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Introduction of Computer

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 reproduced from data.
Data is meaningless and valueless.	Information is meaningful and valuable.

For the decision 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 → Process → Output

Simplest Workflow of Computer

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 **C**ommon **O**perating **M**achine **P**urposely **U**sed for **T**echnological and **E**ducational **R**esearch.

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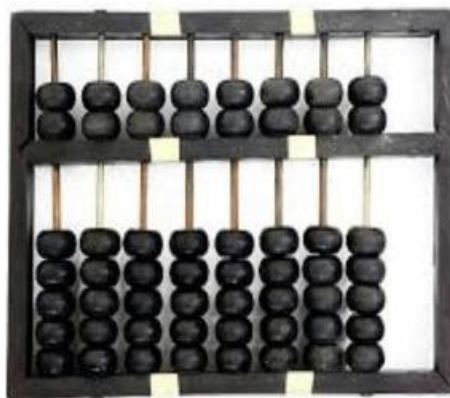
The history of computer begins with the birth of abacus which is **believed to be the first computer**. It is said that Chinese invented Abacus around 4,000 years ago.

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

Napier's Bones
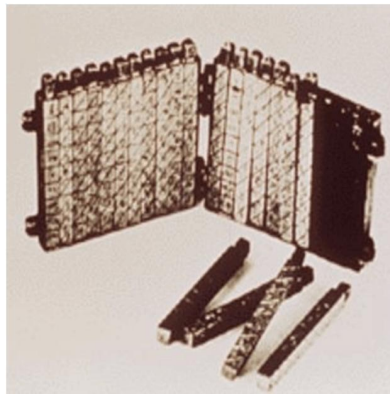
It was a manually-operated calculating device which was invented by **John Napier** (1550-1617) of Merchiston. In this calculating tool, he used **9 different ivory strips or bones** marked with numbers to multiply and divide. So, the tool became known as "Napier's Bones. It was also the first machine to use the decimal point

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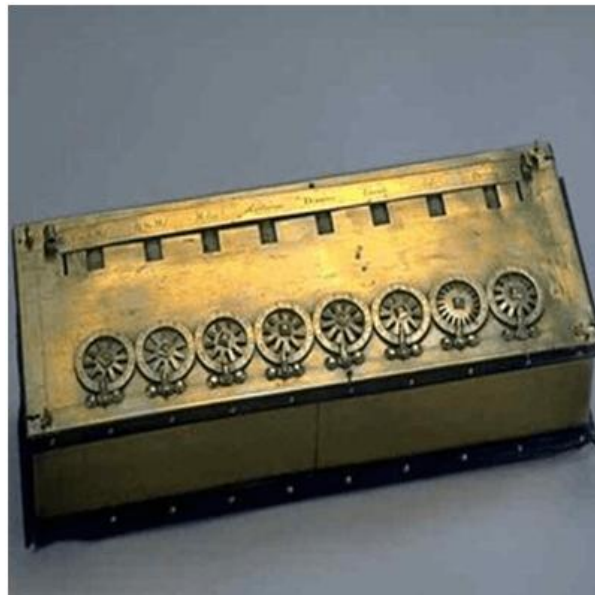
Pascaline is also known **as Arithmetic Machine** or Adding Machine. It was invented between 1642 and 1644 by a French mathematician-philosopher Biaise Pascal. It is believed that it was the **first mechanical and automatic calculator**.

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It could only perform addition and subtraction. It was **a wooden box with a series of gears and 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.

Stepped Reckoner or Leibnitz wheel:

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.

Difference Engine:

In the early 1820s, it was designed by **Charles Babbage** 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**.

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Analytical Engine:
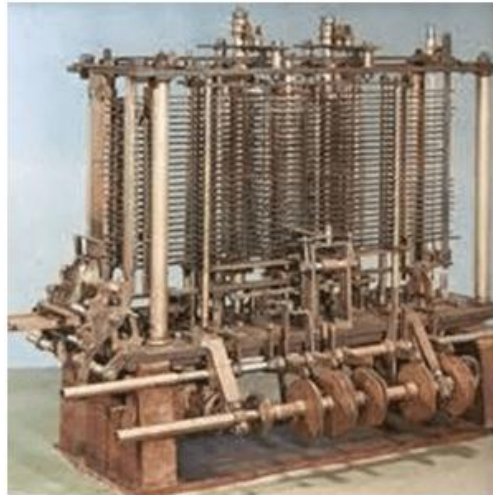
This calculating machine was also developed by **Charles Babbage** in 1830. It was a mechanical computer that **used punch-cards** as input. It was capable of solving any mathematical problem and **storing information as a permanent memory**.

Tabulating Machine:


It was invented in 1890, 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.

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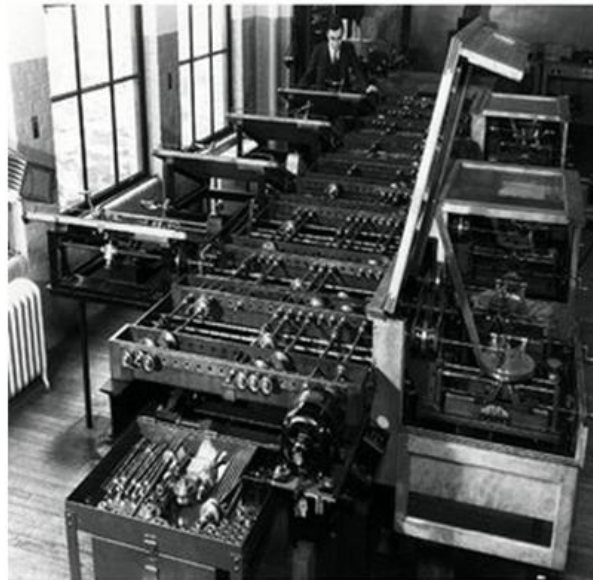
It was the **first electronic computer** introduced in the United States in 1930. It was an **analog device** invented by Vannevar Bush. This machine has **vacuum tubes to switch electrical signals** to perform calculations. It could do **25** calculations in few minutes.

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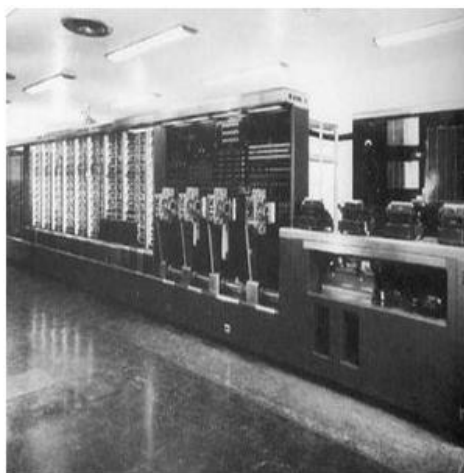
The next major changes in the history of computer began in 1937 when Howard Aiken planned to develop **a machine that could perform calculations involving large numbers**. In 1944, Mark I computer was built as a partnership between **IBM and Harