose programming language. It is used for developing complex scientific, numeric applications, data analysis, and visualization. use Python for developing desktop GUI appn, websites and web applications.

C# - C# is a general-purpose language was **designed by Microsoft** to be **used for developing apps on the Microsoft platform**. used with XML-based Web services on the .NET platform

C++ :C++ is an object-oriented programming language and incorporates all the features offered by C.

Advantages > Independent of machines and can run on any computer > Problem-oriented rather than machine oriented > User-friendly

Disadvantages > Need time for translating.

PHP - PHP stands for Hypertext Pre-processor. It is a scripting language used for the development of web applications.

.Net: .Net is a programming framework developed by Microsoft, which can be used to build different types of applications such as Windows, Web application and Mobile based applications etc.

Visual Basic - Visual Basic is an approachable language with a simple syntax for building type-safe, object-oriented apps.

Java, Python, C++, Visual Basic .NET and Ruby is the most popular **Object Oriented Programming languages**.

Ruby is used in many Web applications.

Curl, Smalltalk, Delphi and Eiffel is also examples of object oriented programming languages.

Scripting Language

Scripting languages are server-side scripting languages that manipulate the data, usually in a database, on the server. Scripting languages came about largely because of the development of the Internet as a communications tool. Html, Xml, JavaScript, ASP, JSP, PHP, Perl, Tcl and Python are examples of scripting languages.

Generation of Languages

The concept of language generations, sometimes called levels, is closely connected to the advances in technology that brought about computer generations.

The five generations of language are as follows

1st GLs are low level languages like machine language.

2nd GLs are also low level languages that generally consist of assembly language.

3rd GLs are high level languages such as Java.

4th GLs are the languages that consist of statements similar to the **statements of human language**. 4 GLs are commonly used in **database programming and scripting programming**.

5th GLs are programming languages that contain **visual tools**, which help to develop a program. A good example of 5 GLs is **Visual Basic**.

Algorithm :-An algorithm is a step-by-step method of solving a problem. It is commonly used for data processing, calculation and other related computer and mathematical operations.

Flow Chart :-A flow chart is a visual representation of the sequence of steps and decisions needed to perform a process. Each step in the sequence is noted within a diagram shape. Steps are linked by connecting lines and directional arrows.

Error:-An error in a program is called bug. It is a term used to describe any issue that arises unexpectedly that cause a computers not function properly.

The types of error are classified into four categories, which are as follows

1. Syntax Error When the rules of the programming language are not followed, the compiler will show syntax error.

2. Semantic Error Semantic errors are reported by the compiler when the statements written in the program are not meaningful to the compiler.

3. Logical Error Logical errors are those errors that occur in the output of the program. The presence of logical errors leads to undesired or incorrect output.

4. Runtime Error Runtime errors are those errors that occur during the execution of a program. It generally occurs due to some illegal operation performed in the program.

■ **Reserved words** are words that a programming language has set aside for its own use.

■ **Pseudocode** is not a programming language, but simply an informal way of describing a program. It does not follow any syntax strictly.

■ **Looping** is a control structure which is used in a program to execute a particular set of statements repeatedly.

■ **Data Flow Diagram (DFD)** describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation.

Number System

When we type some letters or words, the computer translates them in numbers as **computers can understand only numbers**. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using – • The digit • the position of the digit in the number • The base of the number system (where the **base** is defined as the total number of digits available in the number system).

The radix or base is the number of unique digits, including zero, used to represent numbers in a positional numeral system. For example, for the decimal system the radix is ten, because it uses the ten digits from 0 through 9. And that of Binary is base 2.octal hexadecimal system is 8 and 16 respectively.

Number System

Decimal, Binary, Octal and Hexadecimal Equivalents

| Decimal | Binary | Octal | Hexadecimal |
|---------|--------|-------|-------------|
| 0 | 0000 | 000 | 0 |
| 1 | 0001 | 001 | 1 |
| 2 | 0010 | 002 | 2 |
| 3 | 0011 | 003 | 3 |
| 4 | 0100 | 004 | 4 |
| 5 | 0101 | 005 | 5 |
| 6 | 0110 | 006 | 6 |
| 7 | 0111 | 007 | 7 |
| 8 | 1000 | 010 | 8 |
| 9 | 1001 | 011 | 9 |
| 10 | 1010 | 012 | A |
| 11 | 1011 | 013 | B |
| 12 | 1100 | 014 | C |
| 13 | 1101 | 015 | D |
| 14 | 1110 | 016 | E |
| 15 | 1111 | 017 | F |

Hexadecimal to Binary: Refer the above table for the conversion process

$$(1A2)_{16} = (?)_2 \\ 1=0001, \quad A=1010, \quad 2=0010; \quad \text{Hence} \\ (1A2)_{16} = (000110100010)_2$$

Decimal to Binary: $(75)_{10} = (?)_2$

Divide 75 by 2 (and write down its remainder).

$$\begin{array}{r} 75 \\ 2 \bigg| \quad 37 \quad 1 \\ 2 \quad \bigg| \quad 18 \quad 1 \\ 2 \quad \bigg| \quad 9 \quad 0 \\ 2 \quad \bigg| \quad 4 \quad 1 \\ 2 \quad \bigg| \quad 2 \quad 0 \\ 2 \quad \bigg| \quad 1 \quad \end{array}$$

Hence $(75)_{10} = (101011)_2$

Any number system to decimal:

Sum of all (Digit \times (Base)^{Base's Place})
Example: $(1A2)_{16} = (?)_{10}$ (From the table you can refer A is equivalent to 10)

$$((1 \times 16^2) + (10 \times 16^1) + (2 \times 16^0)) = 256 + 160 + 2 = 418$$

Example: $(110110)_2 = (?)_{10}$

$$((1 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)) = 32 + 16 + 4 + 2 = 54; (110110)_2 = (54)_{10}$$

Octal to Binary: $(345)_8 = (?)_2$ (Write down 3 bit binary equivalents of all digits)

$3=011, 4=100, 5=101$; Hence $(345)_8 = (011100101)_2$

Octal to Hexadecimal: Convert to Binary first and then group 4 bits to get hexadecimal number. Example: $(345)_8 = (?)_{16} \Rightarrow (345)_8 = (011100101)_2 = 0000\ 1110\ 0101 = (OE5)_{16}$

16 10000 20 G

Decimal Number System: The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

| S.No. | Number System | Description |
|-------|----------------------------|---|
| 1 | Binary Number System | Base 2. Digits used : 0, 1 |
| 2 | Octal Number System | Base 8. Digits used : 0 to 7 |
| 3 | Hexa Decimal Number System | Base 16. Digits used: 0 to 9, Letters used : A- F |
| 4. | Decimal number System | Base 10. Digits used:0 to 9 |

Binary Number System: Characteristics of the binary number system are as follows –

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a **0 power** of the base (2). Example 20
- Last position in a binary number represents a **x power** of the base (2). **Example** 2^x where x represents the last position - 1.

Octal Number System: Characteristics of the octal number system are as follows –

- Uses eight digits, 0, 1, 2, 3, 4, 5, 6, 7
- Also called as base 8 number system
- Each position in an octal number represents a **0 power of the base (8)**. Example 80
- Last position in an octal number represents a **x power of the base (8)**. **Example** 8^x where x represents the last position – 1

Hexadecimal Number System: Characteristics of hexadecimal number system are as follows –

- Uses 10 digits and 6 letters, **0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F**
- Letters represent the numbers starting from 10. **A = 10, B = 11, C = 12, D = 13, E = 14, F = 15**
- Also called as base 16 number system
- Each position in a hexadecimal number represents a **0 power of the base (16)**. Example, 160
- Last position in a hexadecimal number represents a **x power of the base (16)**. **Example** 16^x where x represents the last position – 1

Octal to Decimal

To convert octal to decimal, following steps are involved

Step 1 Multiply each digit of octal number with powers of 8.

Step 2 These powers should be positive for integral part and negative for fractional part.

Step 3 Add the all multiplying digits.

Example $(327.4)_8 \rightarrow (?)_{10}$

$$\begin{aligned}(327.4)_8 &= 3 \times 8^2 + 2 \times 8^1 + 7 \times 8^0 + 4 \times 8^{-1} \\&= 3 \times 64 + 2 \times 8 + 7 \times 1 + \frac{4}{8} \\&= 192 + 16 + 7 + 0.5 \\&= 215.5\end{aligned}$$

Then, $(327.4)_8 \rightarrow (215.5)_{10}$

Hexadecimal to Decimal

To convert hexadecimal to decimal, following steps are involved

Step 1 Multiply each digit of hexadecimal number with powers of 16.

Step 2 These powers should be positive for integral part and negative for fractional part.

Step 3 Add the all multiplying digits.

Example $(BC9.8)_{16} \rightarrow (?)_{10}$

$$\begin{aligned}(BC9.8)_{16} &= B \times 16^2 + C \times 16^1 + 9 \times 16^0 + 8 \times 16^{-1} \\&= 11 \times 256 + 12 \times 16 + 9 \times 1 + \frac{8}{16} \\&= 2816 + 192 + 9 + 0.5 = 3017.5\end{aligned}$$

Then, $(BC9.8)_{16} \rightarrow (3017.5)_{10}$

Hexadecimal to Octal

To convert hexadecimal to octal, following steps are involved

Step 1 Convert each digit of the hexadecimal number to binary number.

Step 2 Again, convert each binary digit to octal number.

Example $(AC2D)_{16} \rightarrow (?)_8$

$$\begin{array}{cccccc}A & C & 2 & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1010 & 1100 & 0010 & 1101\end{array}$$

Now, $(AC2D)_{16} \rightarrow (1010110000101101)_2$

$$\begin{array}{cccccc}001 & 010 & 110 & 000 & 101 & 101 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 2 & 6 & 0 & 5 & 5\end{array}$$

Then, $(AC2D)_{16} \rightarrow (126055)_8$

Conversion between the Number Systems

Decimal to Binary

To convert decimal to binary, following steps are involved

- Step 1** Divide the given number by 2.
- Step 2** Note the quotient and remainder. Remainder should be 0 or 1.
- Step 3** If quotient $\neq 0$, then again divide the quotient by 2 and back to step 2.
If quotient = 0, then stop the process.
- Step 4** First remainder is called as **Least Significant Bit (LSB)** and last remainder is called as **Most Significant Bit (MSB)**.
- Step 5** Arrange all remainders from MSB to LSB.

Example $(43)_{10} \rightarrow (?)_2$

| Remainder | | |
|-----------|----|---------|
| 2 | 43 | 1 → LSB |
| 2 | 21 | 1 |
| 2 | 10 | 0 |
| 2 | 5 | 1 |
| 2 | 2 | 0 |
| 2 | 1 | 1 → MSB |
| | 0 | |

Then,

$$(43)_{10} \rightarrow (101011)_2$$

Binary to Decimal

To convert binary to decimal, following steps are involved

- Step 1** Multiply the all binary digits by powers of 2.
- Step 2** The power for integral part will be positive and for fractional part will be negative.
- Step 3** Add all the multiplying digits.

Example $(1101.10)_2 \rightarrow (?)_{10}$

$$\begin{aligned}(1101.10)_2 &= 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 \\ &\quad + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} \\ &= 8 + 4 + 0 + 1 + 0.5 + 0 = 13.5\end{aligned}$$

Then,

$$(1101.10)_2 \rightarrow (13.5)_{10}$$

Binary to Octal

To convert binary to octal, following steps are involved

- Step 1** Make the group of 3 bits from right to left. If the left most group has less than 3 bits, put in the necessary number of leading zeroes on the left.
- Step 2** Now, convert each group to decimal number.

Example $(110110100)_2 \rightarrow (?)_8$

$$\begin{array}{ccc|c} 110 & 110 & 100 & \\ \downarrow & \downarrow & \downarrow & \\ 6 & 6 & 4 & \end{array}$$

Then,

$$(110110100)_2 \rightarrow (664)_8$$

Octal to Binary

Convert every digit of the number from octal to binary in the group of 3 bits.

Example $(1034.5)_8 \rightarrow (?)_2$

| | | | | |
|-----|-----|-----|-----|-----|
| 1 | 0 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ |
| 001 | 000 | 011 | 100 | 101 |

Then, $(1034.5)_8 \rightarrow (001000011100.101)_2$

Binary to Hexadecimal

To convert a binary number to its hexadecimal equivalent, follow these steps

- Step 1** Start making the group of 4 bits each from right to left from the given binary number. If the left most group has less than 4 bits, put in the necessary number of leading 0's on the left.
- Step 2** Now, each group will be converted to decimal number.

Example $(11110101111011)_2 \rightarrow (?)_{16}$

$$\begin{array}{cccc|c} 0011 & 1101 & 0111 & 1011 & \\ \downarrow & \downarrow & \downarrow & \downarrow & \\ 3 & 13 & 7 & 11 & \\ \hline D & & & & B \end{array}$$

Then, $(11110101111011)_2 \rightarrow (3D7B)_{16}$

Hexadecimal to Binary

For this type of conversion, convert hexadecimal digit to 4 bits binary equivalent

Example $(BA81)_{16} \rightarrow (?)_2$

$$\begin{array}{ccccc} B = 11 & A = 10 & 8 & 1 & \\ \downarrow & \downarrow & \downarrow & \downarrow & \\ 1011 & 1010 & 1000 & 0001 & \end{array}$$

Then, $(BA81)_{16} \rightarrow (1011101010000001)_2$

Decimal to Octal

To convert decimal to octal, following steps are involved

- Step 1** Divide the given number by 8.
- Step 2** Note the quotient and remainder. Digits of remainder will be from 0 to 7.
- Step 3** If quotient $\neq 0$, then again divide the quotient by 8 and go back to step 2.
- Step 4** If quotient = 0 or less than 8 then stop the process.
- Step 5** Write each remainder from left to right starting from MSD (Most Significant Digit) to LSD (Least Significant Digit).

Example $(97647)_{10} \rightarrow (?)_8$

| | | |
|---|-------|-------|
| 8 | 97647 | 7 LSD |
| 8 | 12205 | 5 |
| 8 | 1525 | 5 |
| 8 | 190 | 6 |
| 8 | 23 | 7 |
| 8 | 2 | 2 MSD |
| | 0 | |

Then,

$$(97647)_{10} \rightarrow (276557)_8$$

Decimal to Hexadecimal

To convert decimal to hexadecimal, following steps are involved

- Step 1** Divide the given number by 16.
- Step 2** Note the quotient and remainder. Digits of remainder will be 0 to 9 or A to F.
- Step 3** If quotient $\neq 0$, then again divide the quotient by 16 and go back to step 2.
- Step 4** If quotient = 0 or less than 16, then stop the process.
- Step 5** Write each remainder from left to right starting from MSD (Most Significant Digit) to LSD (Least Significant Digit).

Example $(929987)_{10} \rightarrow (?)_{16}$

| | | | |
|----|--------|--------|-----|
| 16 | 929987 | 3 | LSD |
| 16 | 58124 | 12 → C | |
| 16 | 3632 | 0 | |
| 16 | 227 | 3 | |
| 16 | 14 | 14 → E | MSD |
| | 0 | | |

Then,

$$(929987)_{10} \rightarrow (E30C3)_{16}$$

Computer Codes

In computer, any character like alphabet, digit or special character is represented by collection of 1's and 0's in a unique coded pattern. In computers, the code is made up of fixed size groups of binary positions.

The binary coding schemes that are most commonly used are as follows

Binary Coded Decimal (BCD)

This system was developed by IBM.

It is a number system where four bits are used to represent each decimal digits.

BCD is a method of using binary digits to represent the decimal digits (0-9).

In BCD system, there is **no limit** on size of a number.

American Standard Code for Information Interchange (ASCII)

These are standard character codes used to store data so that it may be used by other software programs.

Basically, ASCII codes are of two types, which are as follows

- (i) **ASCII-7** It is a 7-bit standard ASCII code. It allows $2^{128} = 7$ (from 0 to 127) unique symbols or characters.
- (ii) **ASCII-8** It is an extended version of ASCII-7. It is an 8-bit code, allows $2^{256} = 8$ (0 to 255) unique symbols or characters.

Extended Binary Coded Decimal Interchange (EBCDIC)

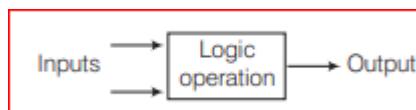
In EBCDIC, characters are represented by eight bits. These codes store information which is readable by other computers. It allows $2^{256} = 8$ combination of bits.

Logic gates and Boolean operations

Logic Gates: The logic gates are the main structural part of a digital system.

- Logic Gates are a **block of hardware** that produces signals of binary 1 or 0 when input logic requirements are satisfied.
- Each gate has a **distinct graphic symbol**, and its **operation can be described by means of algebraic expressions.**
- **The seven basic logic gates includes:** AND, OR, NOT, NAND, NOR, XOR, and XNOR.
- The **relationship between the input-output binary variables** for each gate can be **represented in tabular form by a truth table.**
- Each gate has one or two binary input variables designated by A and B and one binary output variable designated by x.

These are the **building blocks of any digital circuit** that **implement Boolean logic processes** and have **two inputs and only one output**. Arrays of logic gates are used in digital integrated circuits (ICs). These gates are implemented using electronic switches **like transistors, diodes**.



The basic logic gates and their functioning (truth table) are mentioned in the following figure.

AND GATE:

The AND gate is an electronic circuit which **gives a high output only if all its inputs are high**. It is a **digital logic gate with two or more inputs and one output which performs logical conjunction**. The AND operation is represented by a dot (.) i.e. ($A \cdot B$). It returns True only if both the conditions or inputs are True otherwise it returns False.

| AND Gate | | Truth Table of AND Gate | | | | | | | | | | | | | | | |
|----------|---|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | <table border="1"><thead><tr><th>A</th><th>B</th><th>X</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></tbody></table> <p>$\therefore X = A \cdot B$</p> | A | B | X | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| A | B | X | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | | | | | | | | | | | | | | | |

OR GATE: It returns True if any one of the conditions or inputs is True and if both conditions are False, then it returns False.

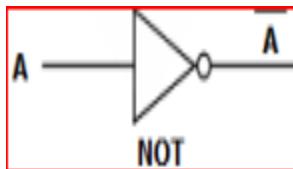
The OR gate is an electronic circuit which **gives a high output if one or more of its inputs are high**. The operation performed by an OR gate is represented by a plus (+) sign, i.e. ($A + B$)

It is a logic gate that **produces inclusive disjunction**. It is **used in Boolean algebra and electronic circuits** like transistor-transistor logic, and complementary metal-oxide semiconductors etc.

| OR Gate | | Truth Table of OR Gate | | | | | | | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | <table border="1"><thead><tr><th>A</th><th>B</th><th>X</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></tbody></table> <p>$X = A + B$</p> | A | B | X | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| A | B | X | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | | | | | | | | | | | | | | | |

NOT GATE: or Inverter This gate is also represented by ('), i.e. A'. It returns True if the input is false and vice-versa.

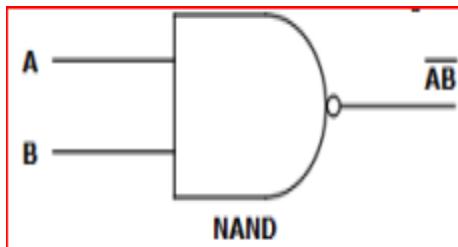
The NOT gate is an electronic circuit which **produces an inverted version of the input at its output**. It is also known as an Inverter. **NOT gate is a single input gate**.



| Truth Table of NOT Gate | | |
|-------------------------|--------|--|
| A | X = A' | |
| 0 | 1 | |
| 1 | 0 | |

NAND GATE: It returns False only if the both conditions or inputs are True otherwise it returns True.

The NOT-AND (NAND) gate which is equal to an AND gate followed by a NOT gate. The NAND gate gives a high output if any of the inputs are low. The NAND gate is represented by a AND gate with a small circle on the output. The small circle represents inversion. **It is the combination of AND & NOT gates. It is the opposite/Inverse of AND logic gate.**

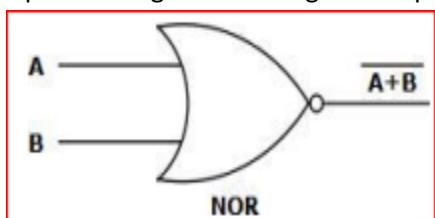


| Truth Table of NAND Gate | | |
|--------------------------|---|---|
| A | B | X |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

$$X = (\overline{A \cdot B}) = \overline{A} + \overline{B}$$

NOR GATE: It is inverse of the OR gate. Designed by combining the OR and NOT gates. 'neither this nor that' is the principle of NOR gate. It returns True only if both the conditions or inputs are False otherwise it returns False.

The NOT-OR (NOR) gate which is equal to an OR gate followed by a NOT gate. The NOR gate gives a low output if any of the inputs are high. The NOR gate is represented by an OR gate with a small circle on the output. **small circle represents inversion.**



| Truth Table of NOR Gate | | |
|-------------------------|---|---|
| A | B | X |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

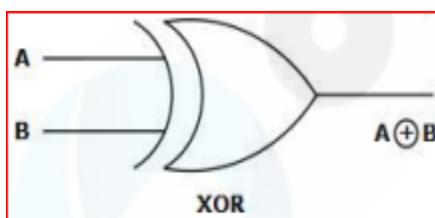
$$X = (\overline{A + B}) = \overline{A} \cdot \overline{B}$$

Note:- NAND and NOR gates are also called universal gates.

Exclusive-OR/ XOR GATE: It performs based on the operation of OR gate. It returns True only if one condition is true from both the conditions otherwise it returns False.

The 'Exclusive-OR' gate is a circuit which will give a high output if one of its inputs is high but not both of them. The XOR operation is represented by an encircled plus sign.

XOR gate is a special type of gate. It is used in the half adder, full adder and subtractor and controlled inverter circuit. It is also used in the computers for implementing the binary addition.



| Truth Table of XOR Gate | | |
|-------------------------|---|---|
| A | B | X |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

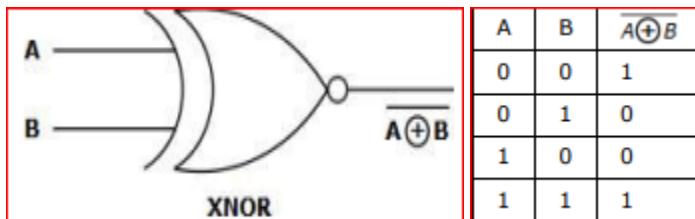
$$X = A \oplus B$$

$$X = \overline{A}B + A\overline{B}$$

EXCLUSIVE-NOR/Equivalence GATE:

The 'Exclusive-NOR' gate is a circuit that does the inverse operation to the XOR gate. It will give a low output if one of its inputs is high but not both of them. The small circle represents inversion.

It is a combination of the Exclusive-OR gate and the NOT gate. The EXOR gate has a high output only when an odd number of inputs are high.



Boolean algebra

Boolean algebra can be considered as an algebra that deals with binary variables and logic operations. Boolean algebraic variables are designated by letters such as A, B, x, and y. The basic operations performed are AND, OR, and complement. The Boolean algebraic functions are mostly expressed with binary variables, logic operation symbols, parentheses, and equal sign. For a given value of variables, the Boolean function can be either 1 or 0.

- **UNICODE** uses 16-bits to represent a symbol in the data. It represents any non-english character, scientific symbol in any language like Chinese, Japanese.
- One's complement of binary number is defined as the value obtained by inverting all the bits For example, 110100 One's complement is 001011

12. Basics of Combinatorial Components

Combinational circuit is a circuit in which we combine the different gates in the circuit, for example encoder, decoder, multiplexer and demultiplexer.

Half Adder:-

Half adder is a combinational logic circuit with two inputs and two outputs. The half adder circuit is designed to add two single bit binary numbers A and B. It is the basic building block for addition of two single bit numbers. This circuit has two outputs carry and sum.

Full Adder:-

Full adder is developed to overcome the drawback of Half Adder circuit. It can add two one-bit numbers A and B, and carry c. The full adder is a three input and two output combinational circuit.

Multiplexers:-

Multiplexer is a special type of combinational circuit. There are n-data inputs, one output and m select inputs with $2m = n$. It is a digital circuit which selects one of the n data inputs and routes it to the output.

Demultiplexers:-

A demultiplexer performs the reverse operation of a multiplexer i.e. it receives one input and distributes it over several outputs. It has only one input, n outputs, m select input.

Decoder:

A decoder is a combinational circuit. It has n input and to a maximum $m = 2n$ outputs. Decoder is identical to a demultiplexer without any data input. It performs operations which are exactly opposite to those of an encoder.

Encoder

Encoder is a combinational circuit which is designed to perform the inverse operation of the decoder. An encoder has n number of input lines and m number of output lines.

Priority Encoder

This is a special type of encoder. Priority is given to the input lines. If two or more input line are 1 at the same time, then the input line with highest priority will be considered.

DATA BASE CONCEPT

A database is a collection of logically related information in an organized way so that it can be easily accessed, managed and updated. Some other operations can also be performed on database such as adding, updating and deleting data.

Fundamentals of Database

1. Data These are raw and unorganized facts that need to be processed such as digital representation of text, numbers, graphical images or sound. e.g. A student's test score is one piece of data.

2. Information When data is processed, organized, structured or presented in a given context to make it useful or meaningful, it is called information. e.g. The class's average score is the information that can be concluded from the given data

Types of Database

1. Network Database

In this type of database, data is represented as a collection of records and relationships among data that are represented as links.

2. Hierarchical Database

In this type of database, data is organized in the form of tree with nodes. Nodes are connected via links.

3. Relational Database

This database is also known as structured database in which data is stored in the form of tables. Where, columns define the type of data stored in the table and rows define the information about the data.

Components of Database

A database consists of several different components. Each component listed, is called an object. Database components are described below

1. Tables :-These are the building blocks or relation of any relational database model where all the actual data is defined and entered. Different types of operation are done on the tables such as storing, filtering, retrieving and editing of data. Tables consist of cells at the intersection of records (rows) and fields (columns), which are described below

(i) Field :-It is an area (within the record) reserved for a specific piece of data. e.g. Customer number, Customer name, Street address, City, State, Phone number, Current address, etc. Field of a table is also known as column.

(ii) Record :-It is the collection of data items of all the fields pertaining to one entity, i.e. a person, company, transition, etc. Record of a table is also known as row or a tuple and the number of records in a relation is called the cardinality of that relation.

2. Queries These are basically questions based on the data available in a database. A query consists of specifications indicating which fields, records and summaries a user wants to fetch from the database. Queries allow you to extract data based on the criteria that you define.

3. Forms :-Although you can enter and modify data in datasheet view of tables but you neither control the user's action very well nor you can do much to facilitate the data-entry process. To overcome this problem, forms are introduced. Like tables, forms can be used to view and edit your data. However, forms are typically used to view the data in an underlying table, one record at a time. e.g. A user can create a data entry form that looks exactly like a paper form. People generally prefer to enter data into a well-designed form, rather than a table.

4. Reports :-When you want to print those records which are fetched from your database, design a report. Access even has a wizard to help produce mailing labels.

Database management system (DBMS)

The database is a collection of inter-related data which is used to retrieve, insert and delete the data efficiently. It is also used to organize the data in the form of a table, schema, views, and reports, etc.

For example: The college Database organizes the data about the admin, staff, students and faculty etc.

Using the database, you can easily retrieve, insert, and delete the information.

Database Management System

DBMS is software which is **used to manage the database**. For example: MySQL, Oracle, SQL Server, IBM DB2, PostgreSQL, Amazon Simple DB (cloud-based) are some popularly used DBMS which is used in different applications.

DBMS provides an interface to perform various operations like database creation, storing data in it, updating data, creating a table in the database and a lot more.

It provides protection and security to the database. In the case of multiple users, it also maintains data consistency.

DBMS allows users the following tasks:

Data Definition:

It is used for creation, modification, and removal of definition that defines the organization of data in the database.

Data Updation:

It is used for the insertion, modification, and deletion of the actual data in the database.

Data Retrieval:

It is used to retrieve the data from the database which can be used by applications for various purposes.

User Administration: It is used for registering and monitoring users, maintain data integrity, enforcing data security, dealing with concurrency control, monitoring performance and recovering information corrupted by unexpected failure.

Characteristics of DBMS:-

- It uses a **digital repository** established **on a server** to store and manage the information.
- It can provide a **clear and logical view** of the process that manipulates data.
- DBMS contains **automatic backup and recovery** procedures.
- It contains **ACID properties** which maintain data in a healthy state in case of failure.
- It can **reduce the complex relationship between data**.
- It is used to support manipulation and processing of data.
- It is used to **provide security** of data.
- It can view the database from different viewpoints according to the requirements of the user.

Users

A typical DBMS has users with different rights and permissions who use it for different purposes. Some users retrieve data and some back it up. **The users of a DBMS can be broadly categorized as follows –**

Administrators –

Administrators maintain the DBMS and are **responsible for administrating the database**. They are responsible to look after its usage and by whom it should be used. They create access profiles for users and apply limitations to maintain isolation and force security. Administrators also look after DBMS resources like system license, required tools, and other software and hardware related maintenance.

Designers –

Designers are the group of **people who actually work on the designing part of the database**. They keep a close watch on what data should be kept and in what format. They identify and design the whole set of entities, relations, constraints, and views.

End Users –

End users are those **who actually reap the benefits of having a DBMS**. End users can range from simple viewers **who pay attention to the logs or market rates** to sophisticated users such as business analysts.

3-tier Architecture

3-tier architecture separates its tiers from each other based on the complexity of the users and how they use the data present in the database. It is the most widely used architecture to design a DBMS.

Database (Data) Tier –

At this tier, the database resides **along with its query processing languages**. We also have the relations that define the data and their constraints at this level.

Application (Middle) Tier –

At this tier reside the **application server and the programs that access the database**. For a user, this application tier presents an abstracted view of the database.

End-users are unaware of any existence of the database beyond the application. At the other end, the database tier is not aware of any other user beyond the application tier.

Hence, the application layer sits in the middle and **acts as a mediator between the end-user and the database**.

User (Presentation) Tier –

End-users operate on this tier and they **know nothing about any existence of the database beyond this layer**. At this layer, multiple views of the database can be provided by the application. All views are generated by applications that reside in the application tier.

Data Models

Data models define how the logical structure of a database is modeled. Data Models are fundamental entities to introduce abstraction in a DBMS. **Data models define how data is connected to each other and how they are processed and stored inside the system**.

Relational Database

In a relational database, data is stored in different tables with relationships to each other. In the case of relational database, a Relational Database Management System (RDBMS) performs this task.

An important feature of this database system is that a single database can be spread across several tables. e.g. **Base, Oracle, DB2, SyBase, Informix, etc.**

Terms Related to Relational Database:

1. Relation It is a table with columns and rows which represent the data items and relationships among them. **It has three important properties, a name**(which is represented by the title or the entity identifier), **cardinality**(refers to the number of tuples (rows) in a relation.) **and a degree**(refers to the number of attributes (columns) in each tuple).

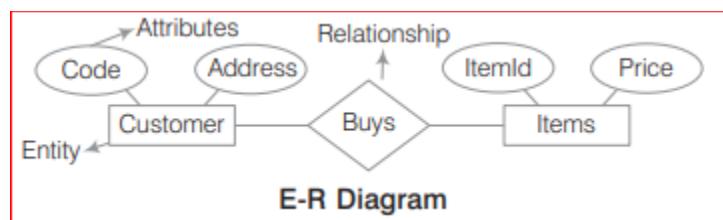
2. Domain It is a collection of all possible values from which the values for a given column or an attribute is drawn. A domain is said to be atomic, if elements are considered to be indivisible units.

3. Attributes The heading columns of a table are known as attributes. Each attribute of a table has a distinct name.

4. Tuples The rows in a relation are also known as tuples. Each row or tuple has a set of permitted values for each attribute.

Entity-Relationship Model: ER Model is based on – ♦ Entities and their attributes. ♦ Relationships among entities.

It represents the entities contained in the database. It is a diagrammatical representation of entities and relationship between them. It is also known as **E-R Diagram**.



Entity – An entity in an ER Model is a real-world entity having properties called attributes. Every attribute is defined by its set of values **called domain**.

It is an object that has its existence in the real world. It includes all those things about which the data are collected. “Entities are represented in rectangles”. e.g. Customer buys items, it means Customer and Items are entities.

Attributes: It describes the characteristics or properties of entity. In tables, attributes are represented by columns. Attributes are drawn in elliptical shapes. e.g. Items entity may contain Item Id and Price.

Entity Set: It is a set of entities of the same type that shares same properties or attributes. e.g. Students are an entity set of all student entities in the database.

Entity set is of two types which are as follows

1. Strong Entity Set It has a primary key or can be easily distinguishable each attribute.

2. Weak Entity Set It does not possess sufficient attributes to form a primary key

Relationship – The logical association among entities is called relationship .A relationship describes how two or more entities are related to each other. **It is represented by diamond shape.** Relationships are mapped with entities in various ways. **Mapping cardinalities define the number of association between two entities.**

Mapping cardinalities (Relationship) can be divided into three parts –

- ❖ **One to one** : This relationship tells us that a single record in Table A is related to a single record in Table B and vice-versa
- ❖ **One to many** : This entails one data in Table A to have links to multiple data in Table B. However, a single data in Table B, will have link to a single data in Table A
- ❖ **Many to many**: Each data in Table A is linked to all the data in Table B and vice-versa.
- ❖ Many to one

Relational Model

The most popular data model in DBMS is the **Relational Model**. It is more scientific a model than others. This model is based on first-order predicate logic and defines a table as an **n-ary relation**.

The main highlights of this model are –

- Data is stored in tables called relations.
- Relations can be normalized.
- In normalized relations, values saved are atomic values.
- Each row in a relation contains a unique value.
- Each column in a relation contains values from a same domain.

Architecture of DBMS: Database systems consist of complex data structures. *The process of masking irrelevant information from users is known as Data Abstraction*. Data abstraction reduces the complexity of users with the database.

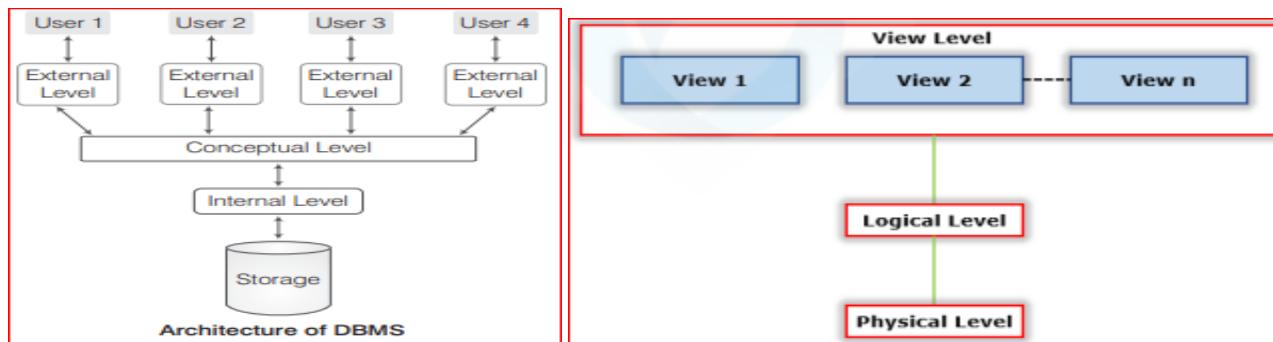
The architecture of DBMS is divided into three levels are as follows

1. Internal Level :-It is the lowest level of data abstraction that deals with the physical representation of the database on the computer. It is also known as **physical level**. It defines how the data is actually stored and organized in the storage medium. **B+ tree, Hash file** organization methods are used in this level.

2. Conceptual Level: It is the overall view of the database and includes all the information that is going to be represented in the database. It describes what type of data is stored in the database, the relationship among the data without effecting to the **physical/view** level. It is also known as **logical level**. Database administrators work at this level of abstraction

3. External Level : It is the **highest level of abstraction** and is viewed by the user in terms of tables and relations. It describes the interaction between the user and the system. It describes only a part of the entire database and hides the details of the logical level. It is also known as **view level**.

The Architecture of commercial DBMS is based on ANSI-SPARC database architecture.



Keys in DBMS

A key is a field in the database table which is used to retrieve and sort **rows** in the table. Keys are used to speed up the data accessing and creating links between different tables.

A key is defined as the column or set of columns in a table that is used to identify either row of data in a table or establish relationship with another table.

If a table has Id, name and address as the column names, then each one is known as the key for that table. The keys are also used to uniquely identify each record in the database table.

Types of Key

Primary Key - It is a special key that uniquely **identify tuples (rows) within the relation**. It has a unique value for each row of data and the field chosen as primary key, **cannot accept null values**. **There should not be duplicacy in the record of primary key**. Primary key can be atomic or composite. The primary key should be chosen in such a way, i.e. its value must not be changed

Candidate Key - It is a **set of columns in the table from which primary key can be selected** to identify each record. Every database table may have one or more candidate keys and one of them will become the primary key. **Uniquely identify each tuple (row) of a relation**. The candidate key of a relation is always a **minimal key**.

Alternate Key - From the set of candidate keys after selecting one of the keys as primary key, all other remaining keys are known as alternate keys i.e. **All keys except primary key are known as Alternate**. Alternate keys are **also called Secondary Keys**.

Foreign Key - Foreign key **points to the primary key of another table**. It acts as a reference between tables. It can accept the null and duplicate value.

It is a non-key attribute whose value is derived from the primary key of the same or some another table. **The relationship between two tables is established with the help of foreign key**. A table may have multiple foreign keys and each foreign key can have a different referenced table.

Super Key - It is a set of one or more attributes whose values uniquely determine each entity in the database table. **It is a subset of a candidate key**.

Composite Key - It is a combination of more than one column in the table that can be used to **uniquely identify each record**. It is also known as a Compound key.

Advantages of DBMS

1. Reduction in Data Redundancy The duplication of data refers to data redundancy. DBMS cannot make separate copies of the same data. All the data is kept at a place and different applications refer to data from centrally controlled system.

2. Better Interaction with Users In DBMS, the availability of up-to-date information improves the data to be accessed or respond as per user requests.

3. Improvement in Data Security DBMS can allow the means of access to the database through the authorised channels. To ensure security, DBMS provides security tools, i.e. username and password.

4. Maintenance of Data Integrity Data integrity ensures that the data of database is accurate. In DBMS, data is centralised and used by many users at a time, it is essential to enforce integrity controls.

5. Backup and Recovery The DBMS provides backup and recovery sub-system that is responsible to recover data from hardware and software failures.

Disadvantages of DBMS

1. Cost of Hardware and Software A processor with high speed of data processing and memory of large size is required to run the DBMS software. It means that you have to upgrade the hardware used for file based system. Similarly, database software is also very costly.

2. Complexity The provision of the functionality that is expected from a good DBMS makes the DBMS an extremely complex piece of software. Failure to understand the system can lead to bad design decisions, which can have serious consequences for an organisation.

3. Cost of Staff Training Mostly DBMSs are often complex systems, so the training for user to use the database is required. The organisation has to pay a lot of amount for the training of staff to run the DBMS.

4. Appointing Technical Staff The trained technical persons such as database administrator, application programmers, etc., are required to handle the database. You have to pay a lot of amount to these persons. Therefore, the system cost increases.

5. Database Failure In most of the organisations, all data is integrated into a single database. If database is corrupted due to power failure or it is corrupted on the storage media, then our valuable data may be lost or whole system stop.

Applications of DBMS

1. Banking For customer information, accounts, loans and other banking transactions. **2. Reservation** For reservation and schedule information. **3. Universities** For student information, course registration, grades, etc. **4 Credit Card Transaction** For purchase of credit cards and generation of monthly statements. **5. Tele-communication** For keeping records of calls made, generating monthly bill, etc. **6. Finance** For storing information about holdings, sales and purchase of financial statements. **7. Sales** For customer, product and purchase information.

- Dr. EF Codd represented 12 rules for Relational Database Management System (RDBMS) in 1970.
- Schema is a logical structure of the database.
- Instances are the actual data contained in the database at a particular point of time.
- Data Duplication wastes the space, but also promotes a more serious problem called data inconsistency.
- Data Mining is the process of sorting through large data sets to identify patterns and establish relationships to solve problems through data analysis.

Data Communication

The term ‘communication’ means sending or receiving information. When we communicate, we share information or data.

A communication system can be defined as the collection of hardware and software that facilitates inter-system exchange of information between different devices.

1. Data Communication: - It is the transfer of data or information including method of preservation of data during the transfer process between two devices using some form of transmission media. Data is transferred from one place to another **in the form of signals.**

There are three types of signal

1. Digital Signal In this signal, data is transmitted in electronic form, i.e. binary digits (0 or 1).

2. Analog Signal In this signal, data is transmitted in the form of **radio waves** like in telephone line.

3. Hybrid Signal These signals have properties of **both analog signal and digital signal.**

Components of Data Communication: -

(i) Sender: - It is a computer or any such device which is capable of sending data over a network. It can be a computer, mobile phone, smart watch, walkie-talkie, video-recording device, etc.

(ii) Receiver: -It is a computer or any such device which is capable or receiving data from the network. It can be any computer, printer, laptop, mobile phone, television, etc. The sender and receiver are known as nodes in a network.

(iii) Message: - it is the data or information that needs to be exchanged between the sender and the receiver. Messages can be in the form of text, number, image, audio, video, multimedia, etc.

(iv) Communication Media: -It is the path through which the message travels between source and destination. It is also called medium or link which is either wired or wireless. The communication media is also **called transmission media.**

(v) Protocol: - It is a **set of rules that need to be followed by the communicating parties** in order to have successful and reliable data communication. - Protocol is a set of guidelines for exchanging data over a computer network, such as LAN, Internet, Intranet, etc.

Characteristics of Data Communication

1. Delivery The data must be delivered from the source device to the correct destination in the right order.

2. Accuracy The data must be delivered error-free. If there exists any inaccuracy during transmission, the data should be re-transmitted.

3. Timeliness The data must be delivered during the specified time period. The late delivered data becomes useless

2. Data Transmission modes OR Communication Channel/Mode

The way in which data is transmitted from one device to another device is known as transmission mode/communication mode. it refers to the direction of signal flow between two linked devices.

The Transmission mode/ communication channels are divided into three categories:

- Simplex mode ➤ Half-duplex mode ➤ Full-duplex mode

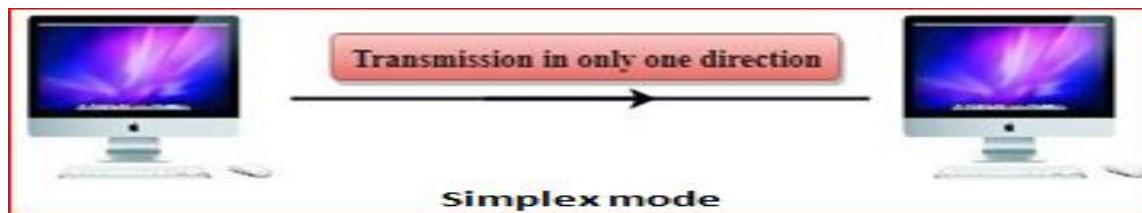
1. Simplex Channel

In this channel, the flow of data is always/only in one direction (**i.e. uni-directional**) with no capability to support response in other direction.

Only one of the communicating devices transmits information and the other can only receive it. In other words, A device can only send the data but cannot receive it or it can receive the data but cannot send the data.

E.g. **Radio broadcasting, television Broadcasting, Keyboard and Monitor, Loud Speaker, Television, Fire alarm system etc.**

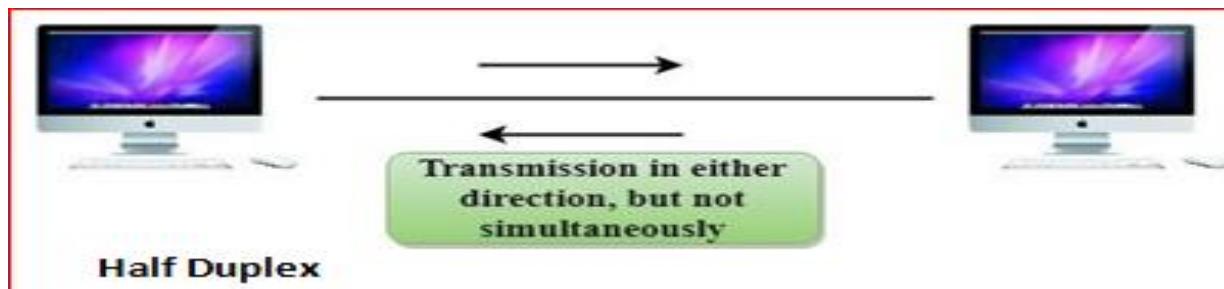
- **The radio station** is a simplex channel as it transmits the signal to the listeners but never allows them to transmit back.
- **Keyboard** can only accept the data from the user and **monitor** can only be used to display the data on the screen.
- The **main advantage** of the simplex mode is that the **full capacity of the communication channel can be utilized** during transmission.



2. Half Duplex Channel

In this channel, the **data can flow in both directions (bi-directional), but not at the same time.** Either of the devices can act as transmitter or receiver but **only one device can transmit the data at one time.** E.g. **Walkie –Talkie.**

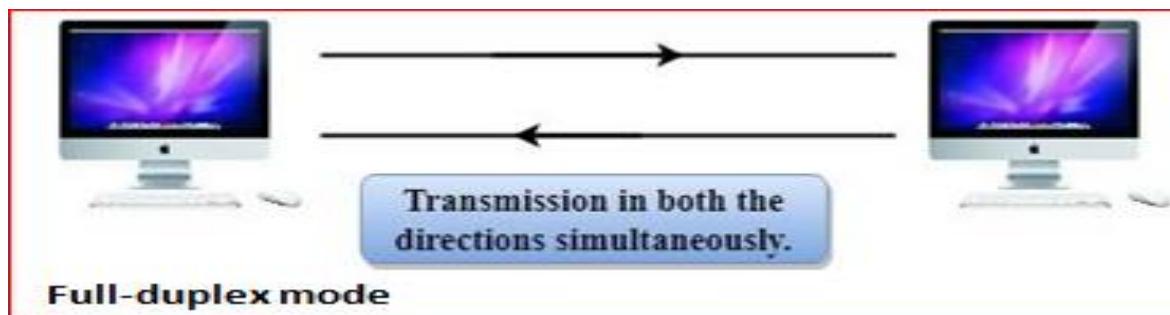
- In a Half-duplex channel, direction can be reversed, i.e., the station can transmit and receive the data as well.
- The entire bandwidth of the communication channel is utilized in one direction at a time.
- In half-duplex mode, it is possible to perform the error detection, and if any error occurs, then the receiver requests the sender to retransmit the data.



3. Full Duplex Channel

In this channel, **the flow of data is in both directions at a time** i.e., both stations can transmit and receive information simultaneously. E.g. Telephone conversation.

- In Full duplex mode, the communication is **bi-directional**, i.e., the data flow in both the directions. Both the stations can send and receive the message **simultaneously**.
- **Full-duplex mode has two simplex channels.** One channel has traffic moving in one direction, and another channel has traffic flowing in the opposite direction.
- The Full-duplex mode is the fastest mode of communication between devices.



3. Communication Media anything that can carry information from a source to the destination.

Communication media of a network **refers to the transmission media or the connecting media used in the network.**

It refers to the physical media through which communication signals can be transmitted from one point to another.

Transmission media can be divided into two broad categories

1. Guided Media or Wired Technologies Cable is a transmission media that transmits the communication signals.

The data signal in guided media is **bound by the cabling system** that guides the data signal along a specific path. It **consists of a cable composed of metals like copper, tin or silver.**

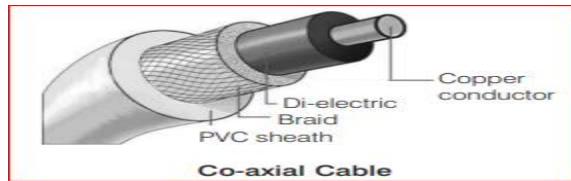
Basically, There are three types of cables:

1. Ethernet Cable or Twisted Pair Cable: - most widely used LAN technology that defines wiring and signaling standards for the physical layer of TCP/IP. Ethernet was standardized as IEEE 802.3. High-speed cable transmits data over 1Gbps or more.

In this cable, wires are twisted together which are surrounded by an insulating material and an **outer layer called jacket**. One of the wires carries signals to the **receiver** and the other is used only as a ground reference. E.g. **LAN** use twisted pair cable.

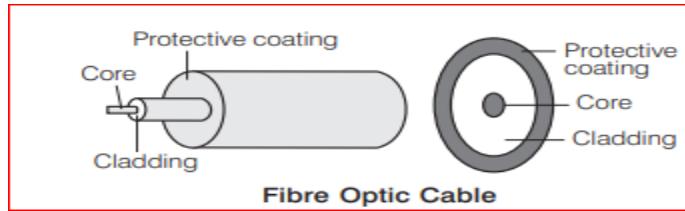
2. Co-axial Cable It is more expensive than twisted pair cable, but it provides the high data transmission speed.

It carries the signal of higher frequency data through the network. It has a single inner conductor that transmits electric signals and the outer conductor acts as a ground and is wrapped in a sheet of Teflon or PVC. Co-axial cable is **commonly used in transporting multi-channel television signals** in cities. E.g. **Cable TV** network.



3. Fibre Optic Cable It is more expensive as compared to other cables, so it is installed at the government level.

It is made up of **glass or plastic** and **transmits signals in the form of light** from a source at one end to another. Optical fibres allow transmission over **longer distance** at higher bandwidth which is **not affected by electromagnetic field**. The speed of optical fibre is hundred times faster than co-axial cables.



Note Tamil Nadu decided to implement **Bharat Net Service** which will connect all the village **panchayats** through optical fibre.

2. Unguided Media or Wireless Technologies

It is the transfer of information over a distance **without the use of enhanced electrical conductors or wires**. When the computers in a network are interconnected and **data is transmitted through waves**, then they are said to be connected through unguided media.

Some commonly used unguided media of transmission are as follows

1. Radio wave Transmission – Radio, Television and Paging system

When **two terminals communicate by using radio frequencies** than such type of communication is known as radio wave transmission. This transmission is **also known as Radio Frequency (RF) transmission**. The frequencies **range from 3Hz to 1GHz**. These are **Omni-directional**. Radio waves, particularly those waves that propagate in the sky mode, can travel long distances.

2. Microwave Transmission Mobile phone, Satellite networks, Wireless LANs

Microwaves are **electromagnetic waves** having frequencies **range from 0.3 to 300 GHz**. Microwaves are **uni-directional**. It has **higher frequency than that of radio waves**. It is **used in cellular network and television broadcasting**.

3. Infrared Wave Transmission Short range communication (TV remote control, IRD port etc)

Infrared waves are the high frequency waves used **for short-range communication**. The frequencies range from **300 GHz to 400 THz**. These waves cannot pass through the solid-objects. They are **mainly used in TV remote and wireless speakers**, etc.

4. Satellite Communication

The communication across longer distances can be provided by **combining radio frequency transmission with satellites**.

It works over long distances and allows fast communication. It is used for communication **to ships, vehicles, planes and handheld terminals**.

Note Bluetooth It is a short range wireless communication technology that allows devices such as mobile phones, computers and peripherals to transmit data or voice wirelessly over a short distance.

Token Ring - It is a local area network topology where nodes are arranged in a ring topology. The data passes between nodes on the network until it returns to the source station. A token ring topology uses a token to ensure that only one node on the line is used at a time to prevent congestion and collision. The token ring LAN system was standardized as IEEE 802.5.

Fiber distributed data interface (FDDI) - FDDI is an optical data communication standard used for long distance networks provides communication with fiber optic lines. This protocol is based on the token ring protocol.

Computer Network or Data Network

Computer Network or data network is a group of computers connected with each other through wires, optical fibers or optical links so that various devices can interact with each other through a network.

- the aim of the computer network is the sharing of resources among various devices.
- Computer network is a combination of hardware and software that allows communication between computers over a network.

A computer network or data network is a telecommunications network which allows computers to **exchange data using a data link**. The connections between **nodes (computers on networks called nodes)** are established using either cable media or wireless media.

Vint Cerf and Bob Kahn are known as fathers of the Internet.

The five components of a computer network are:

Sender (Device) - Sender is a device that sends a message which can consist of text, numbers, pictures etc. It is **also called source or transmitter**.

Sender Equipment (Encoder) - The **encoder** is a device that converts digital signals in a form that can pass through a transmission medium.

Communication Channel (Cables, Wireless) - It is the **physical path** that connects the sender and the receiver. It is **used to transmit data**. It is **also called Medium**. The channel can be a **copper wire, a fiber optic cable, microwaves** etc

Receiver (Device) – Receiver is a device that receives the message. It is **also called a sink**. It must be capable of accepting the message.

Receiving Equipment (Decoder) - The decoder is a device that converts the encoded signals into digital form. The receiver can understand the digital form of message.

Computer Network Architecture/Models of Computer Networking:

Computer Network Architecture is defined as the **physical and logical design** of the software, hardware, protocols, and media of the transmission of data. Simply we can say that **how computers are organized and how tasks are allocated to the computer**.

The two types of network architectures are used: • Peer-To-Peer network • Client/Server network or tiered

1. Peer-To-Peer network (P2P):

- Peer-To-Peer network is a network in which **all the computers are linked together** with equal privilege (no hierarchy among the computers and all of them are considered equal.) for processing the data.
- This is **also known as a distributed architecture**. It doesn't use a server (**no dedicated server**) that controls network activity..
- Useful for small environments, usually up to 10 computers. Peer-to-peer is **mostly used for file sharing**.
- Special permissions are assigned to each computer for sharing the resources, but this can lead to a problem if the computer with the resource is down.
- It relies on computing power at the edges of a connection rather than in the network itself.

- P2P network is used for sharing content like audio, video, data or anything in the digital format.

- In P2P connection, a couple of computers are connected via a Universal Serial Bus (USB) to transfer files.

- In peer-to-peer networking, each or every computer can work as server or client.

2. Client/Server or tiered Network:

The model of interaction between two application programs in which a program at one end (client) requests a service from a program at the other end (server).

- It is a network architecture which separates the client from the server. It is scalable architecture, where one computer works as server and others as client. Here, client acts as the active device and server behaves passively.

- Client/Server network is a network model **designed for the end users called clients**, to access the resources such as songs, video, etc. **from a central computer known as Server**.

- **The central controller is known as a server** while all other computers in the network are **called clients**.

- A server performs all the major operations such as security and network management. A server is responsible for managing all the resources such as files, directories, printer, etc.

- **The server acts as a hub in which other computers (clients) are connected. The server manages and provides resources to any client that requests them. All the clients communicate with each other through a server.**

For example, if client1 wants to send some data to client 2, then it first sends the request to the server for the permission. The server sends the response to the client 1 to initiate its communication with the client 2.

Server-Client model: Computer networking is used in the server-client model. A server is a central computer used to store the information and maintained by the system administrator. Clients are the machines used to access the information stored in the server remotely.

Computer Network Devices:

These devices are required to amplify the signal to restore the original strength of signal and to provide an interface to connect multiple computers in a network.

There are many types of devices used in Computer networking. Some of them are described below: -

1. Network Interface Card (NIC):

- It is a hardware component used to connect a computer with another computer onto a network

- It can support a transfer rate of 10,100 to 1000 Mb/s.

- The MAC address or physical address is encoded on the network card chip which is **assigned by the IEEE** to identify a network card uniquely. The **MAC address is stored in the PROM** (Programmable read-only memory).

There are two types of NIC:

➤ **Wireless NIC:** The wireless NIC contains the antenna to obtain the connection over the wireless network. For example, laptop computer contains the wireless NIC.

➤ **Wired NIC:** The Wired NIC is present inside the motherboard. Cables and connectors are used with wired NIC to transfer data.

2. Repeater

It has two ports and can connect two segments of a LAN. It amplifies the signals when they are transported over a long distance so that the signal can be as strong as the original signal. **A repeater boosts the signal back to its original level.**

3. Hub:

It is like a repeater with multiple ports used to connect the network channels. It acts as a centralized connection to several computers with the central node or server. When a hub receives a packet of data at one of its ports from a network channel, it transmits the packet to all of its ports to all other network channel.

Hub is a central device that splits the network connection into multiple devices. When computer requests for information from a computer, it sends the request to the Hub. Hub distributes this request to all the interconnected computers.

4. Switches:

Switch is a networking device that groups all the devices over the network to transfer the data to another device. **A switch is better than Hub as it does not broadcast the message over the network**, i.e., it sends the message to the device for which it belongs to. Therefore, we can say that **switch sends the message directly from source to the destination.**

It is a small hardware device that joins multiple computers together within one LAN.

It helps to reduce overall network traffic. Switch forwards a data packet to a specific route by establishing a temporary connection between the source and the destination.

There is a vast difference between a switch and a hub. A hub forwards each incoming packet (data) to all the hub ports, while a switch forwards each incoming packet to the specified recipient.

5. Bridge

It serves a similar function as switches. A bridge filters data traffic at a network boundary. Bridges reduce the amount of traffic on a LAN by dividing it into two segments.

Traditional bridges support one network boundary, whereas switches usually offer four or more hardware ports. Switches are sometimes called multiport bridges.

6. Gateway

It is an **inter-connecting device**, which **joins two different network protocols together**.

They are **also known as protocol converters**.

It accepts packet formatted for one protocol and converts the formatted packet into another protocol.

The gateway is a node (computers on networks called nodes) in a network which **serves as a proxy server and a firewall system** and prevents the unauthorized access.

7. Router:

- A router is a hardware device which is used to connect a LAN with an internet connection. It is used to receive, analyze and moving forward and converting packets to the network interface, dropping the packets, directing packets to the appropriate locations, etc. • **A router works in a Layer 3 (Network layer) of the OSI Reference model.**
- A router forwards the packet based on the information available in the routing table.
- It determines the best path from the available paths for the transmission of the packet.

8. Modem:

It stands for Modulator/Demodulator. It converts the digital data into an analog signal over the telephone lines. Modem is always placed between a telephone line and a computer.

Modem connects the computer to the internet over the existing telephone line. A modem is not integrated with the computer motherboard. A modem is a separate part on the PC slot found on the motherboard.

Modem It is a device that converts digital signal to analog signal (**modulator**) at the sender's end and converts back analog signal to digital signal (**demodulator**) at the receiver's end, in order to make communication possible via telephone lines.

9. Firewall - A firewall is a network security system that monitors and controls overall incoming and outgoing network traffic based on advanced and a defined set of security rules.

Some important Uses Of Computer Network:

1. File Sharing Networking of computer helps the users to share data/files.

2. Hardware Sharing Users can share devices such as printers, scanners, CD-ROM drives, hard drives, etc., in a computer network.

3. Application Sharing Applications can be shared over the network and this allows implementation of client/server applications.

4. User Communication This allows users to communicate using E-mail, news groups, video-conferencing, etc. within the network

5. Communication medium: Computer network behaves as a communication medium among the users. For example, a company contains more than one computer has an email system which the employees use for daily communication.

6. E-commerce: Computer network is also important in businesses. We can do the business over the internet. For example, amazon.com is doing their business over the internet.

Computer Network Addressing

Network addresses are always logical, i.e. these are software based addresses which can be changed by appropriate configurations. A network address always points to host/node/ server or it can represent a whole network.

Network address is always configured on network interface card and is generally mapped by system with the MAC address of the machine for layer-2 communication. There are different kinds of network addresses as IP, IPX, AppleTalk.

IPv4 - 32 bits numeric address IPv6 - 128 bits hexadecimal address

IPv6 does not use broadcast messages and has three types of addresses, which are categorized as :

Unicast addresses. A packet is delivered to one interface.

Multicast addresses. A packet is delivered to multiple interfaces.

Anycast addresses. A packet is delivered to the nearest of multiple interfaces (in terms of routing distance).

With an IPv4 IP address, there are five classes of available IP ranges: Class A, Class B, Class C, Class D and Class E, while only A, B, and C are commonly used.

Each class allows for a particular range of valid IP addresses. Class D is reserved for multicast groups and Class E is reserved for future use, or Research and Development Purposes.

Terms Related to Computer Network

1. Multi-plexing It is a technique used for transmitting signals simultaneously over a common medium. It involves single path and multiple channels for data communication. **2. Code Division Multiple Access (CDMA)** It is a channel access method used by various radio communication technologies. CDMA employs spread spectrum technology and a special coding scheme, where each transmitter is assigned a code to allow multiple users to be multi-plexed over the same physical channel.

3. Packet Switching It refers to the method of digital networking communication that combined all transmitted data regardless of content, type or structure into suitable sized blocks known as packets. **4. Public Switched Telephone Network (PSTN)** It is designed for telephone, which requires modem for data communication. It is used for FAX machine also.

5. Integrated Services Digital Network (ISDN) It is used for voice, video and data services. It uses digital transmission and combines both circuit and packet switching.

6. Ethernet It is a widely used technology employing a bus technology. An ethernet LAN consists of a single co-axial cable called Ether. It operates at 10 Mbps and provides a 48-bits address. Fast ethernet operates at 100 Mbps.

7. Token It is a small message used to pass between one station to another.

- **Bandwidth** determines the data transfer rate which is measured in Cycle Per Second (CPS) or Hertz (Hz).
- **Throughput** is the amount of data that is actually transmitted between two computers. It is specified in bits per second (bps). Giga bits per second (Gbps) is the fastest speed unit per data transmission.
- **GPS** (Global Positioning System) is a global navigation satellite system that provides location, velocity and time synchronization. GPS is everywhere. You can find GPS system in your car, your smartphone and your watch.

Cloud computing

Cloud computing is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand.

Public clouds are owned and operated by companies that offer rapid access over a public network to affordable computing resources.

A private cloud is infrastructure operated solely for a single organization, whether managed internally or by a third party, and hosted either internally or externally.

A hybrid cloud uses a private cloud foundation combined with the strategic integration and use of public cloud services. Google Drive is a personal cloud storage service from Google which gives every user 15 GB of Drive storage space. OneDrive is Microsoft's service for hosting files in the "cloud computing". One Drive offers 5GB of storage space for free.

Types of Cloud computing Service

1. Platform as a Service (PaaS): - It is a category of cloud computing service that provide a platform & Environment to build application and service over the internet. Example-Amazon web service, Azure Google App Engine etc.

2. Software as a Service (SaaS): - It is a Category of cloud computing service which delivering services and application over the internet Example: -Microsoft office 365, Dropbox, Elogua etc.

3. Infrastructure as a Service (IaaS): - It is a category of cloud computing which is known as Service model that delivers computer infrastructure on an outsource basis to support various operation. Infrastructure means -web server, database, development tools etc. Example: -Amazon Web Services, IBM, OpenStack etc.

OSI Model

Open System Inter-connection (OSI) is a standard reference model for communication between two end users in a network.

In 1983, the International Standards Organization (ISO) published a document called **Basic Reference Model** for OSI which visualizes network protocols as a **Seven Layered Model**. It is now considered as an architectural model for the inter-computer communications.

OSI is a layered framework for the design of network system that allows communication between all types of computer systems. It mainly consists of seven layers across a network and each layer performs a particular network function

It is a reference model that describes how information from a software application in one computer moves through a physical medium to the software application in another computer.

(OSI) Model is an **intangible** and logical arrangement that describes network communication between two systems by using different layer protocols

The Seven Layers are as follows:

1. Application layer [User-Interface]: [Data] (Network Process to Application)

- It is the **topmost layer** of the network that is responsible for sending application requests by the user to the lower levels.
- Typical applications include file transfer, E-mail, remote logon, data entry, etc
- This layer focuses on process-to-process communication across an IP network and provides a firm communication interface and end-user services.
- It supports services such as electronic mail, remote file access, and transfer, shared database management, Web chat and surfing, Directory services and Network Virtual Terminal.
- HTTP, FTP, Telnet, SMTP, and DNS have used protocols of this layer. It is also called as Desktop Layer.

2. Presentation layer [Data formatting]: [Data] (Data Representation & Encryption)

This layer is concerned with correct representation of data, i.e. syntax and semantics of information. It controls file level security and is also responsible for converting data to network standards.

- This layer performs encryption and decryption of data.
- It gives the data in a readable format from an application layer perspective.
- It reduces the number of bits that need to be transmitted on the network. It offers liberty from compatibility troubles.
- It is called the Translation layer and Syntax layer.
- Example - ASCII code to EBCDIC coded text file.

3. Session layer [Establish and maintain connection]: .[Data] (Inter-host Communication)

- This layer is responsible for the establishment of the connection, maintenance of sessions, synchronization and ensures security between two workstations that want to exchange data.
- It allows adding checkpoints (synchronization points) into the data to identify the error.
- This layer is the network dialog controller which allows two systems into the dialog in either half duplex or full duplex mode.
- RPC, PPTP, SCP, SDP are some protocols of this layer.

4. Transport layer [Transmission Control Protocol (TCP) accurate data]:

- This layer is called as Heart of OSI model.
- It is responsible for end-to-end network communication, flow control of data, error recovery and reliability and quality of data.
- The data in the transport layer is referred to as Segments.
- It is operated by the Operating System. SPX, TCP/IP's, DNS are examples of implemented protocols on this layer.

Till the session layer, file is in its own form. Transport layer breaks it down into data frames, provides error checking at network segment level and prevents a fast host from overrunning a slower one. It isolates the upper layers from network hardware. **[Segments]** (End-to-end connections & reliability). SPX, TCP/IP's, DNS are examples of implemented protocols on this layer

5. Network layer [Internet Protocol (IP) routers]:

It is concerned with routing, switching and controlling flow of information between the workstations. It also breaks down transport layer datagrams into smaller datagrams. **[Packets]** (Path Determination and IP).

- This network provides the shortest path for transmitting data for network communication to avoid congestion.
- Data is transmitted in the form of packets through the logical network path.
- The IP address of the sender/receiver is placed in the header.
- Routers are used as networking devices.
- The IPX and TCP/IP are the implemented protocols on this layer.

Routing and Logical Addressing are the functions of this layer.

- ✓ Routing – Finding the shortest path for data transmission.
- ✓ Logical Addressing – Placing the IP address of the sender/receiver in the header.

6. Data link layer [Media Access Control (MAC) switches]: **{Frames}(Physical Addressing).**

- It is the firmware layer of Network Interface Card.
- It assembles data grams into frames and adds start and stop flags to each frame. It also resolves problems caused by damaged, lost or duplicate frames.
- It is used for the encoding, decoding and logical organization of data bits. **It makes the physical layer appear error-free.**
- It converts the bits into the frames depending on the frame size of Network Interface Card (NIC).
- Switch and Bridge is Data Link Layer devices. HDLC, LSL, and ATM are the implemented protocols on this layer.

It has two sub-layers:-

- **Media Access Control (MAC)** – It is responsible to the physical address of the sender and/or receiver in the header of each frame. CSMA/CD, Ethernet are used as protocol.
- **Logical Link Control (LLC)** – It is responsible for frame management, error checking, and flow control of data.

7. Physical layer [Signals-cables or operated by repeater]:[Bits] (Media, Signal and Binary Transmission). Lowest layer

It is the first layer that physically connects the two systems that need to communicate. It transmits data in bits and manages simplex or duplex transmission by modem. It also manages Network Interface Card's hardware interface to the network, like cabling, cable terminators, topography, voltage levels, etc. **Protocols used** - ATM, RS232, and Ethernet.

- It deals with the bit-level transmission between the devices.
- It supports mechanical and electrical specifications of the interface and transmission medium.
- **Hub, Repeater, Modem, Cables are Physical Layer devices.**
- Simplex, half-duplex and full-duplex are the transmission modes for this layer

Note: Physical layer is the lowest layer and application layer is the highest layer. Physical Layer, Data Link Layer, and Network Layer are also known as Hardware Layer

TCP/IP Model

TCP/IP stands for Transmission Control Protocol/Internet Protocol.

TCP/IP is a set of layered protocols used for communication over the Internet.

TCP model is a **tangible**, client-server model.

A computer that sends a request is the client and a computer to which the request is sent is the server.

It is one of the most used protocols in digital network communications.

It has only four layers in a data communication network.

1. Host-to-Network Layer – In this layer, the host has connected to the network using the protocol to send IP packets. Ethernet, Token Ring, FDDI, X.25, Frame Relay are used.

2. Internet Layer – It transfers the Internet Protocol packets (IP datagrams) to the destination. IP, ICMP, ARP, RARP, and IGMP have used protocols.

3. Transport Layer – It is like as transport layer in the OSI model. Two end-to-end transport protocols are used. Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).

4. Application Layer – It contains high-level protocols. TELNET, FTP, SMTP, DNS, HTTP, NNTP, DHCP are used.

FTP As we have seen, the need for network came up primarily to facilitate sharing of files between researchers. And to this day, file transfer remains one of the most used facilities. The protocol that handles these requests is File Transfer Protocol or FTP.

PPP Point to Point Protocol or PPP is a data link layer protocol that enables transmission of TCP/IP traffic over serial connection, like telephone line.

Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

The Network allows computers to connect and share resources with other devices through a medium. Based on the area coverage, there are three types of computer networks.

> LAN (Local Area Network) > MAN(Metropolitan Area Network) > WAN(Wide Area Network)

LAN (Local Area Network):

- LAN is a computer network covering a small geographical area such as building office , home, hospital, schools, etc. **and is privately owned.**
- LAN is used for connecting two or more personal computers through a **communication medium such as twisted pair, coaxial cable.**
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, **token ring and Ethernet cables.** They also use certain specific connectivity technologies, primarily Ethernet and Token Ring.
- LAN offers high-speed communications data rates **up to 1000 Mbps.** The data is transferred at an extremely faster.
- The fault tolerance of a LAN is more, and congestion is less in this network.

MAN (Metropolitan Area Network):

- MAN covers a large geographical area than LAN by interconnecting a different LAN to form a larger network usually spans several buildings in the same city or town.
- It is designed for customers who need a high-speed connectivity (**Its speed is up to 100 Mbps.**) and it is usually owned by large organizations to interconnect its various branches **across a city.** • Government agencies use MAN to connect to the citizens and private industries.
- The fault tolerance of a MAN is less and congestion in the network is more.
- Modem and Wire/Cable are used as transmission devices.
- It may serve as an Internet Service Provider (ISP).
- Cable TV network is an example of metropolitan area network. The computers in a MAN are connected using co-axial cables or fibre optic cables.

WAN (Wide Area Network):

- In comparison to a MAN, is not restricted to a geographical location, although it might be confined/restricted within the geographical bounds of a state or country.
- A WAN connects several LANs, and may be limited to an enterprise (a corporation or an organization) or accessible to the public.
- It could be a connection of LAN connecting to other LAN through telephone lines and radio waves, fibre optic cable or satellite links etc.
- **The technology is high speed and relatively expensive. Its speed is up to 150 Mbps.** WANs use technology like ATM, Frame Relay and X.25 for connectivity.

- Public packet networks, large corporate networks, Military networks, Banking networks, Stock brokerage networks, and Airline reservation networks are constructed by WAN
- **The internet is one of the biggest** worldwide public WAN.

Other types

PAN (Personal Area Network):

PAN is a computer network, arranged within an individual person, used for data transmission amongst devices such as computers, laptop, tablets, mobile phones, printers, telephones, media player and play stations and personal digital assistants.

- It can be constructed by using cables or it may be wireless **typically within a range of 10 meters (30 feet)** used for connecting the computer devices of personal use
- **Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network.**
- Its speed is upto 3 Mbps. Few examples of PAN are Bluetooth, Wireless USB, Z-wave and Zig Bee.

There are two types of Personal Area Network:

- **Wireless Personal Area Network:** It is developed by simply using wireless technologies such as **WiFi, Bluetooth**. It is a low range network.
- **Wired Personal Area Network:** It is created by **using the USB**.

Wireless Local Area Network (WLAN) –

WLAN is a wireless network communication over short distances. This distribution method uses high-frequency radio waves and often includes an access point to the Internet.

It is also called Local Area Wireless Network (LAWN). Example - A mobile user can connect to LAN via wireless connection.

Storage Area Network (SAN) - SAN is a high-speed special-purpose network. It supports data storage, retrieval, and sharing of data, multiple disk arrays, data migration from one storage device to another and **uses Fibre Channel** interconnection technology.

Campus Area Network (CAN) - CAN is a computer network of interconnected local area networks. **It is larger than a LAN but smaller than MAN or WAN.**

It can also stand for Corporate Area Network. Example - Massachusetts Institute of Technology's (MIT) Project Athena has CAN network.

Wireless Personal Network (WPAN) – WPAN is a type of personal area network. It uses wireless communication to transfer data between the connected devices of the user. **It is also known as short wireless distance network.**

Internetwork:

- An internetwork is defined as two or more computer network LANs or WAN or computer network segments are connected using devices, and they are configured by a local addressing scheme. This process is known as internetworking.
- An interconnection between public, private, commercial, industrial, or government computer networks can also be defined as internetworking.
- An internetworking uses the internet protocol.

- The reference model used for internetworking is Open System Interconnection (OSI).

Types of Internetwork:

➤ **Extranet:** An extranet is a communication network based on the internet protocol such as Transmission Control protocol and internet protocol.

➤ **Intranet:** An intranet is a private network based on the internet protocol such as Transmission Control protocol and internet protocol.

■ **Server** is a system that responds to requests across a computer network to provide a network service. It can be run on a dedicated computer. It is one of the most powerful and typical computer.

■ **File Server** is a type of computer used on network that provides access to files. It allows users to share programs and data over LAN network.

Computer Network Topology

Topology can be referred as the geometric arrangement of a computer system. **Each computer system in a topology is known as node.**

Topology defines the structure of the network of how all the components (**network, nodes and connecting lines**) are interconnected to each other. It refers to the way a network is laid out, either physically or logically.

The physical topology and the logical (**or signal**) topology are the types of network topology.

1. Logical/Signal Topology

Logical topology illustrates how data flows/transmitted from node to node across the system within a network, regardless of its physical design. **Broadcast** and **Token Passing** are the two types of Logical topology.

✓ In Broadcast, there is **no need for instructions**. Ethernet is working in Broadcast transmission.

✓ In Token Passing, electronic token is passed to each node. When a token is received by the node, the node can send data on the network. **Token Ring and Fibre Distributed Data Interface (FDDI)** are using Token Passing.

Arc net is token passing on a **bus** topology.

2. Physical Topology

The physical topology refers to the geometric layout of the connected network.

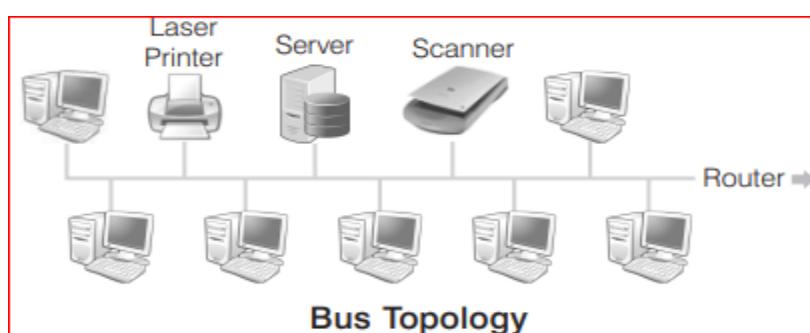
There are six types of physical topology • Bus Topology • Ring Topology • Star Topology • Tree topology • Mesh topology• Hybrid Topology

1. Bus Topology:

In the Bus topology system, every **computer and network** are connected by using a single cable. The cable is known as **Bus**. It **transmits the data** from one end to another end **only in a single direction**.

When it has **exactly two endpoints**, then it is **called Linear Bus topology**. A network that uses a bus topology is referred to as a bus network. **Bus networks were the original form of an Ethernet network**.

- Data network with bus topology has a **linear transmission cable**, usually **coaxial**, to which many network devices and workstations are attached along the length.
- **Server is at one end of the bus**. When a workstation has to send data, it transmits packets (data) with destination address in its header along the bus.
- The **data travels in both the directions along the bus**. When the destination terminal sees the data, it copies it to the local disk.
- It is usually used when a network installation is small, simple or temporary.

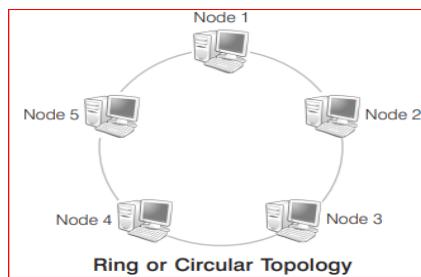


2. Ring Topology:

In ring Topology, network nodes are connected in a closed loop configuration. Each node has directly connected with its adjacent node on both sides. Exactly two neighbors for each device. The others are indirectly connected and the data passing through one or more intermediate nodes.

- In ring topology each terminal is connected to exactly **two nodes**, giving the network a **circular shape**. Data travels in **only one pre-determined direction**.
- This topology is used in high-performance networks where large bandwidth is necessary.
- When a terminal has to send data, it transmits it to the neighboring node which transmits it to the next one. Before further transmission data may be amplified.
- In this way, data reverses the network and reaches the destination node, which removes it from the network. If the data reaches the sender, it removes the data and resends it later.
- The protocols used to implement ring topology are **Token Ring** and **Fiber Distributed Data Interface (FDDI)**. In ring topology, **data is transmitted in the form of token** over a network.

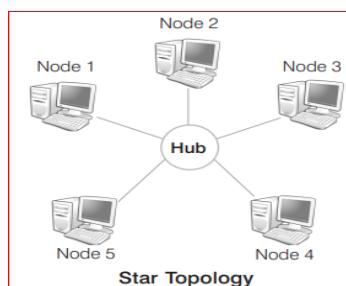
➤ **Dual Ring Topology** - When the transmission is bidirectional by having two connections between each network node, it is called Dual Ring Topology. It is a network redundant topology **where nodes are connected using two concentric rings with four branches**. If one ring fails, the **second ring can act as a backup**, to keep the network up.



3. Star Topology:

In a star topology, all the all the computers or nodes are connected to a single hub through a cable. This hub is the central node. The data can send from one node to another through the hub. Hub acts as a repeater for data flow. It can be used with twisted pair, Optical Fibre or coaxial cable.

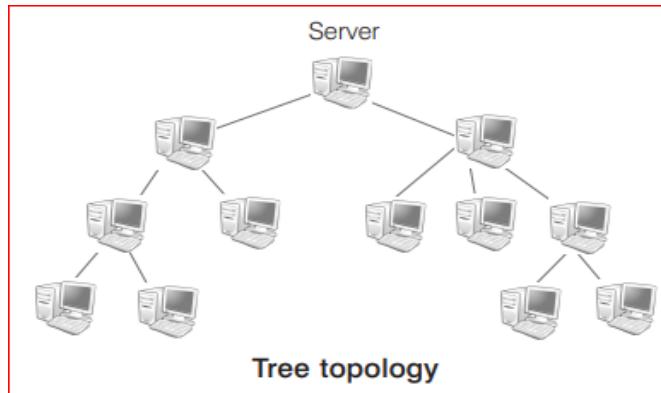
- In star topology, **server is connected to each node individually**.
- **Server is also called the central node**.
- Any exchange of data between two nodes **must** take place through the server.
- It is the **most popular topology for information and voice networks** as central node can process data received from source node before sending it to the destination node. •**A star network can be expanded by placing another star hub**.



4. Tree Topology:

In Tree Topology network, two or more-star networks connected with a root node (which acts as a server) and all other nodes are connected to it forming a hierarchy. So it is **also called hierarchical topology**. It should at least have three levels to the hierarchy.

- Tree topology has a group of star networks connected to a **linear bus** backbone cable.
- It incorporates **features of both star and bus topologies**.
- The function of the central node in this topology may be distributed. It allows more devices to be attached to a single hub.
- This type of topology used in **Wide Area Network**. Tree topology is valued for its scalability and accessibility for troubleshooting.



5. Mesh topology:

It is also known as completely inter-connected topology. It is a point-to-point connection to other nodes or devices. All the network nodes are connected to each other

In mesh topology, every node has a dedicated point-to-point link to every other node. Every node carries traffic **only between the two nodes it connects** (point-to-point connection).

- Mesh has $n(n-1)/2$ physical channels to link n devices.
- **It does not contain the switch, hub or any central computer which acts as a central point of communication.**
- **The Internet is an example of the mesh topology.**

Example - Each telephone regional office needs to be connected to every other regional office.

There are two techniques to transmit data over the Mesh topology. They are Routing, Flooding.

- **Routing** – The nodes have a routing logic to direct the data to reach the designation using the shortest distance.
- **Flooding** – The data is transmitted to all the nodes in the network, hence no routing is required.

Types of Mesh Topology

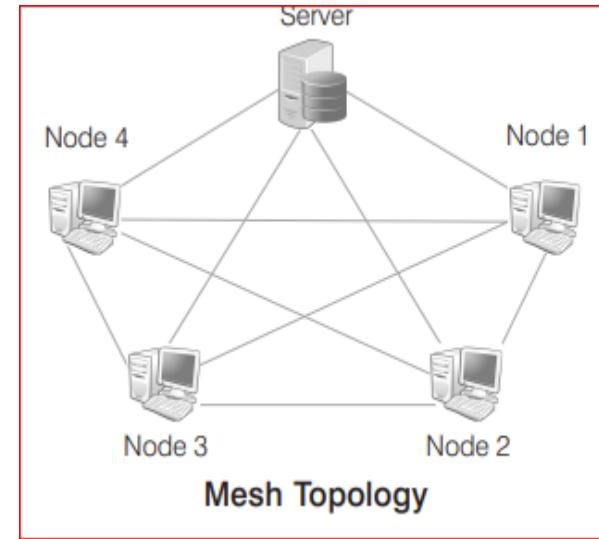
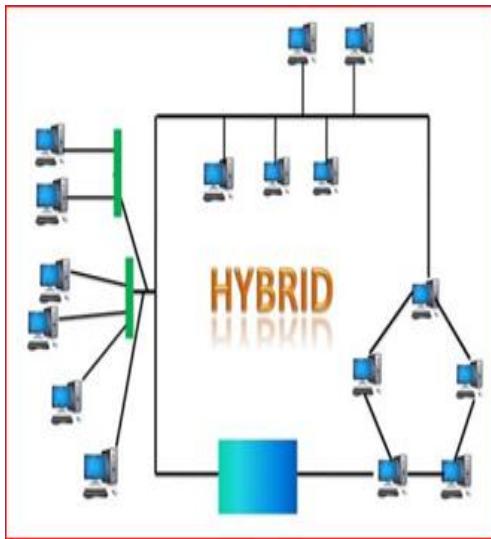
Partial Mesh Topology - In this topology, some of the nodes are connected to all nodes and some nodes are connected only to some nodes.

Full Mesh Topology - Every node is connected to each other.

6. Hybrid Topology:

- The combination of two or more different topologies is known as Hybrid topology.
- A Hybrid topology is a connection between different links and nodes to transfer the data. It is a scalable topology and it can be expanded easily. It is reliable.
- When two or more **different** topologies are combined together is termed as Hybrid topology and if **similar** topologies are connected with each other **will not result in Hybrid topology**.

For example, if there exist a ring topology in one branch of ICICI bank and bus topology in another branch of ICICI bank, connecting these two topologies will result in Hybrid topology.



COMPUTER SECURITY

Computer security is also known as cyber security or IT security. It is a branch of information technology known as information security, which is intended to protect computers.

Computer security, cyber-security or information technology security (IT security) is the protection of computer systems from the theft of or damage to their hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide.

Internet security

It is a branch of computer security specifically related to not only Internet, often involving browser security and the World Wide Web. Its objective is to establish rules and measures to use against attacks over the Internet.

The Internet represents an insecure channel for exchanging information, which leads to a high risk of intrusion or fraud, such as phishing, online viruses, Trojans, worms and more.

Many methods are used to protect the transfer of data, including encryption and from-the-ground-up engineering.

Types of attacks: A cyber-attack is an exploitation of computer systems and networks. It uses malicious code to alter computer code, logic or data and lead to cybercrimes, such as information and identity theft.

Attacks can be classified into the following categories:

Web-based attacks: - attacks which occur on a website or web applications. **Some of the important web-based attacks are as follows-**

> Injection attacks

It is the attack in which some data will be injected into a web application to manipulate the application and fetch the required information. Example- SQL Injection, code Injection; log Injection, XML Injection etc.

> DNS Spoofing

DNS spoofing is a type of computer security hacking. Whereby a data is introduced into a DNS resolver's cache causing the name server to return an incorrect IP address, diverting traffic to the attacker's computer or any other computer. The DNS spoofing attacks can go on for a long period of time without being detected and can cause serious security issues.

> Session Hijacking

It is a security attack on a user session over a protected network. Web applications create cookies to store the state and user sessions. By stealing the cookies, an attacker can have access to all of the user data.

> Phishing

Phishing is a type of attack which attempts to steal sensitive information like user login credentials and credit card number. It occurs when an attacker is masquerading as a trustworthy entity in electronic communication.

> Brute force

It is a type of attack which uses a trial and error method. This attack generates a large number of guesses and validates them to obtain actual data like user password and personal identification number. This attack may be used by criminals to crack encrypted data, or by security, analysts to test an organization's network security.

> Denial of Service

It is an attack which meant to make a server or network resource unavailable to the users. It accomplishes this by flooding the target with traffic or sending it information that triggers a crash. It uses the single system and single internet connection to attack a server.

It can be classified into the following-

- ❖ Volume-based attacks- Its goal is to saturate the bandwidth of the attacked site, and is measured in bit per second.
- ❖ Protocol attacks- It consumes actual server resources, and is measured in a packet.
- ❖ Application layer attacks- Its goal is to crash the web server and is measured in request per second.

> Dictionary attacks This type of attack stored the list of a commonly used password and validated them to get original password.

> URL Interpretation It is a type of attack where we can change the certain parts of a URL, and one can make a web server to deliver web pages for which he is not authorized to browse.

> File Inclusion attacks It is a type of attack that allows an attacker to access unauthorized or essential files which is available on the web server or to execute malicious files on the web server by making use of the include functionality.

> Man in the middle attacks It is a type of attack that allows an attacker to intercepts the connection between client and server and acts as a bridge between them. Due to this, an attacker will be able to read, insert and modify the data in the intercepted connection.

System-based attacks

Computer Hacking

Hacking is an attempt to exploit a computer system or a private network inside a computer. It is the **unauthorized access** to or control over computer network security systems **for some illicit purpose**. Viruses, Key loggers, Root kit, Spoofing attack, Packet Sniffer, Trojan horse and Password cracking are several of techniques for hacking.

These are the attacks which are intended to compromise a computer or a computer network. **Some of the important system-based attacks are as follows**

Computer Virus

It is a computer program or code that can replicate itself and spread from one computer system to another system. A computer virus has the capacity to corrupt or to delete data on your computer and it can utilize an e-mail program to spread the virus to other computer systems. In the worst-case scenario, it can even delete everything on your hard disk. The purpose of it is to disrupt the operation of the computer or the program.

Some examples of Computer Virus are Stealth virus, Disk Killer, Stone virus, Sunday, Cascade, Nuclear, Word Concept, etc.

1. Virus:

A computer virus is a type of malicious software that, when executed, replicates itself by modifying other computer programs and inserting its own code. When this replication succeeds, the affected areas are then said to be "**infected**" with a computer virus.

It is a computer virus is a **malicious software program** loaded onto a user's computer **without the user's knowledge** and performs malicious actions.

Stuxnet, Petya, Wanna cry, Code red, Melissa, Sasser, Zeus, Mydoom, Crypto Locker and Flashback are some example of Viruses.

The Elk Cloner virus was the first self-replicating computer program to spread on a large scale. It was created by a 15-year-old Rich Skrenta in 1982. Ryuk, TroldeSh are ransomware family of newly discovered viruses.

Note The first computer virus, creeper was a self-replicating program written in 1971 by Bob Thomas at VBN Technologies. The first boot sector PC virus named Brain, which was identified in the year 1986.

A virus can be spread by opening an email attachment, clicking on an executable file, visiting an infected website or viewing an infected website advertisement. It can also be spread through infected removable storage devices, such USB drives.

Once a virus has infected the host it has the capacity to corrupt or to delete data on your computer and it can utilize an email program to spread the virus to other computer systems .In the worst case scenario, it can even delete everything on your hard disk .The purpose of it is to disrupt the operation of the computer or the program.

Effects of VIRUS

There are many different effects that viruses can have on your computer, depending on the types of virus. Some viruses can

- (i) monitor what you are doing. (ii) slow down your computer's performance. (iii) destroy all data on your local disk.
- (iv) affect on computer networks. (v) increase or decrease memory size. (vi) display different types of error messages.
- (vii) decrease partition size. (viii) alter PC settings. (ix) display arrays of annoying advertising. (x) extend boot times.
- (xi) create more than one partition.

2. Computer Worm:

A computer worm is a malicious, **self-replicating** software program (malware) which affects the functions of software and hardware programs. **Stuxnet is the most famous computer worm.**

Before widespread use of networks, computer worms were spread through infected storage media, such as floppy diskettes, which, when mounted on a system, would infect other storage devices connected to the victim system. USB drives are still a common vector for computer worms.

Differences between worms and viruses: Computer worms "are self-replicating programs that spread with no human intervention after they are started." In contrast, "viruses are also self-replicating programs, but usually require some action on the part of the user to spread inadvertently to other programs or systems."

Note Payload is a code designed in the form of a worm and for the purpose of expanding on a larger scale than the worm.

3. Malware:

Malware, Short for malicious software is any software used to disrupt computer operation, gather sensitive information, or gain access to private computer systems. It can appear in the form of executable code, scripts, active content, and other software.

Example-Virus, Worm, Trojan Horse, Spyware, Ransomware, Rootkit, Adware,Keylogger etc.

Some primary symptoms of malware attack are as follows

- (i) Odd messages are displaying on the screen. (ii) Some files are missing. (iii) System runs slower. (iv) PC crashes and restarts again and again. (v) Drives are not accessible. (vi) Anti-virus software will not run or installed. (vii) Unexpected sound or music plays. (viii) The mouse pointer changes its graphic. (ix) System receives strange E-mails containing odd attachments or viruses. (x) PC starts performing functions like opening or closing window, running programs on its own.

4. Trojan horse:

It is a **type of malware** that presents itself as legitimate software. It may perform actions on a computer that is genuine but will install malware actions.

Trojan horse or Trojan is any malware which misleads users of its true intent. Trojans are generally spread by **some form of social engineering**, for example where a user is duped into executing an e-mail attachment disguised to appear not suspicious, (e.g., a routine form to be filled in), or by clicking on some fake advertisement on social media or anywhere else.

Trojans may allow an attacker to access users' personal information such as banking information, passwords, or personal identity. It can also delete a user's files or infect other devices connected to the network.

Ransomware attacks are often carried out using a Trojan. After it is activated, it can achieve any number of attacks on the host, from irritating the user (popping up windows or changing desktops) to damaging the host (deleting files, stealing data, or activating and spreading other malware, such as viruses).

Trojans are also known to create backdoors to give malicious users access to the system.

Unlike computer viruses and worms, Trojans generally do not attempt to inject themselves into other files or otherwise propagate themselves. **For example, Beast, Sub7.Zeus, ZeroAccess Rootkit, etc.**

5. Ransom ware:

Ransomware is a type of malware program that infects and takes control of a system. It infects a computer with the intention of extorting money from its owner.

6. Spyware:

Spyware is unwanted software that infiltrates your computing device, stealing your internet usage data and sensitive information. Spyware is classified as a type of malware designed to gain access to or damage your computer, often without your knowledge.

Just like viruses, spyware can be installed when you **open an e-mail attachment containing the malicious software or through cookies**. It can also be installed when you install another program that has a spyware installer attached to it.

Spyware is software that is installed on a computing device without the end user's knowledge. It steals internet usage data and sensitive information such as usernames and passwords, activating the microphone or camera on a computer to record physical activity.

For example, CoolWeb Search, FinFisher, Zango, Zlob Trojan, Keyloggers, etc.

7. Adware:

Adware is unwanted software designed to display advertisements on the computer screen to generate income. This type of ads cannot be removed easily.

Adware, or advertising-supported software, is software that generates revenue for its developer by **automatically generating online advertisements** in the user interface of the software or on a screen presented to the user during the installation process. The software may generate two types of revenue: one is for the display of the advertisement and another on a "pay-per-click" basis, if the user clicks on the advertisement. The software may implement advertisements in a variety of ways, including a static box display, a banner display, full screen, a video, pop-up ad or in some other form.

8. Key logger:

A key logger is a type of malware that **stores all keystrokes of a computer**. It can record all sorts of personal information, such as usernames, passwords, credit card numbers, and personal documents such as emails and reports.

9. Phishing:

Phishing is a cyber-attack that used to steal user data, including login credentials and credit card numbers. They use email as a weapon and trick the email recipient into believing that the message is received from real companies such as banks, Amazon etc to harvest the recipient's details. Email Phishing, Spear Phishing (targets special person/organization) are techniques of Phishing.

Phishing is the fraudulent attempt to obtain **access credentials** such as usernames, passwords and credit card details by disguising oneself as a trustworthy entity in an electronic communication. Typically carried out by email spoofing or instant messaging, it often directs users to enter personal information at a fake website which matches the look and feel of the legitimate site.

10. Spoofing: It is also known as Masquerade.

A Spoofing attack is a situation in which one person or program successfully represents oneself as another by falsifying data and thereby gaining an illegitimate advantage.

Smurfing

It is a type of denial-of-service attack that relies on flooding a network with a large volume of traffic through the manipulation of IP addresses in that network. This type of attack can result in a high volume of excess activity, which can overwhelm a server or IT setup.

11. Pharming:

Pharming is a cyber-attack intended to redirect a website's traffic to another, fake site. Pharming can be conducted either by changing the hosts file on a victim's computer or by exploitation of a vulnerability in DNS server software. DNS servers are computers responsible for resolving Internet names into their real IP addresses. **User of online banking and e-commerce websites are more prone to this attack.**

12. Rootkit

A rootkit is a secret computer program designed to provide continued access to a computer while actively hiding its presence. Rootkits are associated with malware such as Trojans, worms, viruses.

Sources of Cyber Attack

The most potent and vulnerable threat to computer users is **virus attacks**. A computer virus is a small software program that spreads from one computer to another and that interferes with computer operation.

The sources of cyber attack can be as follows

1. Downloadable Programs

Downloadable files are one of the best possible sources of virus. Any type of executable file like games, screen saver is one of the major sources. If you want to download programs from the Internet, then it is necessary to scan every program before downloading them.

2. Cracked Software

These softwares are another source of virus attacks. Such cracked forms of illegal files contain virus and bugs that are difficult to detect as well as to remove. Hence, it is always a preferable option to download software from the appropriate source.

3. E-mail Attachments

These attachments are the most common source of viruses. You must handle E-mail attachments with extreme care, especially if the E-mail comes from an unknown sender.

4. Booting from Unknown CD

When the computer system is not working, it is a good practice to remove the CD. If you do not remove the CD, it may start to boot automatically from the disk which enhances the possibility of virus attacks.

Methods to Provide Protection

There are four primary methods to provide protection

1. System Access Control

It ensures that unauthorized users do not get into the system by encouraging authorised users to be security conscious.

2. Data Access Control

It monitors who can access the data, and for what purpose. The system determines access rules based on the security levels of the people, the files and the other objects in your system.

3. System and Security Administration

It performs offline procedures that make or break secure system.

4. System Design

It takes advantage of basic hardware and software security characteristics.

Components of Computer Security

Computer security is associated with many core areas. Basic components of computer security system are as follows

1. Confidentiality It ensures that data is not accessed by any unauthorised person.

2. Integrity It ensures that information is not altered by any unauthorised person in such a way that it is not detectable by authorised users.

3. Authentication Verification of a login name and password is known as authentication. It ensures that users are the persons they claim to be.

4. Access Control It ensures that users access only those resources that they are allowed to access.

5. Non-Repudiation It ensures that originators of messages cannot deny that they are not sender of the message.

6. Availability It ensures that systems work promptly and service is not denied to authorised users.

7. Privacy It ensures that individual has the right to use the information and allows another to use that information.

8. Stenography It is an art of hiding the existence of a message. It aids confidentiality and integrity of the data.

9. Cryptography It is the science of writing information in a 'hidden' or 'secret' form and in an ancient art. It protects the data during transmission and also the data stored on the disk.

Some terms commonly used in cryptography are as follows

(i) Plain text is the original message that is an input.

(ii) Cipher is a bit-by-bit or character-bycharacter transformation without regard to the meaning of the message.

(iii) Cipher text is the coded message or the encrypted data.

(iv) Encryption is the process of converting plain text to cipher text, using an encryption algorithm. The scrambling of code is known as encryption.

(v) **Decryption** is the reverse of encryption, i.e. converting cipher text to plain text.

IMPORTANT TERMS:

Computer Virus

1. Anti-virus software is a program or set of programs that are designed to prevent, search for, detect, and remove software viruses, and other malicious software like worms, Trojans, and adware.

Antivirus Software is used to scan the hard disk to remove the virus from them.

Some of the famous anti – viruses available are McAfee, K7, Avast, Norton, Avira, Kaspersky, AVG, Symantec, Trend Micro, Quick Heal etc.

2. Firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.

It is a network security system which prevent form unauthorized attach It works on monitoring and filtering.

3. Authorization is the function of specifying access rights to resources related to information security and computer security in general and to access control in particular. More formally, "to authorize" is to define an access policy.

4. Authentication is the act of confirming the truth of an attribute of a single piece of data or entity. It might involve confirming the identity of a person by validating their identity documents, verifying the validity of a website with a digital certificate, tracing the age of an artifact by carbon dating, or ensuring that a product is what its packaging and labeling claim to be. In other words, Authentication often involves verifying the validity of at least one form of identification.

5. Hacker: A person who uses his or her expertise to gain access to other people's computers to get information illegally or do damage is a **Hacker**.

6. Zombie is a computer connected to the Internet that has been compromised by a hacker, computer virus or trojan horse program and can be used to perform malicious tasks of one sort or another under remote direction.

7. Breach is the moment a hacker successfully exploits vulnerability in a computer or device, and gains access to its files and network.

8. Bot/Botnet is a type of software application or script that performs tasks on command, allowing an attacker to take complete control remotely of an affected computer. A collection of these infected computers is known as a "botnet" and is controlled by the hacker or "bot-herder".

It is a set of networks connected computers/devices that are used for malicious purposes. Each computer in a botnet is called Bot. **It is also known as Zombie**.

9. Spam is unwanted emails. In other words we can call them as unsolicited promotional mail.

10. Encryption is the method by which plaintext or any other type of data is converted from a readable form to an encoded version that can only be decoded by another entity if they have access to a decryption key. Encryption is one of the most important methods for providing data security, especially for end-to-end protection of data transmitted across networks.

10. Salami Technique It diverts small amounts of money from a large number of accounts maintained by the system.

11. Cracking It is the act of breaking into computers. It is a popular, growing subject on Internet. Cracking tools are widely distributed on the Internet. They include password crackers, trojans, viruses, war-dialers, etc.

Note Cyber cracker is a person called who uses a computer to cause harm to people or destroy critical systems.

Digital Certificate

It is the attachment to an electronic message used for security purposes. The common use of a digital certificate is to verify that a user sending a message is who he or she claims to be, and to provide the receiver with the means to encode a reply.

Digital Signature

It is an electronic form of a signature that can be used to authenticate the identity of the sender of a message or the signer of a document, and also ensure that the original content of the message or document that has been sent is unchanged.

Password

It is a secret word or a string of characters used for user authentication to prove identity or approval to gain access to a resource. A password is typically somewhere between 4 to 16 characters, depending on how the computer system is setup. When a password is entered, the computer system is careful not to display the characters on the display screen, in case others might see it.

There are two common modes of password as follows

(i) Weak Password Easily remember just like names, birth dates, phone number, etc.

(ii) Strong Password Difficult to break and a combination of alphabets and symbols.

Firewall

It can either be software based or hardware based and is used to help in keeping a network secure.

Its primary objective is to control the incoming and outgoing network traffic by analysing the data packets and determining whether it should be allowed through or not, based on a pre-determined rule set.

A network's firewall builds a bridge between an internal network that is assumed to be secure and trusted, and another network, usually an external (inter) network, such as the Internet, that is not assumed to be secure and trusted.

A firewall also includes or works with a proxy server that makes network requests on behalf of work station users.

File Access Permission

Most current file systems have methods of assigning permissions or access rights to specific user and group of users. These systems control the ability of the users to view or make changes to the contents of the file system.

File access permission refers to privileges that allow a user to read, write or execute a file.

There are three specific file access permissions as follows (i) Read permission (ii) Write permission (iii) Execute permission

Terms Related to Security

1. Eavesdropping The unauthorised real time interception of a private communication such as a phone call, instant message is known as eavesdropping.

2. Masquerading The attacker impersonates an authorised user and thereby gain certain unauthorised privilege.

3. Patches

It is a piece of software designed to fix problems with a computer program or its supporting data. This includes fixing security vulnerabilities and other bugs and improving the usability and performance. Note Vendor created program modifications are called patches.

4. Logic Bomb

It is a piece of code intentionally inserted into a computer's memory that will set off a malicious function when specified conditions are met. They are also called slag code and does not replicate itself.

5. Application Gateway

This applies security mechanisms to specific applications such as File Transfer Protocol (FTP) and Telnet services.

6. Proxy Server

It can act as a firewall by responding to input packets in the manner of an application while blocking other packets. It hides the true network addresses and used to intercept all messages entering and leaving the network.

- The legal right to use software based on specific restrictions is granted via Software License.
- Software Piracy means copying of data or computer software without the owner's permission.

INTERNET

Network is a group of two or more computer systems linked together.

The Internet is a worldwide network of computers that are able to exchange information with each other.

Internet stands for International Network, which began in 1950's by **Vint Cerf known as the Father of Internet.**

Internet is a '**network of networks**' that consists millions of private, public, academic, business, and government networks of local to global scope that are linked by a broad array of electronic, wireless, and optical networking technologies.

The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (**TCP/IP**) to link several billion devices worldwide.

ARPANET((Advanced Research Projects Agency Network)) was the **world's first fully operational packet switching computer network**, developed by the Advanced Research Projects Agency of the U.S. Department of Defense in 1969. It connected with only four computers. ARPANET adopted TCP/IP in 1983 and the "network of networks" became the modern Internet.

In 1969, the University of California at Los Angeles, and the University of Utah were connected for the beginning of the ARPANET using 50 kbits circuits.

In mid 80's another federal agency, the **National Science Foundation**, created a new high capacity network **called NSFnet**, which was more capable than ARPANET. The only drawback of NSFnet was that it **allowed only the academic research** on its network and not any kind of private business on it.

So, private organizations and people started working to build their own networks, which were **later inter-connected with ARPANET and NSFnet to form the Internet.**

The World Wide Web (abbreviated as WWW or W3, commonly known as the Web) **is a system of interlinked hypertext documents** that are accessed via the Internet.

It is a collection of all information, resources, pictures, sounds and multimedia on the internet which is formatted in HTML and accessed through HTTP.

Web Server – A web server stores, processes and delivers web pages to the users. The intercommunication between users and servers is done using Hypertext Transfer Protocol (HTTP).

Web Page – It is a document was written in HTML that can be accessed through the internet by using the web browser. It is identified by Uniform Resource Locator.

A Website is a set of related web pages served from a single web domain.

A Home page, index page, or main page is a page on a website. A home page usually refers to:

- The initial or main web page of a website, sometimes called the "front page" (by analogy with newspapers).
- The first page that appears upon opening a web browser program, which is also sometimes called the start page. This 'start page' can be a website or it can be a page with various browser functions such as the visual display of websites that are often visited in the web browser.
- The web page or local file that automatically loads when a web browser starts or when the browser's "home" button is pressed; this is also **called a "home page"**. The user can specify the URL of the page to be loaded, or alternatively choose e.g. to re-load the most recent web page browsed. **Homepage is the default page of the website.**
- A personal web page, for example at a web hosting service or a university web site that typically is stored in the home directory of the user.

A Hyperlink is a reference to data that the reader can directly follow either by clicking or by hovering or that is followed automatically.

A web browser (commonly referred to as a browser) is a software application that allows users to access the websites for retrieving, presenting and traversing information resources on the World Wide Web. Some of the famous browsers are Apple Safari, Google Chrome, Opera, Mozilla Firefox, Bolt, UC Browser and Internet Explorer, Microsoft Edge.

The Uniform Resource Locator (URL) is a specific character string that constitutes a reference to a resource. In most web browsers, the URL of a web page is displayed on top inside an address bar. **(URL) is used to locate the address of a resource and protocol.**

URL, is an entire set of directions, and it contains extremely detailed information. The domain name is one of the pieces inside of a URL.

(i) An example of a typical URL would be "http://www.bankersadda.com". Here the domain name is 'bankersadda.com'

Downloading means to receive data to a local system from a remote system or to initiate such a data transfer

Uploading refers to the sending of data from a local system to a remote system such as a server or another client with the intent that the remote system should store a copy of the data being transferred.

Internet Host – Host is a computer or application which is used to transfer the data on the internet. Each host has a unique IP address called Hostname.

An Internet Protocol address (also known as an **IP address**) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network. It acts as an identifier for a computer. It is a unique address for every computer.

It is a logical numeric address that is used to identify the host over the internet network.

- ✓ The stable version of IP – IPv4 (32 bits). It is written in decimal and separated by periods.
- ✓ Latest Version of IP – IPv6 (128 bits). It is written in Hexadecimal and separated by colons.

(HTML) – HTML is used to create web pages that are displayed on the Internet.

Hypertext Transfer Protocol (HTTP) - This protocol is used to transfer data over the web. It runs on top of the TCP/IP set of protocols. It uses a server-client model.

Domain names are used to identify one or more IP addresses. A domain name serves as an address which is used to access the website. It can be universally understood by Web servers and online organizations.

Domain Types

| Type | Description |
|------|---|
| .com | Commercial and for profit organization |
| .edu | Educational provider, college, Universities |
| .gov | Government agencies |
| .mil | US military sites |
| .net | Internet infrastructure and service providers |
| .org | Miscellaneous and Non-profit organizations |
| .int | International Treaties |

Domain Name System (DNS) – DNS translates domain names into IP addresses. It has a large database of domain names and its IP addresses.

An email attachment is a computer file sent along with an email message. One or more files can be attached to any email message, and be sent along with it to the recipient.

Hotmail was co-founded by an Indian American entrepreneur Sabeer **Bhatia** along with Jack Smith in July of 1996.

CC (Carbon Copy) It is used to share e-mail with one or more recipients. Both the main recipients and other (CC) recipients can see all the mail addresses. CC in e – mail indicates those who are to receive a copy of a message addressed primarily to another.

The list of CC recipients is visible to all other recipients of the message.

An additional BCC (blind carbon copy) field is available for hidden notification; recipients listed in the BCC field receive a copy of the message, but are not shown on any other recipient's copy (including other BCC recipients). In this, the recipients of the message and other recipients (BCC) cannot see the persons who all receive the e-mail.

The Drafts folder retains copies of messages that you have started but are not yet ready to send.

The first email was sent by Ray Tomlinson to himself in 1971.

Internet Explorer was deprecated in Windows 10, with Microsoft Edge replacing it as the default web browser.

Intranet is a private network for Internet tools, but available within an organization. In large organization, Intranet allows an easy access to corporate information for employees.

Extranet is a private network that uses the Internet protocol and the public tele-communication system to securely share part of business information.

Podcast is a form of audio broadcasting on the web. It can be listened to on the go, while commuting to office or even while working.

Internet Connections

Bandwidth and cost are the two factors that help you in deciding which Internet connection is to use.

The speed of Internet access depends on the bandwidth.

Some of the Internet connections available for Internet access are as follows:-

Dial-Up Connection

Dial-up is a method of connecting to the Internet using an existing telephone.

When a user initiates a dial-up connection, the modem dials a phone number of an Internet Service Provider (ISP) that is designated to receive dial-up calls. The ISP then establishes the connection, which usually takes about **ten seconds** and is accompanied by several beeping and buzzing sounds. **Its transfer speed is 56 kbit/s.**

Broadband Connection The term 'broadband' commonly refers to high speed Internet access that is **always on and faster than the traditional dial-up access**. It uses a telephone line to connect to the Internet. The transfer speed is **256 Kbit/s.**

Broadband includes several high speed transmission technologies such as

1. Digital Subscriber Line (DSL) It is a popular broadband connection. It provides Internet access by transmitting digital data over the wires of a local telephone network. DSL is the most common type of broadband service. It uses the existing copper telephone lines. Its transfer speed is 256 kbits.

2. Cable Modem This service enables cable operators to provide broadband using the same co-axial cables that deliver pictures and sound to your TV set.

Most cable modems are external devices that have two connections, one to the cable wall outlet and the other to a computer. They provide transmission speed of 1.5 Mbps or more.

3. Broadband over Power Line (BPL) BPL is the delivery of broadband over the existing low and medium voltage electric power distribution network. Its transfer speed is upto 3 Mbps.

BPL is good for areas, where there are no other broadband connections, but power infrastructure exists. For example,rural areas

Wireless Connection

Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed. Unlike DSL and cable, wireless broadband requires neither modem nor cables. It can be easily established in areas where it is not feasible to deploy DSL or cable.

Some ways to connect the Internet wirelessly are as follows

1. Wireless Fidelity (Wi-Fi) It is a universal wireless networking technology that utilises radio frequencies to transfer data. Wi-Fi allows high speed Internet connections without the use of cables or wires. Wi-Fi networks can be used for public Internet access at 'hotspot' such as restaurants, coffee shops, hotels, airports, convention centers and city parks.

2. Worldwide Interoperability for Microwave Access (WiMAX) WiMAX systems are expected to deliver broadband access services to residential and enterprise customers in an economical way. It has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure.

3. Mobile Wireless Broadband Services These services are also becoming available from mobile telephone service providers and others. These services are generally appropriate for mobile customers and require a special PC card with a built-in antenna that plugs into a user's computer. Generally, they provide lower speeds in the range of several hundred kbps.

Interconnecting Protocols

A protocol is a set of rules that govern data communications. It defines what is communicated, how it is communicated and when it is communicated.

Some of the protocols generally used to communicate via Internet are as follows

1. Transmission Control Protocol/Internet Protocol (TCP/IP)

(a) Transmission Control Protocol (TCP) It provides reliable transport service, i.e. it ensures that message sent (from sender to receiver) is properly routed. TCP converts messages into a set of packets at the source which are then reassembled back into messages at the destination.

(b) Internet Protocol (IP) It allows different computers to communicate by creating a network of networks. IP handles the dispatch of packets over the network. It maintains the addressing of packets with multiple standards. Each IP packet must contain the source and the destination addresses.

Note:- An IP address is a 32 bit number.

2. File Transfer Protocol (FTP)

It can transfer files between any computers that have an Internet connection and also works between computers using totally different operating systems. Some examples of FTP software are FileZilla, Kasablanca, gFTP, Konqueror, etc.

3. HyperText Transfer Protocol (HTTP) HTTP defines how messages are formatted and transmitted and what actions should be taken by the Web servers and browsers in response to various commands.

Hyper Text Markup Language (HTML) It is used for designing Web pages. A markup language is a set of markup (angular bracket, <>) tags which tells the Web browser how to display the Web page's words and images for the user. Each individual markup code is referred to as an element or tag.

4. Telnet Protocol Telnet is a program that runs on the computer and connects PC to a server on the network. Telnet session starts by entering valid username and password.

5. Usenet Protocol The usenet service allows a group of Internet users to exchange their views/ideas and information on some common topic that is of interest to all the members belonging to that group. Several such groups exist on the Internet are called newsgroups. Usenet has no central server or administration.

6. Point-to-Point Protocol (PPP) It is a dial account which puts your computer directly on the Internet. A modem is required for such connection which transmits the data at 9600 bits per second.

7. Simple Mail Transfer Protocol (SMTP) It is the standard protocol for E-mail services on a TCP/IP network. It provides the ability to send and receive E-mail messages.

8. Wireless Application Protocol (WAP) A WAP browser is a commonly used Web browser for small mobile devices such as cell phones.

9. Voice over Internet Protocol (VoIP) It allows delivery of voice communication over 'IP' networks. For example, IP calls.

10. Post Office Protocol version 3 (POP3) It is an Internet standard protocol used by local email software clients to retrieve emails from a remote mail server over a TCP/IP connection.

Terms Related to Internet World Wide Web (WWW)

The world wide web is a system of Internet servers that supports hypertext and multimedia to access several Internet protocols on a single interface. WWW was introduced on 13th March, 1989. The world wide web is often abbreviated as the Web or WWW. The world wide web is a way of exchanging information between computers on the Internet.

Web Page The backbone of the world wide web is made of files, called pages or Web pages, containing information and links to resources - both text and multimedia - throughout the Internet. It is created using HTML. There are basically two main types of web page i.e., static and dynamic. The main or first page of a Website is known as home page.

Note:- Bookmarks are links to web pages that make it easy to get back to your favourite page.

Hyperlink is a piece of text which connects different documents on a web page. It is a reference data that the user can follow by simply clicking on it.

Website

A group of Web pages that follow the same theme and are connected together with hyperlinks is called Website.

In other words, "A Website is a collection of digital documents, primarily HTML files, that are linked together and that exist on the Web under the same domain."

For example, <http://www.carwale.com> is a Website while <http://www.carwale.com/new/> is a Web page.

Web Browser It is a software application that is used to locate, retrieve and display content on the world wide web, including Web pages. Web browsers are programs used to explore the Internet.

We can install more than one Web browser on a single computer. The user can navigate through files, folders and websites with the help of a browser.

Note F11 key on a windows keyboard sets to full screen mode in most browsers.

The two types of Web browser are as follow

1. Text Web Browser A Web browser that displays only text-based information is known as text web browser. For example, Lynx, which provides access to the Internet in the text mode only.

2. Graphical Web Browser A Web browser that supports both text and graphic information is known as graphical web browser. For example, Internet Explorer, Firefox, Netscape, Safari, Google Chrome and Opera.

Note The first graphical web browser was NCSA Mosaic.

Web Server A web server is a computer that runs websites. The server computer will deliver those Web pages to the computers that request them and may also do other processing with the Web pages. The web browser is a client that requests HTML files from Web servers. Every Web server that is connected to the Internet is given a unique address, i.e. IP address, made up of a series of four numbers between 0 to 255 separated by periods (.). For example, Apache HTTP Server, Internet Information Services (IIS), Lighttpd, etc.

Note Cookie is a small message given to a web browser by a web server. It stores information about the user's web activity

Web Address and URL

A Web address identifies the location of a specific Web page on the Internet, such as <http://www.learnyoga.com>. On the Web, Web addresses are called URLs. It stands for Uniform Resource Locator.

Tim Berners Lee created the first URL in 1991 to allow the publishing of hyperlinks on the world wide web. For example, "<http://www.google.com/services/index.htm>"

http:// — Protocol identifier www — World Wide Web google.com — Domain name /services/ — Directory
index.htm — Web page

Domain Name

Domain is a group of network resources assigned to a group of users. A domain name is a way to identify and locate computers connected to the Internet. A domain name must be unique. It always have two or more parts, separated by period/dot (.). For example, google.com, yahoo.com, etc.

Domain Abbreviation

Domains are organised by the type of organisations and the country. A three-letter abbreviation indicating the organisation and usually two-letter abbreviation indicates the country name.

Domain Name System (DNS) DNS stores and associates many types of information with domain names, but most importantly, it translates domain names (computers host names) to IP addresses. It also lists mail exchange servers accepting E-mail for each domain. DNS is an essential component of contemporary Internet use.

Blog

A blog is a Website or Web page in which an individual records opinions and links to other site on regular basis. A typical blog combines text, images, and links to other blogs, web pages and media related to its topic. Most blogs are primarily textual, although some focus on art, photographs, videos, music and audio. These blogs are referred to as edublogs. The entries of a blog is also known as posts.

Newsgroup

A newsgroup is an online discussion forum accessible through usenet, devoted to discussion on a specified topic. Online discussion group allows interaction through electronic bulletin board system and chat sessions.

Search Engine

It is a Website that provides the required data on specific topics. Search engines turn the Web into a powerful tool for finding information on any topic. When a search engine returns the links to web pages corresponding to the keywords entered is called a hit, otherwise called a miss.

Many search engines also have directories or lists of topics that are organised into categories. Browsing these directories, is also a very efficient way to find information on a given topic.

Note Project Loon is a search engine project by Google for providing internet access to rural and remote areas using high altitude helium filled balloons.

Services of Internet:-

Chatting:- For example, Skype, Yahoo, Messenger, etc.

E-Mail (Electronic Mail):-

Video-Conferencing

E-Learning

E-Banking (Electronic Banking) is also known as **Internet Banking** or **Online Banking**.

E-Shopping: Naaptol, Flipkart, Yebbi, Homeshop 18, etc.

E-Reservation:- book/reserve railways and airways tickets, hotel rooms, tourist packages, etc.

Social Networking

Facebook, MySpace, Orkut, etc.

LinkedIn is an American site which provides business and employment oriented services. It was founded by Reid Hoffman in 2002.

Facebook is an American social networking site which was founded in 2004 by Mark Zuckerberg.

Twitter is an American company which provides social networking services. Besides this, Twitter also provides online news.

- Cluster is a group of servers that share work and may be able to back each other up if one server fails.
- With the Webmail Interface, E-mails are accessible from anywhere in the world.
- Rich Text Formatting helps the sender (of E-mail) format the contents of his/her E-mail message by applying font, size, bold, italic, etc.

Video-Conferencing Apps

OVERVIEW OF FUTURE TECHNOLOGY

'Future Technology' is a term generally used to describe a new technology, but it may also refer to the continuing development of an existing technology. It can have slightly different meaning when used in different areas, such as media, business, science or education.

This term commonly refers to technologies that are currently developing or that are expected to be available within the next 4 to 5 years. It is usually reserved for technologies that are creating, or expected to create, significant social or economic effects.

Introduction to Internet of Things (IoT)

IoT is a network in which all physical objects are connected to the Internet through network devices and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure.

The goal of IoT is to extend Internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.

Components of IoT

1. Sensors

Sensors or devices are key components that help you to collect real time data from the surrounding environment. All this data may have various levels of complexities. It could be a simple temperature monitoring sensor or it may be in the form of the video feed.

2. Connectivity

All the collected data is sent to a cloud infrastructure. The sensors should be connected to the cloud using various media of communication. These communication media include Mobile or Satellite networks, Bluetooth, Wi-Fi, WAN, etc.

3. Data Processing

Once the data is collected and it gets to the cloud, the software performs processing on the gathered data. This process can be just checking the temperature, reading on devices like AC or heaters. However, it can sometimes also be very complex like identifying objects using computer vision on video.

4. User Interface

The information made available to the end user in some ways, that can achieve by triggering alarms on their phones or notifying through text or E-mails. Also, a user sometimes might also have an interface through which he/she can actively check in on their IoT system.

Advantages of IoT

- 1. Technical Optimisation** IoT technology helps a lot in improving technologies and making them better.
- 2. Reduce Waste** IoT offers real time information leading to effective decision-making and management of resources.
- 3. Improved Customer Engagement** IoT allows you to improve customer experience by detecting problems and improving the process.
- 4. Improved Data Collection** Traditional data collection has its limitations and it's designed for passive use. With the help of IoT, limitation of data collection has reduced.

Disadvantages of IoT

- 1. Security** As the IoT systems are inter-connected and communicate over networks, the system offer little control despite any security measures. It can reduce the various kinds of network attacks.
- 2. Privacy** Even without the active participation of user, IoT system provides substantial personal data in maximum detail.
- 3. Complexity** The designing, developing, maintaining and enabling the large technology to IoT system is quite complicated.

Big Data Analytics

It is the process of collecting, organising and analysing large sets of data to discover patterns and other useful information. Big data analytics can help organisations to better understand the information contained within the data and well also help to identify the data that is most important to the business and future business decisions.

Characteristics of Big Data Analytics

- 1. Variety** Variety of big data analytics refers to structured, unstructured and semi-structured data, i.e. gathered from multiple sources. While in the past, data could only be collected from spreadsheets and databases, today data comes in an array of forms such as E-mails, PDFs, Photos, etc.
- 2. Velocity** It essentially refers to the speed at which data is being created in real time. In a broader prospect, it comprises the rate of change and linking of incoming data sets at varying speeds.
- 3. Volume** Big data indicates huge volumes of data that is being generated on a daily basis from various sources like social media platforms, business processes, machines, networks, etc.

Applications of Big Data Analytics

- 1. Government** When government agencies are harnessing and applying analytics to their big data, they have improvised a lot in terms of managing utilities, running agencies, dealing with traffic congestion or preventing the crimes.
- 2. Healthcare** Big data analytics had already started to create a huge difference in the healthcare sector. With the help of predictive analytics, medical professionals can now able to provide personalised healthcare services to individual patient.
- 3. Banking** The banking sector relies on big data for fraud detection. Bit data tools can efficiently detect fraudulent acts in real time such as misuse of credit/debit cards, etc.
- 4. Manufacturing** Using big data analytics, manufacturing industry can improve product quality and output by minimising waste.

Virtual Reality

It is a computer interface which tries to mimic real world beyond the flat monitor to give an immersive 3D visual experiences.

It is an artificial environment that is created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment.

On a computer, virtual reality is primarily experienced through two of the five senses, i.e. sight and sound.

Virtual Reality (VR) technology is applied to advance fields of machine, engineering, education, design, training and entertainment.

Applications of Virtual Reality

1. In Gaming Virtual technology's devices are used for virtual gaming experiences. Along with this, devices such as Wi-Fi Remote, Playstation Move/Eye, Kinect are based on virtual reality which track and send input of the players to the game.

2. In Healthcare

Healthcare is one of the applications where virtual reality could have the most significant impact. Healthcare professional can now use virtual models to prepare them for working on a real body.

3. In Education

Virtual reality has been adopted in education too. It improves teaching and learning process. With virtual reality, a large group of students can interact with one another within a three dimensional environment.

4. In Entertainment

Virtual reality is being used in the entertainment industry to boost experiences with 3D films and increase emotional connection with them and/or the characters.

5. In Business

Virtual reality has also been adopted in business. It is now being used for virtual tours of a business environment, training of new employees and this also gives new employees a 360° view of every product.

Artificial Intelligence (AI)

AI is an area of computer science that emphasises the creation of intelligent machines that work and react like humans. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. Knowledge engineering is a core part of AI research.

Machines can often act and react like humans only if they have abundant information relating to the world. Artificial intelligence must have access to objects, categories, properties and relations between all of them to implement knowledge engineering.

Types of Artificial Intelligence

1. Weak AI It embodies a system designed to carry out one particular job. Weak AI systems include video games such as chess and personal assistants such as Amazon's Alexa.

2. Strong AI These are the systems that carry on the tasks considered to be human-like. These tend to be more complex and complicated systems. These kinds of systems can be found in applications like self-driving cars or in hospital operating rooms.

Applications of Artificial Intelligence

1. In Business Robotic process automation is being applied to highly repetitive tasks normally performed by humans.

2. In Gaming Over the past few years, AI has become an integral part of the gaming industry. Infact, one of the biggest accomplishments of AI is in the gaming industry.

3. In Healthcare Companies are applying machine learning to make better and faster diagnoses than humans. One of the best known technologies is IBM's Watson. It understands natural language and can respond to questions asked from it.

4. In Banking A lot of banks have already adopted AI based systems to provide customer support, detect anomalies and credit card frauds. AI solutions can be used to enhance security across a number of business sectors, including retail and finance.

5. In Autonomous Vehicles Just like humans, self-driving cars need to have sensors to understand the world around them and a brain to collect, process and choose specific actions based on information gathered.

Blockchain Technology

The blockchain is an encrypted, distributed database that records data. It is a digital ledger of any transactions, contracts that need to be independently recorded.

In financial sector, with blockchain technology the participants can interact directly and can make transactions across the internet without the interference of a third party.

With all the fraud resistant features, the blockchain technology holds the potential to revolutionise various business sectors and make processes smarter, secure, transparent and more efficient compared to the traditional business processes.

Advantages of Blockchain Technology

1. It allows smart devices to speak to each other better and faster.
2. It allows the removal of intermediaries that are involved in record keeping and transfer of assets.
3. It provides durability, reliability and longevity with decentralised network.
4. The data that is entered in blockchain based systems is immutable which prevents against fraud through manipulating transactions and the history of data.
5. It brings everyone to the highest degree of accountability.

Challenges of Blockchain Technology

1. To verify all the transactions, huge power, i.e. electricity is required.
2. Blocks in a chain must be verified by the distributed network and it can take time. So, transaction speed can be an issue.

3D Printing / Additive Manufacturing

3D printing is a manufacturing process where a 3D printer creates three dimensional objects by depositing materials layer by layer in accordance to the object's 3D digital model.

It uses data Computer Aided Design (CAD) software or 3D object scanners to direct hardware to deposit material, layer upon layer, in precise geometric shapes. As its name implies, additive manufacturing adds material to create an object.

How does 3D Printing Work? Here are the steps taken in creating a 3D object

1. Produce a 3D model using CAD or equivalent 3D design software.
2. Convert the drawing to the STL (Standard Tessellation Language) file format, which is a format developed for 3D printers.
3. Transfer the STL file to the computer that controls the 3D printer. From there, you can specify the size and orientation for printing.
4. It prepares for a new print job based on the requirement of the 3D printer. This may include refilling whichever additive you are using to make your object.
5. Begin the building process. Since, each layer is usually about 0-1 mm thick, this can be taken anywhere from hours to days to complete depending on the object's size.
6. Remove the object from the printer and avoid any contact with toxins or hot surfaces.

7. Performs any post processing needed, which may involve brushing off residue or washing the object.

8. Use your new printed object.

Examples of 3D Printing

Architectural scale model and maquettes.

Eyewear.

Dental Products.

Design (lamps, furniture, etc).

Reconstructing bones and body parts in forensic pathology.

Reconstructing heavily damaged evidence retrieved from a crime scene.

Robotics Process Automation (RPA)

RPA is the use of specialised computer programs, known as software robots, to automate and standardise repeatable business processes. Robotic process automation does not involve any form of physical robots.

Software robots mimic human activities by interacting with applications in the same way that a person does. Robot process automation enables business professionals to easily configure software robots to automate repetitive, routine work between multiple systems, filling in automation gaps to improve business processes.

Applications of RPA

1. Customer Service RPA can help companies offer better customer service by automating contact center tasks, including verifying E-signatures, uploading scanned documents and verifying information for automatic approvals or rejections.

2. Healthcare Medical organisation can use RPA for handling patient records, claims, customer support, account management, billing, reporting and analytics.

3. Supply Chain Management RPA can be used for procurement, automating order processing and payments, monitoring inventory levels and tracking shipments.

4. Financial Services Companies in the financial services industry can use RPA for foreign exchange payments, automating account opening and closing, managing audit requests and processing insurance claims.

5. Accounting Organisations can use RPA for general accounting, operational accounting, transactional reporting and budgeting.

Fifth Generation (5G)

5G standard is for broadband cellular networks, which cellular phone companies began deploying worldwide in 2019. It is designed to improve network connections by addressing the legacy issues of speed, latency and utility, which the earlier generations and the current generation of mobile networks could not address.

5G is promised to deliver data speed at a rate 100 times faster than 4G networks. Globally, 5G network deployment is rapidly moving from trials to early commercialisation. In India, network operators like Airtel, Vodafone, Idea, Reliance, Jio, etc., have already partnered with vendors like Ericsson, Huawei and Samsung for planned trials sometime by the end of year 2020, before the service's forecast commercial rollout in 2020.

Advantages of 5G

1. Greater Speed in Transmission Speed in transmissions can approach 15 or 20 Gbps. By being able to enjoy a higher speed, we can access files, programs and remote applications in direct without waiting.

2. Lower Latency Latency is the time that elapses since we give an order on our device until the action occurs. In 5G, the latency will be ten times less than in 4G, being able to perform remote actions in real time.

3. Greater Number of Connected Devices With 5G, the number of devices that can be connected to the network increases greatly, it will go to millionaire scale per square kilometer.

All connected devices will have access to instant connections to the internet, which in real time will exchange information with each other.

4. New Technology Options As speed of network has improved, more and more tasks are being transitioned to the world of smart devices from the world of computers. With the rising network speeds, this could open new doors for smart devices that may not have been available.

Disadvantages of 5G

1. Obstruction can Impact Connectivity The range of 5G connectivity is not great as the frequency waves are only able to travel a short distance. Added to this setback is the fact that 5G frequency is interrupted by physical obstructions such as trees, towers, walls and buildings. The obstructions will either block, disrupt or absorb the high frequency signals. To counter this setback, the telecom industry is extending cell towers to increase the broadcast distance.

2. Limitation of Rural Access While 5G might bring about real connectivity for the predominantly urban areas, those living in the rural area, they will not necessarily benefit from the connection.

3. Battery Drain on Devices When it comes to cellular devices connected to 5G, it seems the batteries are not able to operate for a significant period of time. The battery technology needs to advance to allow for this enhanced connectivity, where a single charge will power a cellphone for a full day. Alongside depleted batteries, users are reporting that cellphones are getting increasing hot when operating on 5G.

Fathers and Inventors of Computer Field

| Invention | Inventors |
|---|--|
| The Analytical Engine | Charles Babbage |
| The Turing Machine | Alan Turing |
| Microprocessor | Faggin, Hoff&Mazor |
| Floppy Disk | Alan Shugart |
| Computer Mouse | Douglas Engelhard |
| Key board | Herman Hollerith |
| Transistor | John Bardeen, Walter Brattain & William Shockley |
| RAM | An Wang and Jay Forrester |
| Trackball | Tom Cranston and Fred Longstaff |
| Integrated Circuit | Jack Kilby & Robert Noyce |
| Laser printer | Gary Stark weather |
| Scanner | Rudolph Hell |
| CD-ROM | James Russell |
| C programming language | Dennis Ritchie |
| C++ programming language | Bjarne Stroustrup |
| PASCAL programming language | Niklaus Wirth |
| Java programming language | James Gosling |
| Perl programming language | Larry Wall |
| Python programming language | Guido van Rossum |
| The Z Series Computers | Konrad Zuse |
| First fully electronic digital computer | John Vincent Atanasoff & Clifford Berry |
| ABC computer | |

SHORTCUT KEYS

KEYBOARD SHORTCUTS:

| Shortcut keys | Description |
|---------------|--|
| Alt + F | File menu options in current program |
| Alt + E | Edit options in current program |
| Ctrl+A | Select all text |
| Ctrl+F | Find |
| Ctrl+X | Cut selected item |
| Shift+ Del | Delete permanently |
| Ctrl+C | Copy selected item |
| Ctrl+Insert | Copy selected item |
| Ctrl+V | Paste |
| Shift+ Insert | Paste |
| Home | Go to beginning of current line |
| Ctrl+Home | Go to beginning of document |
| End | Go to end of current line |
| Ctrl+End | Go to end of document |
| Shift+ Home | Highlight from current position to beginning of line |
| Shift+ End | Highlight from current position to end of line |
| Ctrl+<-- | Move one word to the left at a time |
| Ctrl+--> | Move one word to the right at a time |

| MS-Windows Shortcut Keys | | Keys | Description |
|--------------------------|--|--------------------|--|
| Keys | Description | | |
| Delete | Delete characters to the right of cursor | Ctrl + Right Arrow | Move the insertion point to the beginning of the next word |
| Backspace | Delete characters to the left of the cursor | Ctrl + Left Arrow | Move the insertion point to the beginning of the previous word |
| Ctrl + A | Select all | Ctrl + Alt + Del | Restart the computer |
| F3 | Search for a file or folder | Ctrl + Esc | Display the Start menu |
| Alt + Enter | View properties for the selected item | F5 | Refresh the active window |
| Alt + F4 | Close the active item or quit the active program | Esc | Cancel the current task |
| Alt + Spacebar | Opens the shortcut menu for the active window | Window | To display or hide the Start menu |
| F2 | Rename selected item | Window + D | To display the desktop |
| | | Window + L | To lock the keyboard |

MICROSOFT WORD

| Shortcut | Description | Shortcut | Description |
|--------------------|---|------------------|---|
| Ctrl+0 | Toggles 6pts of spacing before a paragraph. | Shift + F3 | Change the case of letters |
| Ctrl+A | Select all contents of the page. | Shift + F4 | Repeat a find |
| Ctrl+B | Bold highlighted selection. | Shift+F7 | Thesaurus |
| Ctrl+C | Copy selected text. | Shift + F10 | Display a shortcut menu |
| Ctrl+D | Open the font preferences window. | Shift+F12 | Save the open document. Like Ctrl+S. |
| Ctrl+E | Aligns the line or selected text to the center of the screen. | Shift+Enter | Create a soft break instead of a new paragraph. |
| Ctrl+F or G or H | Open find box . Find and Replace Go To | Shift+Insert | Paste. |
| Ctrl+I | Italic highlighted selection. | Shift+Alt+D | Insert the current date. |
| Ctrl+J | Aligns the selected text or line to justify the screen. | Shift+Alt+T | Insert the current time. |
| Ctrl+K | Insert a hyperlink . | Ctrl+F1 | Open the task panel |
| Ctrl+L | Aligns the line or selected text to the left of the screen. | Ctrl + F2 | Choose Print Preview |
| Ctrl+M | Indent the paragraph. | Ctrl + F4 | Close the window |
| Ctrl+N | Opens new, blank document window. | Ctrl + F10 | Maximize the document window |
| Ctrl+O | Opens the dialog box or page for selecting a file to open. | Ctrl + F12 | Choose the open button |
| Ctrl+P | Open the print window. | Ctrl+Shift+> | Increase selected font+1ptsupto 12pt and then increase font +2pts. |
| Ctrl+R | Aligns the line or selected text to the right of the screen. | Ctrl+Shift+< | Decrease selected font -1ptsif 12pt or lower; if above12,decreases font by +2pt.. |
| Ctrl+S | Save the open document.LikeShift+F12. | Ctrl+Shift+L | Quickly create a bullet point. |
| Ctrl+T | Create a hanging indent. | Ctrl+Shift+F | Change the font. |
| Ctrl+U | Underline the selected text. | Ctrl + Shift + S | Applies a style or records a style. |
| Ctrl+V | Paste . | Ctrl+Alt+1 | Changes text to heading 1. |
| Ctrl+W | Close the currently open document | Ctrl+Alt+2 | Changes text to heading 2 |
| Ctrl+X | Cut selected text. | Ctrl+Alt+3 | Changes text to heading 3. |
| Ctrl+Y | Redo the last action performed. | Alt + F4 | Exit |
| Ctrl+Z | Undo last action. | Alt + F5 | Restore the program |
| Ctrl+Del | Deletes word to right of cursor. | Alt + F7 | window Find the next misspelling |
| Ctrl+Backspace | Deletes word to left of cursor. | Alt + F10 | Maximize the program window |
| Ctrl+End | Moves the cursor to the end of the document. | Alt + H | Home Tab |
| Ctrl+Home | Moves the cursor to the beginning of the document. | Alt + N | Insert Tab |
| Ctrl+Spacebar | Reset highlighted text to the default font. | Alt + G | Design Tab |
| Ctrl+left arrow | Moves one word to the left | Alt + F | File Page |
| Ctrl+<right arrow> | Moves one word to the right | Alt + M | Mailings Tab |
| Ctrl+<up arrow> | Moves to the beginning of the line or paragraph. | Alt + P | Layout Tab |
| Ctrl+<down arrow> | Moves to the end of the paragraph. | Alt + R | Review Tab |
| Ctrl+1 | Single-space lines. | Alt + W | View Tab |
| Ctrl+2 | Double-space lines. | Alt + S | Reference Tab |
| Ctrl+5. | 1.5-line spacing | Alt + Q | Tell me box |
| | | | |
| | | | |

MOCROSOFT EXCEL

| Shortcut | Description | Shortcut | Description |
|-----------------|---|---------------------|---|
| Tab | Move to the next cell, to the right of the currently selected cell. | Ctrl+0 | Hides columns. , |
| Ctrl+A | Select all contents of a work sheet. | Ctrl+Shift+Tab | Activates the previous workbook. |
| Ctrl+B | Bold all cells in the highlighted section. | Ctrl+Shift+A | Inserts argument names into a formula. |
| Ctrl+C | Copy all cells in the highlighted section. | Ctrl+Shift+F | Opens the drop-down menu for fonts. |
| Ctrl+D | Fill down. Fills the cell beneath with the contents of selected cell. | Ctrl+Shift+O | Selects all of the cells that contain comments. |
| Ctrl+F | Search current sheet. | Ctrl+Shift+P | Opens the drop-down menu for point size. |
| Ctrl+G | Go to a certain area. | Alt + F1 | Create Pivot Chart |
| Ctrl+H | Find and replace. | F2 | Edit active cell |
| Ctrl+I | Puts italics on all cells in the highlighted section. | F4 | Create an absolute |
| Ctrl+K | Inserts a hyperlink. | F5 | Go to Dialog box |
| Ctrl+N | Creates a new workbook. | F9 | Calculate worksheets |
| Ctrl+O | Opens a workbook. | Shift + Tab | Left One Cell |
| Ctrl+P | Print the current sheet. | Ctrl + Home | To first Cell |
| Ctrl+R | Fills the cell to the right with the contents of the selected cell. | Ctrl + End | To Last Cell |
| Ctrl+S | Saves the open work sheet. | Shift + Spacebar | Select entire row |
| Ctrl+U | Underlines all cells in the highlighted section. | Ctrl + Spacebar | Select entire column |
| Ctrl+V | Pastes everything copied on to the clipboard. | Arrow Keys | Move between Cells |
| Ctrl+W | Closes the current work book. | Alt + Spacebar | Display control Menu |
| Ctrl+X | Cuts all cells in the highlighted section. | Shift + F11 | Insert new worksheet |
| Ctrl+Y | Repeats the last entry. | Shift + F9 | Calculate the active worksheet |
| Ctrl+Z | Undo the last action. | Ctrl + Shift + U | Expand/Collapse formula bar |
| Ctrl+1 | Changes the format of the selected cells. | Ctrl + Shift + % | Apply the% format without decimal |
| Ctrl+2 | Bolds all cells in the highlighted section. | Ctrl + Shift + \$ | Apply the currency format with two decimals |
| Ctrl+3 | Puts italics all cells in the highlighted section. | Alt + Enter | Start a new line in the same cell |
| Ctrl+4 | Underlines all cells in highlighted section. | Ctrl + Shift + Home | Extend the selection of the cells |
| Ctrl+5 | Puts a strikethrough all cells in the highlighted section. | Shift+Insert | Pastes what is stored on the clipboard. |
| Ctrl+6 | Shows or hides objects. | Shift+PageUp | In a single column, highlights all cells above that are selected. |
| Ctrl+7 | Shows or hides the toolbar. | Shift+PageDown | In a single column, highlights all cells above that are selected. |
| Ctrl+8 | Toggles the outline symbols. | Shift+Home | Highlights all text to the left of the cursor. |
| Ctrl+9 | Hides rows. | Shift+End | Highlights all text to the right cursor. |

| | | | |
|---------------------|--|-------------------|---|
| Ctrl+Enter | Fills the selected cells with the current entry. | Shift+UpArrow | Extends the highlighted area up one cell. |
| Ctrl+Tab | Move between Two or more open Excel files. | Shift+DownArrow | Extends the highlighted area down one cell. |
| Ctrl+Shift+Spacebar | Selects the entire worksheet. | Shift+LeftArrow | Extends the highlighted area left one character. |
| Alt+Tab | Cycles through applications. | Shift+Right Arrow | Extends the highlighted area right one character. |
| Alt+Spacebar | Opens the system menu. | Alt+F1 | Inserts a chart. |
| Alt+Backspace | Undo. | Alt+F2 | Save As option. |
| Ctrl+Shift+F3 | Creates names by using those of either row or column labels. | Alt+F4 | Exits Excel. |
| Ctrl+Shift+F6 | Moves to the previous work sheet window. | Alt+F8 | Opens the macro dialog box. |
| Ctrl+Shift+F12 | Prints the current work sheet. | Alt+F11 | Opens the Visual Basic editor. |
| Alt+= | Creates a formula to sum all of the above cells. | Alt+Shift+F1 | Creates a new worksheet. |
| F2 | Edit the selected cell. | Alt+Shift+F2 | Saves the current worksheet. |
| F7 | Checks the spellings. | Ctrl + Tab | Move between two or more open Excel files. |
| F11 | Create chart. | Ctrl + Space | Select entire column. |
| Ctrl + Shift + ; | Enter the current time | Shift + Space | Shift + Space Select entire row. |
| Ctrl + ; | Enter the current date. | Ctrl + Shift + ! | Format number in comma format. |

MICROSOFT POWERPOINT

| Shortcut | Description | Shortcut | Description |
|------------------|---------------------------------|-----------------|--------------------|
| Alt + W | View Tab | Alt+N, P | Insert a picture |
| Alt + G | Design Tab | Alt + H | Home Tab |
| Alt + R | Review Tab | Alt + N | Insert tab |
| Alt + Q | Search | Alt + S, B | Start Slides how |
| Ctrl+F5 | Restore window to previous Size | Alt+ F, X | Close Power Point |
| Shift+ F10 | Display context menu | Esc | End the slide show |
| Shift+ F6 | Move anticlockwise among Pane | Alt + T | Transitions Tab |
| Ctrl+ Shift+ Z | Normal/Plain Text | Alt + A | Animation Tab |
| Shift+ F3 | Toggle cases | F5 | Slide Show |
| Ctrl+ Shift+ F | Change Font Style | | |
| Ctrl+D | Duplicate slide | | |
| Alt + F10 | Maximize window | | |
| Alt+N, W | Insert word art | | |
| Alt+N, X | Insert text box | | |
| Alt + W, Q | Change the zoom | | |
| Alt + H, F and S | Change the font Size | | |
| Alt + H, S and H | Insert a shape | | |
| Alt + G, H | Select a theme | | |
| Alt + H, L | Select a slide layout | | |

23. Definitions and terminologies

Application: An application is a set of codes designed to allow specific tasks to happen. Microsoft Windows and Internet Explorer are common examples.

Access time: The performance of a hard drive or other storage device - how long it takes to locate a file.

Active program or window: The application or window at the front (foreground) on the monitor.

ALGOL: It was the first language with a formal grammar. ALGOL was created by a committee for scientific use in 1958. Its major contribution is being the root of the tree that has led to such languages as Pascal, C, C + and Java.

Algorithm: In computing, an algorithm is a procedure for accomplishing some tasks which, given an initial state, will terminate in a defined end-state.

ASCII (pronounced ask key): American Standard Code for Information Interchange. a commonly used data format for exchanging information between computers or programs.

Amplifier: A device that takes in a weak electric signal and sends out a strong one. It is used to boost electrical Signals in many electronic devices such as radios, televisions and telephone.

Analog Computer: A computer that operates on data which is in the form of continuous variable physical quantities.

Android: It is a linux based operating system designed Primarily for touchscreen mobile devices such as smartphones and tablets computer.

Antivirus Software: Antivirus software consists of 3computer programs that attempt to identify threat and eliminate computer virus and other malicious software (Malware)

API: API refers to Application Programming Interface. It's the platform used by a program to access different services on the computer system.

Application Software: Application software is a subclass of computer software that employs the capabilities of a computer directly to a task that the user wishes to perform. e.g., word document, spreadsheet, etc.

Archive: It provides backup storage.

Arithmetic Logic Unit (ALU): The arithmetic logic unit is a part of the execution unit, a core component of all CPUs. ALUs are capable of calculating the results of a wide variety of basic arithmetical and logical computations

Artificial Intelligence: Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today.

Array: An array is similar data saved on a computer system in a sequential form.

Assembler: A program that translates mnemonic statement into executable instruction.

Attribute: The characteristics of an entity are called its attributes.

Animation It is the process of making the illusion of motion and change by means of the rapid display of a sequence of static image that minimally differ from each other.

BIOS: BIOS stands for Basic Input/output System. It gives the computer a platform to run the software using a floppy disk or a hard disk. BIOS are responsible for booting a PC.

Bit: Bit is Binary Digit. It refers to a digit number, either a 0 or a 1. The binary digit is used to represent computerized data.

Backup: A copy of a file or disk you make for archiving purposes.

Backspace: Backspace key is used on the keyboard to delete the text. Backspace will delete the text to the left of cursor.

Bandwidth: The maximum amount of data that can travel in a communication path in a given time, measured in bits per second (bps).

Bar Code: A bar code is a machine-readable representation of information in a visual format on a surface. The first bar code system was developed by Norman Joseph Woodland and Bernard Silver in 1952.

Bitmap: A method of storing a graphic image as a set of bits in a computer memory. To display the image on the screen, the computer converts the bits into pixels.

Blog: It is a discussion or informational site published on the World Wide Web.

Bomb: A type of virus designed to activate at a specific date and time on your computer.

Bluetooth: A protocol that permits a wireless exchange of information between computers. Cell phone and other electronic devices within a radius about 30 feet,

Booting: Booting is a bootstrapping process which starts the operating system when a computer is switched on

Botnet: It is a collection of internet connected programs communicating with other similar programs in order to perform tasks.

Boot Sequence: A boot sequence is the set of operations the computer performs when it is switched on which loads an operating system.

Browser: A special software that enables users to read/view web pages and jump from one web page to another.

Buffering: The process of storing data in a memory device, allowing the devices to change the data rates, perform error checking and error retransmission.

Bug: A software bug is an error, flaw, failure, or fault in a computer program or system that produces an incorrect or unexpected result.

Boolean: An expression, the value of which is either true or false.

BUS: A bus is a set of wires that enables flow of data from one location of the computer to another. Byte: Eight bits is equal to 1 byte.

CGI: CGI stands for Common Gateway Interface. It defines how an auxiliary program and a Web server would communicate.

Class: A group of objects having same operations and attributes is defined as a class.

Client: A client is a program that asks for information from other processes or programs. Outlook Express is a great example of a client.

CD-ROM: An acronym for Compact Disc Read-Only Memory.

Client – Server: A common form of distributed system in which software is split between server tasks and client tasks. A client sends requests to a server, according to some protocol, asking for information or action, and the server responds.

Clipboard - A portion of memory where the Mac temporarily stores information. Called a Copy Buffer in many PC applications because it is used to hold information which is to be moved, as in word processing where text is "cut" and then "pasted".

Clock Rate (MHz) - The instruction processing speed of a computer measured in millions of cycles per second (i.e., 200 MHz).

Compiler - a program that converts programming code into a form that can be used by a computer.

Compression - a technique that reduces the size of a saved file by elimination or encoding redundancies (i.e., JPEG, MPEG, LZW, etc.)

CPU: The Central Processing Unit. The processing chip that is the "brains" of a computer.

Cache Memory: The speed of CPU is extremely high compared to the access time of main memory. Therefore, the performance of CPU decreases due to the slow speed of main memory. To decrease the mismatch in operating speed, a small memory chip is attached between CPU and main memory whose access time is very close to the processing speed of CPU. It is called the Cache Memory.

Chip: A tiny wafer of silicon containing miniature electric circuits that can store millions of bits of information.

Client-Server: Client-server is a network architecture which separates the client from the server. Each instance of the client software can send requests to a server or application server.

Cookie: A packet of information that travels between a browser and the web server

Compiler: A compiler is a computer program that translates a series of instructions written in one computer language (called the source language) into another computer language (also called the object or target language).

Communication: The transmission of data from one computer to another or from one device to another is called communication

Computer Networks: A computer network is a system or communication among two or more computers. The computer networks can be broadly classified as 'Homogenous' and 'Heterogeneous'.

Computer Graphics: Computer Graphics are visual presentations on a computer screen. Examples are photographs, drawings, line arts, graphs, diagrams, typography, numbers, symbols, geometric designs, maps, engineering drawings or other images.

Cold Boot: When a computer restarts after the power cut is called cold boot. Control Panel: Control Panel is the part of Windows menu. Accessible from the start menu, which allows users to view and manipulate basic system settings and controls, such as adding hardware, adding/removing software, controlling user accounts, changing accessibility options, etc.

Control Unit: A control unit is the part of a CPU that 'controls' its operation. The outputs of this unit control the activity of the rest of the device.

Cracker: The preferred term used to refer to a computer criminal that penetrates a computer to steal information or damage the program in some way

Crash - a system malfunction in which the computer stops working and has to be restarted.

Cursor - The pointer, usually arrow or cross shaped, which is controlled by the mouse.

CMOS: CMOS is an abbreviation for Complementary Metal-Oxide-Semiconductor. It is the battery powered chip that is situated on the Motherboard that retains system information such as date and time.

Data: Data refers to the information that is saved on a computer.

DOS: DOS is an acronym for Disc Operating System. It is a command line operating system launched by Bill Gates. Database - an electronic list of information that can be sorted and/or searched.

Defragment - (also - optimize) to concatenate fragments of data into contiguous blocks in memory or on a hard drive.

Dialog box - an on-screen message box that appears when the computer requires additional information before completing a command.

Digitize - To convert linear, or analogue, data into digital data that can be used by the computer.

Disk - a spinning platter made of magnetic or optically etched material on which data can be stored.

Disk drive: The machinery that writes the data from a disk and/or writes data to a disk. **Disk window**: The window that displays the contents or directory of a disk.

Document - a file you create, as opposed to the application which created it.

DOS - acronym for Disk Operating System - used in IBM PCs.

Download - to transfer data from one computer to another. (If you are on the receiving end, you are downloading. If you are on the sending end, you are uploading).

Drag - to move the mouse while its button is being depressed.

Driver - a file on a computer that tells it how to communicate with an add-on piece of equipment (like a printer).

DTP: Desk Top Publisher (ing) is a term that describes a program that enables users to create, design, and print items such as business cards, birthday cards, letterheads, calendars, invitations, and so on.

Editing: The process of changing information by inserting, deleting, replacing, rearranging and reformation.

E-mail: Electronic mail, abbreviated e-mail is a method of composing, sending, storing and receiving messages over electronic communication systems.

Encapsulation: It is a mechanism that associates the code and the data it manipulates into a single unit and keeps them safe from external interference.

Encryption: In cryptography, encryption is the process of encoding messages (or information) in such a way that hackers cannot read it, but the authorized users can access it.

End User: Any individual who uses the information oefierated by a computer based system.

Entity: An entity is something that has certain attributes or properties which may be assigned values.

Entity-relationship diagram: It's a diagram that represents entities and how they are related to each other.

Ethernet - a protocol for fast communication and file transfer across a network.

Execution Time: The total time required to executela program on a particular system. **Expansion slot**: A connector inside the computer that allows one to plug in a printed circuit board that provides new or enhanced features.

Environment: Environment refers to the interaction among all factors external to a physical platform. An environment is made of specific software, hardware, and network protocols that allow communication with the system.

FAT: FAT is an acronym for File Allocation Table. It resembles a table of contents so that files can be located on a computer. **Fault**: Hardware or software failure.

Fax: It stands for 'Facsimile machine'. It is used to transmit a copy of a document electronically.

Field: The attributes of an entity are written as fields in the table representation.

File - the generic word for an application, document, control panel or other computer data.

Floppy - a 3.5-inch square rigid disk which holds data. (so named for the earlier 5.25 and 8 inch disks that were flexible).

Folder - an electronic subdirectory that contains files.

Font - a typeface that contains the characters of an alphabet or some other letterforms.

Fragmentation - The breaking up of a file into many separate locations in memory or on a disk.

Freeze - a system error, which causes the cursor to lock in place

Front End: It is an interface through which a program can be accessed by common users.

Gateway: A device that is used to joint together two networks having different base protocols.

Groupware: It is software that allows networked individual to form groups and collaborate on documents, programs or database.

Hardware: Hardware is a set of physical objects such as monitor, keyboard, mouse, and so on.

Hard drive - a large capacity storage device made of multiple disks housed in a rigid case.

Head crash - a hard disk crash caused by the heads coming in contact with the spinning disk(s).

High density disk: a 1.4 MB floppy disk.

Hub: A network device that connects multiple computers on a LAN, so that they can communicate with one another.

Hyperlink: An image or portion of text on a web page that is linked to another web page.

Highlight: To select by clicking once on an icon or by highlighting text in a document.

Hit rate - The fraction of all memory reads which are satisfied from the cache.

Hz - Abbreviation for hertz, the number of cycles per second, used to measure clock speed

Icon: Icon is a small visual display of an application which can be activated by clicking on it.

IDE: It stands for Integrated Development Environment. IDE is a programming system that combines several tools of programming to provide an integrated platform for programming. For instance, Visual Basic provides an IDE.

Initialise - to format a disk for use in the computer; creates a new directory and arranges the tracks for the recording of data.

Insertion point - in word processing, the short flashing marker that indicates where your next typing will begin.

Installer - software used to install a program on your hard drive.

Interrupt button - a tool used by programmers to enter the debugging mode. The button is usually next to the reset button

Instance: It is an object described by its class.

Internet: Internet is a network that accommodates several computers to facilitate exchange and transfer of data.

Joystick: A joystick is a computer peripheral or general control device consisting of a handheld stick that pivots about one end and transmits its angle in two or three dimensions to a computer.

Kernel: It is a program called when a computer system is started. Kernel is responsible for setting up system calls in order to manage hardware and system services, and allocate resources to applications.

Kilobyte - 1024 bytes.

LIGHT Pen: A light sensitive style for forming graphics by touching coordinates on a display screen. There by seeming to draw directly on the screen.

Loop: A sequence of instructions that is executed repeatedly until a terminal condition occurs.

LAN: LAN is an acronym for Local Area Network that spans small area. A LAN can be connected to another LAN to accommodate more computers.

Landscape: In printing from a computer, to print sideways on the page. Launch - start an application.

Memory: Memory is the internal storage location where data and information is stored on a computer

Modem: Modem is a term created from the beginning letters of two other words viz. MODulation and DEModulation. The term implies changing of data from digital to analog and then back to digital.

Morphing: The transformation of one image into another image

Multitasking: Multitasking can simultaneously work with several programs or interrelated tasks that share memories, codes, buffers and files.

Multithreading: It is a facility available in an operating system that allows multiple functions from the same application packages.

Multiuser: The term describing the capability of a computer system to be operated at more than one terminal at the same time.

Multiplexer: It is a device that combines multiple input signals into an aggregate signal for transmission.

Memory - the temporary holding area where data is stored while it is being used or changed; the amount of RAM a computer has installed.

Menu - a list of program commands listed by topic.

Menu bar: The horizontal bar across the top of the screen that lists the menus.

MHz - Abbreviation for megahertz, or millions of cycles per second.

Multi-tasking: Running more than one application in memory at the same time.

Nibble: A sequence of four adjacent bits, or a half byte . A hexadecimal or BCD coded digit can be represented by a nibble .

Network: A Network is a group of computers connected to each other in order to send and receive data.

Operating System: An Operating System provides the software platform required for various applications to run on. Its responsibility is to manage memory storage and security of Data.

Optical disk: A high-capacity storage medium that is read by a laser light. Packet: Sections in which message or data are divided to transfer it over a network.

Pixel: Pixel is formed by combining the two words viz. Picture Element. It represents one point within an image.

Palette - a small floating window that contains tools used in a given application.

Partition - a subdivision of a hard drives surface that is defined and used as a separate drive.

Paste: To insert text, or other material, from the clipboard or copy buffer.

PC: acronym for personal computer commonly used to refer to an IBM or IBM clone computer that uses DOS.

PCI: Acronym for Peripheral Component Interchange - the newer, faster bus architecture.

Peripheral - an add-on component to your computer.

Pop-up menu: Any menu that does not appear at the top of the screen in the menu bar. (May pop up or down)

Power PC - a processing chip designed by Apple, IBM and Motorola (RISC based).

Power Mac - a family of Macs built around the PowerPC chip.

Print spooler - a program that stores documents to be printed on the hard drive, thereby freeing the memory up and allowing other functions to be performed while printing goes on in the background.

Port: Port is a connecting component mainly a hardware that enables two computers to allow data sharing physically. Examples are USB and HDMI.

Process: It's a series of commands that changes data values.

Protocol: Protocol refers to a set of rules that are followed by two devices while interacting with each other.

Query: Query is a request made by a computer from a database residing in the same system or a remotely located system.

RAM: RAM is an acronym for Random Access Memory. It is a configuration of storage cells that hold data so that it can be processed by the central processing unit. RAM is a temporary storage location.

Router: A network device that enables the network to reroute messages it receives that are intended for other networks. The network with the router receives the message and sends it on its way exactly as received. In normal operations, they do not store any of the messages that they pass through.

Routing: The process of choosing the best path throughout the LAN. Root directory - the main hard drive window.

ROM: ROM is an acronym for Read-Only Memory. It is semiconductor-based storage system that saves information permanently.

Software: Software is a program (coding) that the computer reads. The system then carries out functions as directed by the code. Adobe Photoshop is software.

Save - to write a file onto a disk.

Save as: To save a previously saved file in a new location and/or with a new name.

Scroll: To shift the contents of a window to bring hidden items into view.

Swapping: Storing programs on disk and then transferring these programs into main storage as and when they are needed.

Synchronization: This method ensures that the receiving end can recognize characters in order, in which the transmitting end sends them in a serial data transmission.

Scroll bar - a bar at the bottom or right side of a window that contains the scroll box and allows scrolling.

Scroll box - the box in a scroll bar that is used to navigate through a window.

SCSI: Acronym for Small Computer System Interface.

Serial port: A port that allows data to be transmitted in a series (one after the other), such as the printer and modem ports on a Mac.

Server - a central computer dedicated to sending and receiving data from other computers (on a network).

Shut down - the command from the Special menu that shuts down the computer safely.

Spreadsheet - a program designed to look like an electronic ledger.

Startup disk - the disk containing system software and is designated to be used to start the computer.

Surge suppressor - a power strip that has circuits designed to reduce the effects of surge in electrical power. (Not the same as a UPS)

TCP/IP: TCP/IP is an acronym for Transmission Control Protocol/Internet Protocol. It's a set of communication protocols used to connect host computers on the Internet.

Title bar - the horizontal bar at the top of a window that has the name of the file or folder it represents.

URL: URL stands for Universal Resource Locator. It's a way of accessing the Internet.

Upload - to send a file from one computer to another through a network.

Uninterruptible Power Source (UPS): A constantly charging battery pack that powers the computer. A UPS should have enough charge to power your computer for several minutes in the event of a total power failure, giving you time to save your work and safely shut down.

UPS - acronym for Uninterruptible Power Source.

Virtual Memory: Virtual Memory is the unused memory on the hard disk used when certain applications require more RAM than is available on the machine.

Virus: Virus is a program that is loaded onto your computer without you knowing about it and it runs to hinder the normal functioning of the computer.

WWW: WWW stands for World Wide Web. It's a term used to define the Internet.

WAN: WAN is an acronym for Wide Area Network. Such a network spans over an area larger than a LAN.

WORM - acronym for Write Once-Read Many; an optical disk that can only be written to once (like a CD-ROM).

Zoom box - a small square in the upper right corner of a window which, when clicked, will expand the window to fill the whole screen.

ZIP: ZIP is an acronym for Zone Information Protocol. ZIP application enables transfer of data using compression of files.

ABBREVIATION

| | |
|--|--|
| ADC Analog to Digital Convertor | BINAC Binary Automatic Computer |
| ARP Address Resolution Protocol | BCC Blind Carbon Copy |
| AH Active Hub | BMP Bitmap |
| AI Artificial Intelligence | <u>BASIC</u> Beginner's All purpose Symbolic Instruction Code |
| ALGOL Algorithmic Language | BCD Binary Coded Decimal |
| ALU Arithmetic Logic Unit | <u>BCR</u> Bar Code Reader |
| APCI Application layer Protocol Control Information | <u>BRD</u> Blu-ray Disc |
| API Application Program Interface | Bin Binary |
| ARPANET Advanced Research Projects Agency Network | BIOS Basic Input/Output System |
| <u>ASCII</u> American Standard Code for Information Interchange | B2B Business-to-Business |
| ATM Automated Teller Machine | Bit Binary Digit |
| ADF Automatic Document Feeder | BLOG Web Log |
| ACID Atomicity Consistency Isolation Durability | BPI Bytes/Bits Per Inch |
| ASP Active ServerPages | BPL Broadband over Power Line |
| AS Autonomous System | BPS Bits Per Second |
| ANSI American National Standard Institute | BHIM Bharat Interface for Money |
| ADSL Asymmetric Digital Subscriber Line | BIPS Billion Instruction PerSecond |
| BIU Bus Interface Unit BIS Business Information System | BGP Border Gateway Protocol |
| | |
| CAM Computer Aided Manufacturing | |
| Cc Carbon Copy CPI Clock / Cycle Per Instruction | DAC Digital to Analog Convertor |
| CMOS Complementary Metal Oxide Semi-conductor | DB Database |
| CAD D Computer Aided Design and drafting | DBA Database Administrator |
| <u>COBOL</u> Common Business Oriented Language | DBMS Database Management System |
| CD Compact Disc CASE Computer-Aided Software Engineering | DCL Data Control Language |

C-DAC Centre for Development of Advanced Computing

CRT Cathod Ray Tube

CSS Cascading Style Sheet

CU Control Unit **CPS** Characters Per Second.

CTCP Client-To-Client Protocol

CD-R Compact Disc Recordable

CD-ROM Compact Disc Read Only Memory

CD-RW Compact Disc ReWritable

CD-R/W Compact Disc-Read/Write

CG Computer Graphics **CROM** Control Read-Only Memory

CGI Common Gateway Interface

CLI Command Line Interface

CLR Common Language Runtime

CDMA Code Division Multiple Access

CMYK Cyan Magenta YellowBlock

CAN Campus Area Network

C NM Circulatory Network Mode

EBCDIC Extended Binary Coded Decimal Interchange Code

E-Commerce Electronic Commerce

EDP Electronic Data Processing

EDSAC Electronic Delay Storage Automatic Calculator

EEPROM Electrically Erasable Programmable Read Only Memory

E-Mail Electronic Mail

ENIAC Electronic Numerical Integrator And Computer

EOF End Of File **EFS** Encrypted File System

EPROM Erasable Programmable Read Only Memory

EXE Executable

EDI Electronic Data Interchange **ESDI** Enhanced Small Device Interface

DFS Distributed File System

DFD Data Flow Diagram

DHTML Dynamic Hyper Text Markup Language

DMA Direct Memory Access

DNS Domain Name System

DPI Dots Per Inch

DRAM Dynamic Random Access Memory

DSL Digital Subscriber Line

DTP Desktop Publishing **DVI** Digital Visual Interface

DVD Digital Video Disc/Digital Versatile Disc

DVD-R Digital Video Disc-Recordable

DVD-ROM DVD-Read Only Memory

DVD-RW DVD-Rewritable

DVR Digital Video Recorder

DOS Disk Operating System

DHCP Dynamic Host Configuration Protocol

DNS Domain Name Server

FAT File Allocation Table

FAX Facsimile **FPS** Frames Per Second

FDC Floppy Disk Controller

FDD Floppy Disk Drive

FIFO First In First Out

FORTRAN Formula Translation

FPU Floating Point Unit

FTP File Transfer Protocol

FXP File Exchange Protocol

FLOPS Floating Point Operations Per Second

Gb Gigabit **GDI** Graphical Device Interface

GB Gigabyte **GIS** Geographic Information System

GIF Graphics Interchange Format

GIGO Garbage In Garbage Out

GPU Graphics Processing Unit

GSM Global System for Mobile communication

GUI Graphical User Interface

GPS Global Positioning System

HLL High Level Language

HPFS High Performance File System

HDD Hard Disk Drive **HD** Hard Disk

HSM Hierarchical Storage Management

HTML Hyper Text Markup Language

HTTP Hyper Text Transfer Protocol

HTTPS Hyper Text Transfer Protocol Secure

HDMI High Definition Multimedia Interface

| | | | | | |
|---|---|---|--------------------------------------|--|--|
| IM Instant Message | JPEG Joint Photographic Experts Group | | | | |
| IMAP Internet Message Access Protocol | JRE Java Runtime Environment | | | | |
| iOS iPhone Operating System | JS Java Script JAR Java Archive JSP Java Server Page | | | | |
| IP Internet Protocol | IOP Input Output Processor | IBM International Business Machines | | | |
| ISDN Integrated Services Digital Network | | Kb Kilobit | | | |
| ISOC Internet Society | IC Integrated Circuit | KB Kilobyte | | | |
| ISP Internet Service Provider | KHz Kilohertz | | | | |
| ISR Interrupt Service Routine | Kbps Kilobit Per Second | | | | |
| IMEI International Mobile Equipment Identity | INTEL Integrated Electronics | | | | |
| IVR Interactive Voice Response | ICT Information Communication Technology | | | | |
| ICANN Internet Corporation of Assign Names & Numbers | IEEE Institute of Electrical and Electronic Engineer | | | | |
| IPv4 Internet Protocol Version 4 | ISO International Standard Organization/ International Org for Standardization | | | | |
| LAN Local Area Network | LCD Liquid Crystal Display | LDU Liquid Display Unit | | | |
| LED Light Emitting Diode | LPI Lines Per Inch | LSI Large Scale Integration | LISP List Processing | | |
| MAN Metropolitan Area Network | Mb Megabit | MB Megabyte | MBR Master Boot Record | | |
| MAC Media Access Control | MPEG Moving Picture Experts Group | | | | |
| MIME Multipurpose Internet Mail Extensions | MSN Microsoft Network MDI Multiple Document Interface | | | | |
| MICR Magnetic Ink Character Recognition/Reader | MIPS Million Instructions Per Second | | | | |
| MIDI Musical Instrument Digital Interface | MODEM Modulator Demodulator | | | | |
| MANET Mobile Ad-HocNetwork | | | | | |
| NFS Network File System | NIC Network Interface Card | NOS Network Operating System | | | |
| NAT Network Address Translation | NTP Network Time Protocol | | | | |
| OCR Optical Character Recognition /Reader | OMR Optical Mark Reader | OOP Object Oriented Programming | | | |
| OS Operating System | OSS Open Source Software | OLE Object Linking and Embedding | | | |
| OTP One Time Password | OSI Open Systems Interconnection | | | | |
| P2P Peer-to-Peer | PAN Personal Area Network | PAP Password Authentication Protocol | | | |
| PC Personal Computer | PD Pen Drive | PCL Printed Command Language | | | |
| PDF Portable Document Format | PDL Program Design Language | PIO Programmed Input/Output | | | |
| PLA Programmable Logic Array | PnP Plug and Play | POS Point Of Sales | PPM Pages Per Minute | | |
| PPP Point-to-Point Protocol | PPP Peer to Peer Protocol | PPTP Point-to-Point Tunneling Protocol | | | |
| PROM Programmable Read Only Memory | PSTN Public Switched Telephone Network | PSU Power Supply Unit | | | |
| POST Power On Self Test | POP3 Post Office Protocol Version3 | PING Packet Internet Gopher | | | |
| PDA Personal Digital Assistants | PCB Printer Circuit Board | PHP Hypertext Pre-processor | PNG Portable Network Graphics | | |

PPM Pages Per Minute **PIN** Personal Identification Number

QoS Quality of Service

QBE Query By Example

QR Quick Response

RPA Robotics Process Automation

RAID Redundant Array of Independent Disks

RAM Random Access Memory

RDBMS Relational Database Management System

RIP Routing Information Protocol

ROM Read Only Memory

RPG Report Program Generator

RTOS Real Time Operating System

RTF Rich Text Format

RARP Reverse Address Resolution Protocol **RPM** Revolutions Per Minute

SaaS Software as a Service

SAN Storage Area Network

SCSI Small Computer System Interface

SDL Simple DirectMedia Layer

SMTP Simple Mail Transfer Protocol

SNOBOL String Oriented and Symbolic Language

SP Service Pack

SQL Structured Query Language

SRAM Static Random Access Memory

SNMP Simple Network Management Protocol

SIM Subscriber Identification Module

SIMM Single In-line Memory Module

SFTP Secure File Transfer Protocol

SIP Session Initiation Protocol

SSH Secure Shell

SIU Serial Interface Unit

SMIME Secure MIME

SMPS Switch Mode Power Supply

SMS Short Message Service **SNAP** Sub Network Access Protocol

TFTP Trivial File Transfer Protocol

TCP Transmission Control Protocol

TDMA Time Division Multiple Access

TTA True Tap Audio

TTF True Type Font

TTS Text-To-Speech

TTY Tele Type

TFT Thin-Film Transistor

TB Terabytes **TBPS** Tera Bytes Per Second

TCP Transmission Control Protocol

Tel Net Telecommunication Networking

TIPS Trillion Instruction Per Second

UI User Interface

UPS Uninterruptible Power Supply

URI Uniform Resource Identifier

URL Uniform Resource Locator

URN Uniform Resource Name

USB Universal Serial Bus

ULSI Ultra Large Scale Integration

UNIVAC Universal Automatic Computer

UAS Unmanned Aircraft System

UDP User Datagram Protocol

VB Visual Basic

VDD Virtual Device Driver

VGA Video Graphics Array

VLAN Virtual Local Area Network

VM Virtual Memory

VMS Video Memory System

VPN Virtual Private Network

VT Video Terminal

VR Virtual Reality

VSNL Videsh Sanchar Nigam Limited

VDU Visual Display Unit

VoIP Voice over Internet Protocol

VLSI Very Large Scale Integration

VRAM Video Random Access Memory **VIRUS** Vital Information Resource Under Siege

VAN Value Added Network **VCD** Video Compact Disk

WAN Wide Area Network

WAP Wireless Application Protocol

Wi-Fi Wireless Fidelity

Wi-MAX Worldwide Interoperability for Microwave Access

WINS Windows Internet Naming Service

WLAN Wireless Local Area Network

WMA Wireless Media Audio

WMV Wireless Media Video

WPA Wi-Fi Protected Access

WWAN Wireless Wide Area Network

WPM Words Per Minute

WLL Wireless Local Loop

WORM Write Once Read Many

WYSIWYG What you see is what you get

XHTML Extensible Hyper Text Markup Language

XML Extensible Markup Language

XMF Extensible Music File

XNS Xerox Network Services

XUL -XML User interface Language

YB Yotta-byte

MISCELLANEOUS

MyGov App

It was launched on 26th July, 2014. Google became the first multinational firm to collaborate with MyGov. Key features of MyGov app MyGov provides you a readymade interface to connect with the government on regular basis. It also gives you the opportunity to connect and engage with government representatives through live chats.

DigiLocker App

It is a digital locker to store all official documents that linked to both Aadhaar Card and cellphone numbers. It was launched by Prime Minister on 1st July, 2015. Initially, it had 100 MB space and was later increased to 1 GB.

Key features of DigiLocker app

It provides an online account with 1GB storage space to Aadhaar holders.

These documents can be shared by residents with governments or other registered organisations.

GARV (Grameen Vidyutikaran) App

GARV app is used to monitor the progress of the rural electrification scheme and provide real-time updates. This app was launched in October, 2015.

GARV app is an important part of the Digital India Initiative of the Government and will contribute in further development of the villages.

Key features of GARV app

Using this app, user can know that which village will be electrified next. You can also check the progress status of any village.

e-Wallet

e-Wallet (Mobile Wallet) is a type of prepaid account in which a user can store his/her money for any future online transaction. An e-Wallet is protected with a password.

With the help of an e-Wallet, one can make payments for groceries, online purchases and flight tickets among others. An e-Wallet needs to be linked with the individual's bank account to make payments. The main objective of e-Wallet is to make paperless money transaction easier.

Types of e-Wallet

There are various types of e-Wallet as follows

Paytm

Paytm is India's largest mobile commerce platform launched in 2010 by Vijay Shekhar Sharma. Paytm Wallet, because of its amazing marketing and operation strategies, has been able to capture maximum market share of this industry.

The wallet can be used to sent money directly to bank accounts as well. Paytm is the first company in India to receive a license from the (RBI) to start a payment bank.

Freecharge

This service was launched in September, 2015 and has ever since introduced many attractive features. This will enable all customers to send and receive funds through the UPI system. Freecharge UPI will allow users to initiate fund transfers instantly on a 24/7 basis on all 365 days in a year, including bank holidays.

Mobikwik

It is a digital wallet that can be used for a number of online payments including transferring money, accepting payments, mobile recharge, payment of utility bills, such as electricity, DTH, online shopping, etc. Mobikwik has received an approval from the (RBI) and has tied up with a number of retails and online merchants in the country.

Oxigen

It is a digital wallet service through which users can avail all the services offered by Oxigen. It is an application based service that can be used on all types of smartphone such as Android, Windows and IOs.

Oxigen wallet is a semi-closed wallet as per RBI guidelines. You can transfer funds from your wallet to your bank account.

Airtel Money

Airtel Money is the Mobile Wallet from the successful and popular telecom company Airtel. It allows you to use your smartphone as an electronic wallet to make and receive payments. Originally launched in 2012, this app offers customers with an efficient alternative to cash transactions. Citrus Wallet It is an app that lets you send money to and receive from anyone who has a phone number or E-mail. It lets your transfer money to friends, colleagues and family members within seconds. You can pay canteen, movie, travel and party bills with ease. You can even see all your past transactions and keep a track of your spending patterns.

SBI Buddy

SBI had launched the Mobile Wallet Buddy in August 2015, in 13 different languages in collaboration with Master Card. It is a digital platform by which customers can simply send or ask money from any of their contacts even if they do not have an SBI account.

PayZapp

PayZapp offered by HDFC bank is an ideal mobile payment wallet. With PayZapp, you can shop on your mobile at partner apps, bus and movie tickets, groceries, book flight tickets and hotels, pay bills and recharge your mobile. With the HDFC PayZapp e-Wallet app, customers do not need to depend on card based transactions and can enjoy secure and convenient payments.

PhonePe

PhonePe wallet has launched by Sameer Nigam and Rahul Chari. It provides an online payment system based an Unified Payments Interface (UPI), which is a new process in electronic funds transfer launched by National Payments Corporation of India (NPCI). Using PhonePe, users can send and receive money, recharge mobile, data cards, buy gold and shop online and offline.

MICROSOFT OFFICE

Microsoft Office (MS-Office) was developed by Microsoft in 1988. It is a collection of softwares, based on specific purpose and mainly used in office work. You can start any software of MS-Office by using the Start button.

(MS-Office) is an office suite of desktop applications, servers and services for the MS Windows and Mac operating systems.

Note: Microsoft Windows Vista was an windows OS for PC not Office Suit.

Office 365 is a subscription service that includes the most recent version of Office, which currently is Office 2016.

Microsoft Azure

It is a growing collection of integrated cloud services which developers and IT professionals use to build, deploy and manage applications through our global network of data centres.

It provides software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) and supports many different programming languages, tools and frameworks. Microsoft Azure was earlier known as Windows Azure.

There are five packages of MS-Office listed below

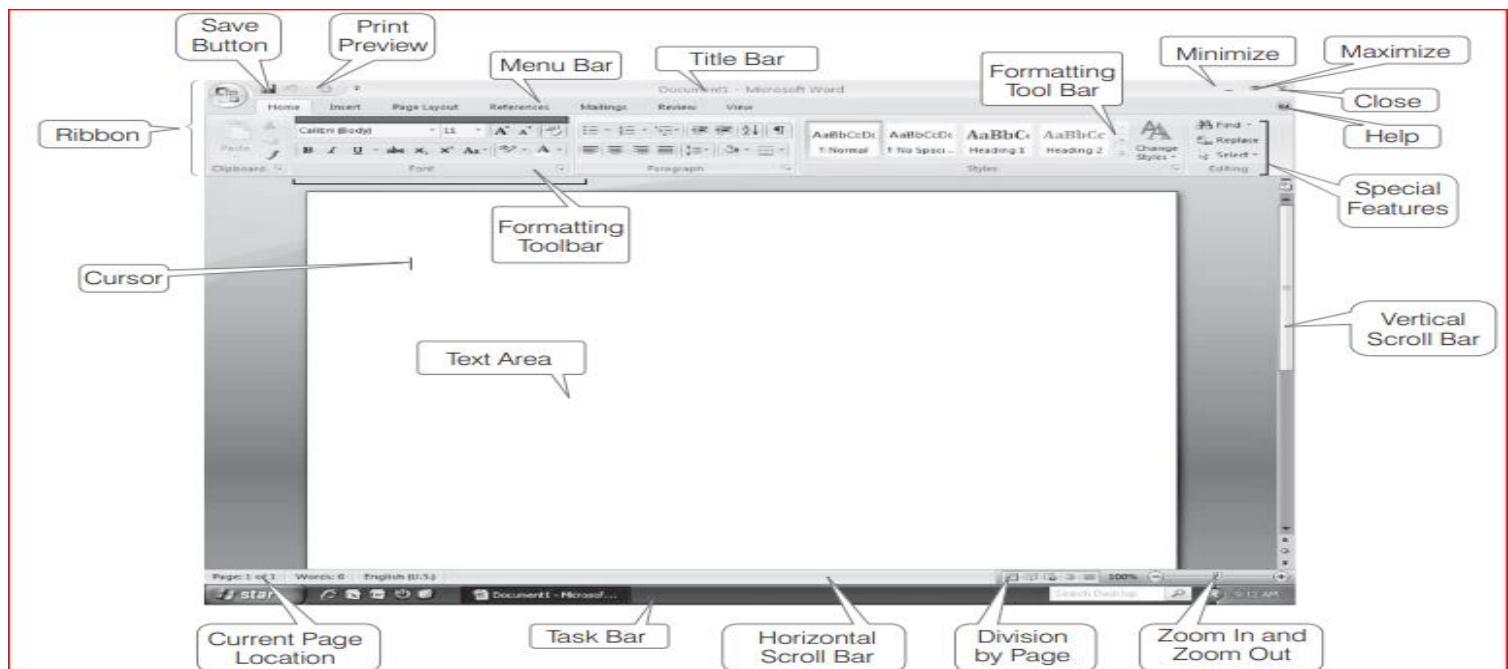
1. MS-Word (Word Processing Software)
2. MS-Excel (Spreadsheet Software)
3. MS-PowerPoint (Presentation Software)
4. MS-Access (Database Management Software)
5. MS-Outlook (E-mail Client)
6. OneNote,
7. Publisher.

Microsoft Word

MS Word is a Word processing application which is one of the most important and widely used applications found on computer. It provides tools for editing, formatting and printing of documents smaller than 45 KB.

The document can be a poster, report, letter, brochure, web page, news letter, etc. e.g. WordStar, Notepad for Windows.

To start the MS-Word software, Click on Start button and then click on Run option. Run dialog box will be appear on the screen. Now, type **winword** on text box and press Enter key. **OR** Click Start button → All Programs → Microsoft Office → Microsoft Word 2010. By default, the name of the blank document is Document1.docx, where. docx are the extensions of a MS-Word file.



Components of Microsoft Word

(0) Title Bar It shows the name of the application and name of the file. It consists of three control buttons, i.e. (a) Minimize (reduces the window but application still active) (b) Restore (brings Word window to the maximum original size) (c) Close (close the Word window)

(i) Quick Access Tool Bar The quick access toolbar is a small and customizable toolbar at the top of the document window. It contains a set of commands that are independent of the tab on the ribbon that is currently displayed. It usually contains buttons to save, undo, redo and print.

(ii) Standard Tool Bar It displays the symbol for the common operations like Open, Print, Save, etc.

(iii) Ribbon The Ribbon is a cluster of toolbars in Microsoft Office which are used for writing, designing, formatting and reviewing different styles, adaptations, add-ins, themes etc. Every tab in the top of a given word file window displays the Ribbon toolbar.

(iv) Tab On the ribbon, it contains the buttons needed to edit characters, text and layout. **There are various tabs as follows**

(a) Home Tab: -

The Home tab is the default tab in Microsoft Word, Microsoft Excel, Microsoft PowerPoint and other Microsoft Office products. It allows changing document settings, such as the font properties by using control groups on the tab.

The control groups and keys are

✓ Clipboard Group (Copy (only one item at a time), Paste, Cut, Format Painter) ✓ Font Group (Font style, colour & size, Bold, Underline, Strikethrough) ✓ Paragraph Group (Bullets & Numbering, Alignment, Shading, Borders, Line spacing) ✓ Style Group (Listed Styles) ✓ Editing Group (Find, Replace etc).

(b) Insert Tab: -

Insert Tab The Insert Tab is used to insert different features such as tables, pictures, clip art, shapes, charts, page numbers, word art, headers, and footers etc into a document.

The availed groups and keys under this tab are:

✓ Pages Group (Cover page, Blank page, Page break) ✓ Tables Group (Tables) ✓ Illustrations Group (Pictures, Shapes, Smart Art etc) ✓ Media and Links Group (Hyperlink, Bookmark etc) ✓ Header and Footer Group (Page number, Header, Footer) ✓ Text Group (Text Box, Word Art etc) ✓ Symbol Group (Equation, Symbol)

(c) Page Layout Tab

Layout Tab The Layout Tab holds the buttons which are used to arrange document pages. It consists of Themes, Page Setup, Page Background, Paragraph, Arrange.

The control groups and keys under layout tabs are:

✓ Page Setup Group (Margins, Orientation, Breaks, Line numbers, Hyphenation, Size of the page, Columns) ✓ Paragraph Group (Paragraph Indentation, Spacing) ✓ Arrange Group (Align, wrap text, Rotate etc)

(d) References Tab

References Tab References Tab allows to now create a table of contents, footnotes, citations, cross-references. It consists of Table of Contents, Footnotes, Citations & Bibliography, Captions, Index, Table of Authorities.

The availed control groups and keys in this tab are:

✓ Table of Contents Group (Customize table of contents) ✓ Footnotes Group (Insert footnotes) ✓ Research Group (Smart outlook of the text) ✓ Citations & Bibliography Group (Inserting and choosing a style of citation, Bibliography) ✓ Captions group (cross reference, insert a table of figures, Insert Caption) ✓ Index Group (Insert Index, Mark entry) ✓ Table of Authorities group (Mark Citation, Insert Table of Authorities)

(e) Mailings Tab It consists of Create, Start Mail Merge, Write & Insert Fields, Preview Results, Finish.

Mailings Tab Mail Merging is an ideal task in MS word by using Mailings Tab. Mail merge is used to create form letters or address labels, certificates with unique names, and more. The following group buttons are available in Mailings Tab. ✓ Create Group (Envelops, Labels) ✓ Start Mail Merge Group (Start Mail Merge, Selection of Recipients, Edit Recipient List) ✓ Write & Insert Fields Group (Highlighting the fields, Address Block, Greeting Line etc) ✓ Preview Results Group (Check for errors, Find Recipient) ✓ Finish Group (Finish & Group)

(f) Review Tab It consists of Proofing, Language, Comments, Tracking, Changes, Compare, Protect.

The tools in the Review Tab helps to improve the document. It contains the following control groups and keys. ✓ Proofing Group (Spelling & Grammar, Thesaurus, Autocorrect, word count) ✓ Comments Group (Add new comment, show comment, Delete comment) ✓ Tracking Group (Track changes, Simple mark-up, Review pane) ✓ Changes Group (Accept or Reject changes) ✓ Compare Group (Comparing the documents) ✓ Protect Group (Restrict editing, Block Authors)

(g) View Tab It consists of Document Views, Show, Zoom, Window, Macros.

The View tab has the functionality to change the document views. The options in the view tab are: ✓ Views Group (Read mode, Print Layout, Web Layout Outline, Draft) ✓ Page Movement Group (Vertical and Side to side) ✓ Show Group (Ruler, Gridline, Navigation Pane) ✓ Zoom Group (Zoom {10% to 500%}, Page width, Multiple pages) ✓ Window Group (New window, Arrange and Split window, Switch windows etc) ✓ Macros group

(v) Ruler It appears on the top of the document window. It allows to format the horizontal or vertical alignment of text in a document. There are two types of ruler

(a) Horizontal Ruler It indicates the width of the document and is used to set left and right margins.

(b) Vertical Ruler It indicates the height of the document and is used to set top and bottom margins.

(vi) Status Bar It displays the information such as page number, current page, current template, column number, line number, etc.

(vii) Work Area It is the rectangular area of the document window that can be used to type the text. It is also called as workplace.

(viii) Cursor It is also called insertion pointer. It denotes the place where text, graphics or any other item would be placed when you type, overwrite or insert them.

The features of MS-Word are described below

(i) Text Editing : -It provides editing, adding and deleting text, modification of text content i.e. cut, copy and paste.

(ii) Format Text: - It offers to modify the text in any of the available hundreds of text designs.

(iii) Indentation : -It denotes the distance between text boundaries and page margins. It offers three types of indentation-positive, hanging and negative.

(iv) Page Orientation: -It facilitates selection of typed text printed or visible in horizontal view or vertical view on a specified size of the page. MS-Word offers Portrait–vertically oriented and Landscape–horizontally oriented.

(v) Find & Replace: - allows flexibility and comfort to the user to replace a text with a substituted text at all places.

(vi) Spell Check : -automatic and manual checking of spelling mistakes and also suggests a few possible alternate options for incorrect spelt words.

(vii) Thesaurus: -**comprehensive dictionary** that offers the **synonym options** for a word.

(viii) Bullets and Numbering: - A list of bullets and numbering features is used for tables, lists, pages and tables of content. Bullets are arranged in **unordered lists** and numbering is arranged in **ordered lists**.

(ix) Graphics: - It provides the facility of incorporating drawings in the documents which enhance their usefulness.

(x) Object Linking and Embedding (OLE): - It is a program integration technology that is used to share information between programs through objects. Object save entities like charts, equations, video clips, audio clips, pictures, etc.

(xi) Horizontal and Vertical Scroll Bars: - They enable one to move up and down or left and right across the window. The horizontal scroll bar is located above the status bar. The vertical scroll bar is located along the right side of the screen to move up and down the document.

(xii) Save a Document: - When we create a new document, it will be saved into the hard drive. To save a document, user has three common ways (i) To click on Save option from File menu. (ii) Select Save button from Standard toolbar. (iii) Press Ctrl + S key.

■ MS-Word was first released in 1983 under the name Multi-Tool Word for Xenix Systems.

■ In MS-Word, a default alignment for the paragraph is left.

■ MS-Word has a list of pre-defined typing, spelling, capitalisation and grammar errors that **Auto-correct** can detect and correct.

(xiii) Footer and Header - The footer constantly appears on every page of a document, at the bottom of each page. It includes the page number, or a company's name and contact details in formal documents. The header sits at the very top of every page in a document. A Header contains page numbers, the document name or sub-titles within a document.

(xiv) Alignment – This option is used to align the text in a document adhere to the right side, left, centre or justified.

(xv) Clipboard – The clipboard saves the text temporarily. Using the Cut or Copy commands will place the text in the clipboard.

(xvi) Font – It is a type of design for text. Times New Roman, Arial, Calibri, Verdana etc are the examples of font style. The **maximum size of Font is 72** in a drop-down selection of MS Word.

Microsoft Excel

A spreadsheet is a matrix of rows and columns similar to an accounting ledger.

An electronic spreadsheet is used for analysing, sharing and managing information for accounting purpose performing mathematical calculations, budgeting, billing etc. The spreadsheet program also provides tools for creating graphs, inserting pictures and chart, analysing the data, etc.

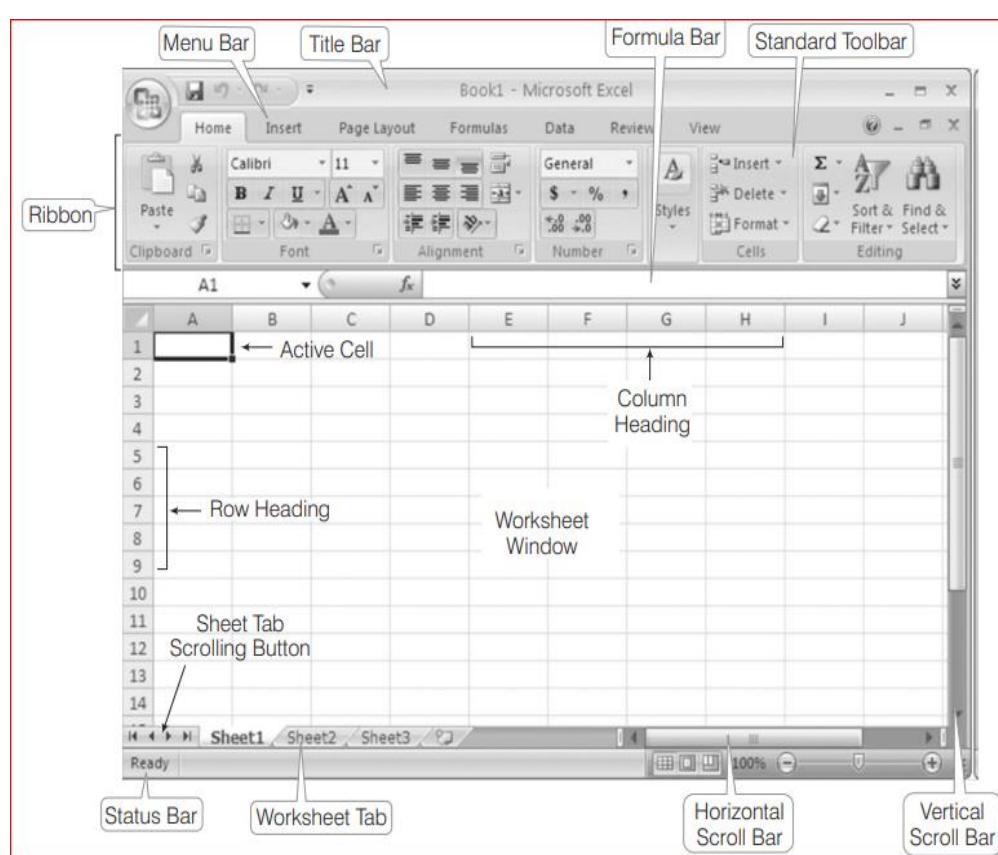
e.g. Corel Quattro Pro, Visicalc, Lotus-1-2-3, Apple Numbers, etc.

To start MS-Excel software, we can follow any one method out of them

(i) Click on Start button and then click on Run option. Run dialog box will be appear on the screen. Now, type Excel on Text box and press Enter key.

(ii) Click Start button → All Programs → Microsoft Office → Microsoft Excel 2010.

It opens MS-Excel with a blank spreadsheet. By default, the name of the blank spreadsheet is Book1.xlsx, where .xls and .xlsx are the extensions of a MS-Excel spreadsheet.



EXCEL 2016

| Feature | Maximum limit |
|--|--|
| Worksheet size | 1,048,576 rows by 16,384 columns |
| Column width | 255 characters |
| Row height | 409 points |
| Page breaks | 1,026 horizontal and vertical |
| Total number of characters that a cell can contain | 32,767 characters |
| Characters in a header or footer | 255 |
| Maximum number of line feeds per cell | 253 |
| Sheets in a workbook | Limited by available memory (default is 1 sheet) |
| Unique cell formats/cell styles | 64,000 |
| Unique font types | 1,024 global fonts available for use; 512 per workbook |
| Hyperlinks in a worksheet | 66,530 hyperlinks |
| Panes in a window | 4 |
| Zoom range | 10 percent to 400 percent |
| Fields in a data | 32 |

MS EXCEL 2016 Microsoft Excel is a spreadsheet developed by Microsoft. Spreadsheets allow you to keep track of data, create charts based from data, and perform complex calculations. Just like a book ledger, spreadsheets store information in columns and rows. **You can have up to 256 columns and 65,536 rows per worksheet.**

Workbook and Worksheet : -An Excel worksheet is a single spreadsheet that contains cells organized by rows and columns. A worksheet begins with row number 1 and column A. Each cell can contain a number, text or formula. Excel Workbook comprises number of worksheets. Many new sheets can be added to a workbook using adding worksheet command which is present at the bottom.

.xls' is the file extension of the MS Excel. Ribbons in MS Excel are divided into logical groups called Tabs and Each tab has its own set of unique function to perform

Components of Microsoft Excel

Home Tab

The Excel Home Tab is used to perform common commands such as bold, underline, alignment, Number, copy, and paste. It is also used to apply formats to cells in a worksheet. The Home Tab groups and their buttons are:

- ✓ Clipboard Group (Paste, Cut, Copy, Format Painter)
- ✓ Font Group (Bold, Italic, Underline, Font Style, Colour & Size {decrease and increase}, Fill colour, Borders)
- ✓ Alignment Group (Alignment {Top, Middle, Bottom, Left, Right, Centre}, Orientation, wrap text, Merger& Centre, Indent decrease & increase)
- ✓ Number Group (General, Accounting Number Format, Percent style, Comma style, Increase and decrease decimal)
- ✓ Styles Group (Conditional Formatting, Format as Table, Cell Styles)
- ✓ Cells Group (Insert cells, Delete cells, Format cells)
- ✓ Editing Group (AutoSum, Fill, Clear the format, Sort& Filter, Find & Select)

Insert Tab

Insert Tab is used to insert the picture, charts, filter, hyperlink etc. Alt+N is the shortcut Key to open Insert Tab. The Insert Tab groups and keys are:

- ✓ Tables Group (Pivot Table, Recommended Pivot Tables, Table)
- ✓ Illustrations Group (Pictures, Online pictures, Icons, Shapes, Smart Art Graphic, 3D models, Screenshot)
- ✓ Add-ins Group (Store, Insert Add-ins)
- ✓ Charts Group (Recommended charts, Maps, Pivot Chart Charts*)
- ✓ Tours Groups (3D Maps)
- ✓ Sparklines Group (Line, Column, Win/Loss)
- ✓ Filters Group (Slicer, Timeline)
- ✓ Links Group (Hyperlink)
- ✓ Text Group (TextBox, Header & Footer), WordArt, Signature line, Object)
- ✓ Symbols Group (Equation and Symbol)

***Charts** – There are eight types of charts. Colum or Bar Chart, Hierarchy Chart, Line or Area Chart, Combo Chart, Statistic Chart, Bubble Chart, Pie Chart, Waterfall, Funnel, Stock, Surface or Radar Chart.

Page Layout

Tab The features under this tab used to change the look of a workbook. The groups under this tab are:

- ✓ Themes Group (Themes, Colours, Fonts, Effects)
- ✓ Page Setup Group (Margins, Orientation, Size, Print Area, Breaks, Background, Print Titles)
- ✓ Scale to fit Group (Page scale, Width and Height)
- ✓ Sheet Options Group (Gridlines, Headings)
- ✓ Arrange Group (Bring Forward, Send Backward, Align, Group, Rotate, Selection Pane)

Formulas Tab

Formulas Tab is used to make dynamic reports by using functions. In excel, 461 functions are availed from Office 2003 to 2013. Formulas Tab is divided into **four groups**.

- ✓ Function Library (Insert Function, AutoSum, Financial & Logical Function, Date &Time, Math& Trig, Lookup &Reference, Text, More functions {Statistical, Engineering, Cube etc})
- ✓ Defined Names group (Name Manager, Define Name, Use in Formula, Create from selection)
- ✓ Formula Auditing (Trace Precedents & Dependents, Error Checking, Evaluate Formula, Watch window)
- ✓ Calculation Group (Calculate sheet, options)

Data Tab

Data tab is used for importing a large amount of data. Importing Data can be done by connecting with the server, automatically from the web, MS Access etc. It makes easy to read vast data.

- ✓ Get & Transform Data Group (Get Data, From Text/CSV, Web, Table/Range, Existing Connections)
- ✓ Queries & Connection Group (Refresh All, Properties, Edit Links, Queries, Connections)
- ✓ Sort & Filter Group (Sort, Filter, Reapply, Clear, Advanced)
- ✓ Data Tools Group (Text to columns, Flash Fill, Remove Duplicates, Data Validation, Consolidate, Manage

Data Mode, Relationships) ✓ Forecast Group (What-If Analysis, Forecast Sheet) ✓ Outline Group (Group, Ungroup, Subtotal)

Review Tab

It contains the editing feature, comments, track changes and workbook protection options. It makes it easy to share the data easily with the proper information and ensuring the security of data.

✓ Proofing Group (Spell Check, Thesaurus) ✓ Language Group (Translate) ✓ Comments Group (Comment – New, Delete, Previous, Next, Hide/Show) ✓ Protect Group (Protect Sheet, Protect Workbook, Allow Edit Ranges, Unshared workbook) ✓ Ink Group (Start Inking, Hide Ink)

View Tab

View tab helps to change the view of an Excel sheet and make it easy to view the data. This tab is useful for preparing the workbook for printing. The groups and keys under this tab are

✓ Workbook Views Group (Normal, Page Break Preview, Page Layout & Custom View) ✓ Zoom Group (Zoom {range – 10% to 400%}, Zoom to selection) ✓ Window Group (New Window, Arrange All, Freeze Panes, View side by side, Synchronous Scrolling, Reset Window, Show/Hide, Switch Windows) ✓ Macros Group (Macros)

Help Tab

The user can get help using this tab, by pressing F1 Key. ✓ Help & Support Group (Help, Contact Support, Feedback, Show Training, What's New) ✓ Community Group (Community, Blog Site, Suggest a Feature)

Charts

Charts are the graphical and pictorial representation of worksheet data.

Types of Chart

1. **Area Chart** It emphasises the magnitude of change over time.
2. **Column Chart** It shows data changes over a period of time or illustrates comparisons among items.
3. **Bar Chart** It illustrates comparisons among individual items. Categories are organised vertically and Values horizontally.
4. **Line Chart** It shows trends in data at equal intervals. It is useful for depicting the change in a value over a period of time.
5. **Pie Chart** It shows the proportional size of items that make up only one data series to the sum of the items.
6. **XY (Scatter) Chart** It shows the relationship among the numeric values in several data series or plots two groups of numbers as series of XY coordinates. Scatter compares pairs of values.

Components of Chart

1. Chart Area This is the total region surrounding the chart.
2. Plot Area The area where data is plotted. The plot area is bounded by axes in a 2D-Chart, whereas in 3D-Chart it is bounded by walls and floor.
3. Chart Title The descriptive text aimed at helping user identify the chart.
4. Axis Title This is the title given to three axis, i.e. X, Y and Z.
5. Data Series A row or column of numbers that are plotted in a chart is called a data series.

6. Gridlines These are horizontal and vertical lines, which inserted in the chart to enhance its readability.

7. Legend It helps to identify various plotted data series.

8. Data Label It provides additional information about the data marker.

9. Data Table It is defined as a range of cells that is used for testing and analysing outcomes on a large scale.

Other Terms

Workbook – It is an Excel file which contains worksheets of rows and columns.

Worksheet – A single document or sheet in a workbook which is used to store and work with data. It consists of rows and columns. In Excel 2016, Default worksheet in a workbook is one.

Row & Column Headings – It indicates the number of rows (Left of the worksheet) and alphabet of column (Top of the worksheet). The total number of rows is 1,048,576 and columns is 16,384 in the new version of Excel sheet. Column width is 255 characters and row height is 409 points.

Cell – Cell is a box which is the intersection of a row and column in a worksheet. It is the smallest block of the spreadsheet. The cell in which the user working is known as Active Cell. The maximum number of line feeds per cell is 253 in the new version of Excel.

Cell Address – The location of a cell is known as Cell Address. Example: C10 (Column: Row)

Autofill – Autofill fills the values in the cell according to a given pattern. (i.e. Months & Days, Even Numbers, Odd Numbers, tens, etc) This is done through the Fill Handle.

Formula – It is an expression which calculates the value of a cell. It always starts with a '='.

Formula Bar – It is located just below the ribbon. It shows the contents of the active cell and allows to create and view formulas.

Pivot Table – Pivot Table is an interactive report creation system. It is used to reorganize and summarize the data.

Flash Fill – Flash Fill is used to identify the patterns in existing data. It copies only required data from one column to another.

Freeze Panes – It is used to freeze rows/columns in place and making it visible when scrolling. Example – Header row visible

Macro – It is a sequence of instructions that replace a repetitive series of keyboard and mouse actions to execute. It is used in MS Word and MS Excel.

Status Bar – It is the Bar below the worksheet names that has a few buttons and indicators. Wrap Text –When text exceeds a column width/Height, wrap text automatically adjust the height/width of a cell to make all text visible.

Sparklines –They are graphs that can fit into one cell and gives the information about the data.

- \$ Sign locks the cells location to a fixed position.
- Stacked Bar Column shows the relationship of individual items to the whole.
- Chart Wizard is used to create charts in MS-Excel.
- Embedded Chart is a chart that is drawn on an existing sheet.

Basic Terms of Spreadsheet

The basic terms of spreadsheet are as follows

1. A spreadsheet is a software tool that lets one enter, calculate, manipulate and analyse set of numbers.

2. The intersection of each row and column is called cell. A cell is an individual container for data. It may hold

(i) Numbers (Constants) (ii) Formulas (Mathematical equations) (iii) Text (Labels)

3. An array of cells is called a sheet or worksheet. A worksheet holds information presented in tabular format with text.

4. A workbook is a document that contains one or more worksheet. Each new workbook has created three worksheets by default.

5. A row is given a number that identifies it starts from 1, 2, 3, 4, 5, ... and so on.

6. A column is given a letter that identifies it starts from A ... Z, AA ... AZ, BA, BB ... BZ and so on.

7. Active cell is a cell in which you are currently working.

8. A cell pointer is a cell-boundary that specifies which cell is active at that moment.

9. A formula is an equation that calculates the value to be displayed. A formula must begin with Equal To () = sign.

10. A cell address is used to specified the intersecting of row and column of the letter and number on the worksheet.

Microsoft PowerPoint

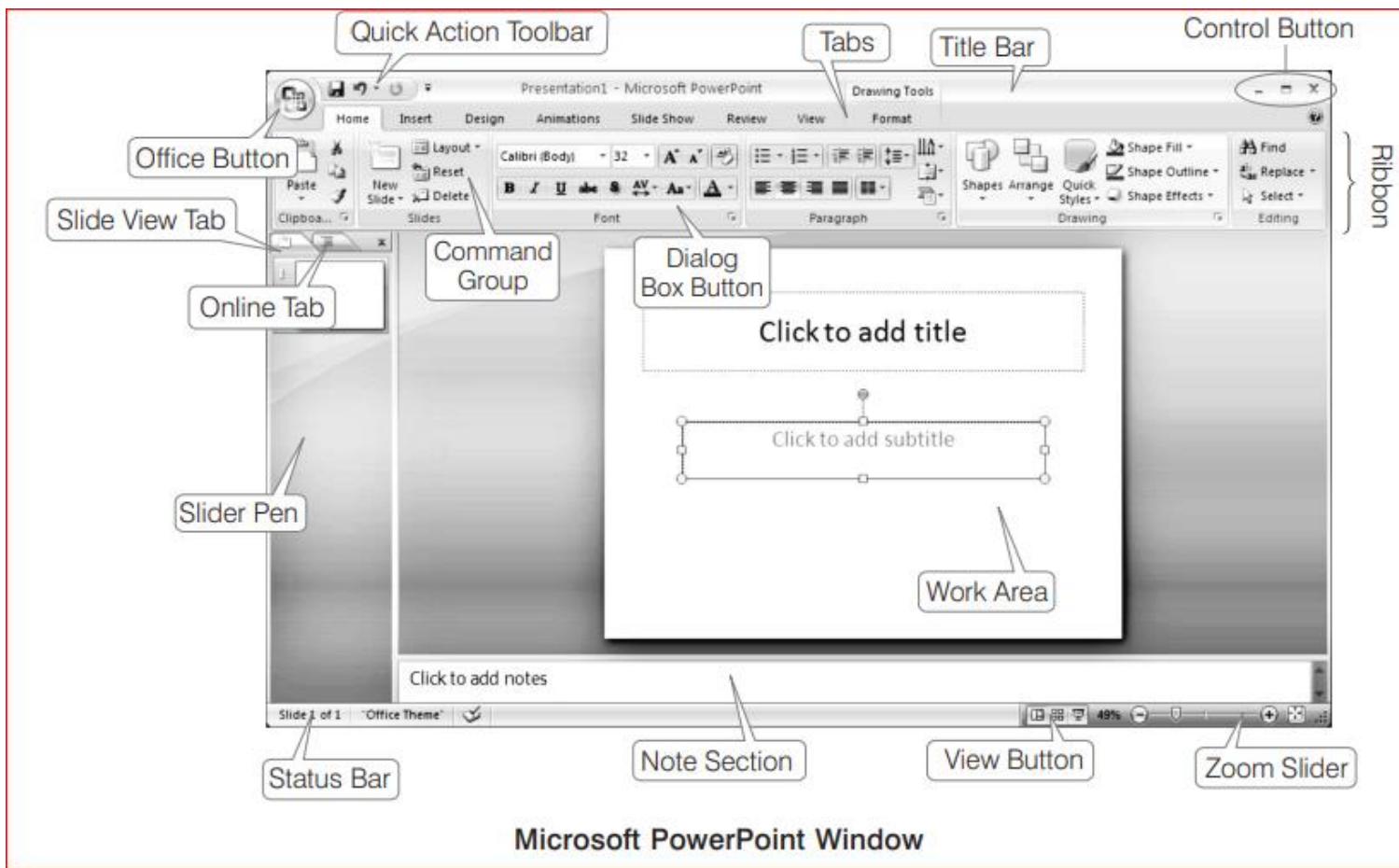
Presentation is the practice of showing and explaining the contents of a topic to an audience or a learner visually. The application software that can create professional looking visual aids is called presentation graphics software.

The presentation software is used for creation of the slides and to display the information in the form of presentation of slides.

A presentation software provides tools like editor that allows insertion and formatting of text and methods for inserting and manipulating graphics images along with sound and visual effects.

To start the MS-PowerPoint software, we need to Click Start button → All Programs → Microsoft Office → Microsoft PowerPoint 2010.

By default, the name of the blank document is Presentation1.ppt, where .ppt or .pptx is the extension of a PowerPoint file.



- Trigger is defined as an object or item that performs on the slide when we click the mouse.
- The MS-PowerPoint can maximum zoom to 400% only.
- In MS-PowerPoint, we can add many types of image and sound format such as .gif, .bmp, .png, .jpg, .giv, .wav, .mid, etc.

In PowerPoint 2016 there are 9 tabs followed by a new feature of “Tell me what you want to do” arranged in a horizontal fashion. The tabs are as follows: File, Home, Insert, design, Transition, Animation, Slide Show, Review, and View.

The Ribbons in MS Power-point 2016 are divided into following tabs.

Home Tab

The Home Tab includes the commands for formatting presentations. The Keys and Groups under the Home Tab are:

✓ Clipboard Group (Cut, Copy, Paste, Format Painter) ✓ Slides Group (New slide, Layout, Reset, Section) ✓ Font Group (Font Style & size {Max. size is 96 in dropdown selection}, Text Shadow, Bold, Underline, Italic, Strikethrough, Clear All Formatting, Character Spacing, Change case) ✓ Paragraph Group (Bulleting, Numbering, Align Text, Text direction, Convert to SmartArt) ✓ Drawing Group (Shapes, Arrange, Quick Styles, Shape Fill, Shape Outline, Shape Effects) ✓ Editing Group (Find, Replace, Select)

Insert Tab

It is used to add features such as tables, pictures, clip art, shapes, charts, word art, or headers, and footers into a presentation. The groups and buttons in this tab are:

✓ Slides Group (New Slide) ✓ Tables Group (Draw/Add Table) ✓ Images Group (Pictures, Online Pictures, Screenshot, Photo Album) ✓ Illustrations Group (Shapes, Icons, 3D models, Smart Art, Chart) ✓ Add-ins Group (Store, Add-ins) ✓ Links Group (Zoom, Link, Action) ✓ Comments (Add comment, Edit& Delete Comment) ✓ Text Group (TextBox, Header & Footer, Word Art, Date & Time, Slide number, Object) ✓ Symbols Group (Equation and Symbol) ✓ Media Group (Video, Audio, Screen Recording)

Design Tab

The Design tab holds commands related to the presence of slides like page setup and slide orientation. The group and Keys under this tab are:

✓ Themes Group (Listed Slide Themes) ✓ Variants Group (Listed Variants) ✓ Customize Group (Slide Size, Format Background) ✓ Designer Group (Design Ideas)

Transition Tab

Transitions tab is used to add transitions to a slide and to customize transition effects. Group and Keys of Transition Tab are:

✓ Preview (to view slides) ✓ Transition to this slide (Listed transition, Effect options) ✓ Timing Group (Sound in slides, Duration, Apply to all slides, Advance slide)

Animation Tab

It is used to add animation to text in a slide and to manage the animation order. The Groups and Keys are: ✓ Preview Group (Slide's Preview) ✓ Animation Group (Listed Animation, Effect Options) ✓ Advanced Animation (Add Animation, Animation Pane, Trigger, Animation Painter) ✓ Timing Group (Start, Duration, Delay of slides, Reorder Animation)

Slideshow Tab

This tab is used to finalize the slideshow details, timings, and more. The Keys and groups under this tab are: ✓ Start Slide Show Group (From Beginning, From Current Slide, Present Online, Custom Slideshow) ✓ Set up Group (Set up slideshow, Hide slide, Rehearse timings, Record Slide Show) ✓ Monitors Group

Review Tab

Review tab is used to check spelling, to collaborate by adding comments, and to access editor tools. The groups are: ✓ Proofing Group (Spelling, Thesaurus) ✓ Language Group (Translate, Language) ✓ Comments Group (New comment, Delete Previous/next Comment) ✓ Compare Group (Compare, Accept, Reject, End Review, reviewing Pane) ✓ Ink Group (Start inking, Hide ink) ✓ OneNote Group (Linked Notes)

View Tab

View tab is used to access the various presentation views, to show and hide the ruler and grid lines, and more. ✓

Presentation Views Group (Normal, Outline view, Slide Sorter, Notes Page, Reading view) ✓ Masters View Group (Slide Master, Handout Master, Notes Master) ✓ Show Group (Ruler, Gridlines, Guides, Notes) ✓ Zoom Group (Zoom {10% to 400%}, Fit to the window) ✓ Colour/Grayscale Group (Colour, Grayscale, Black & White) ✓ Window Group (New window, Arrange All, Cascade, Move Split) ✓ Macros Group (Macros)

Other Terms

Presentation – A Presentation is a collection of individual slides that contain information on a topic with audio, visual features. It makes an interaction between a speaker and an audience.

Design Template - A PowerPoint template is a pattern of a slide whose format and colour scheme is used as the basis for other presentations. It can contain layouts, theme colours, theme fonts, theme effects, background styles, and even content.

Master Slide – A slide that controls the properties such as theme, layout, background, colour, fonts, and positioning of all other slides in a presentation.

Normal View - Normal view is used for creating, editing and viewing presentation slides. It contains all three view panes such as Slides, Outline and Notes.

Greyscale - Grayscale is a variety of shades of grey (Black and white combination) without apparent colour.

Notes Pane - It is used to add notes and graphics that apply to the current slide in the presentation. It is also used to print the notes.

Slides Pane – Slide Pane displays the slides thumbnails. It allows the user to view and edit the slides. Outline Pane – Outline Pane displays the text from the slides.

Slide Show View – It is used to display the presentation. It is the way to preview the presentation.

Slide Sorter View – It shows all the slides in a presentation as thumbnails. It is used to reorganize, insert, delete and copy the presentation slides.

Slide Timing – It is the time period that a slide seems on the screen.

Task Pane – It allows to access commands like getting started, PowerPoint help, slide, new presentation etc related to a specific task.

AutoContent Wizard - A wizard helps to create a presentation. It helps with a general structure and suggested topics based on the user's view regarding the presentation output.

Components of Microsoft PowerPoint

Various components of MS-PowerPoint 2010 window are described below

1. Title Bar It contains the name of currently opened file followed by software name.

2. Ribbon It is same as Word and Excel, just few tabs are different like Animations, Slide Show, etc.

3. Slide It appears in the centre of the window. You can create your presentation by adding content to the slides.

4. Slide Pane This area of PowerPoint window displays all the slides that are added in the presentation.

5. Slide View Tab This tab displays a thumbnail view of all the slides.

6. Outline View Tab This tab displays the text contained in the presentation in an outline format.

7. Notes Section This section can be used for creating notes.

8. Status Bar It displays the number of the slide that is currently being displayed.

Microsoft Access

A database is a collection of logically related and similar data. Database stores similar kind of data for a specific purpose that is organized in such a manner that any information can be retrieved from it, when needed.

Microsoft Access is an application which allows the creating of database. Microsoft Access is a Relational Database Management System (RDBMS).

Microsoft Outlook

It is an E-mail client and personal information manager that is available as a part of Microsoft Office suite. Windows mobile devices are the version of MS-Outlook, enables users to synchronise their E-mails data to their smartphones.

MS-Outlook can work with Microsoft exchange server and Microsoft sharepoint server for multiple users in an organisation such as shared mail boxes, calendars, exchange public folders, sharepoint lists and meeting schedules

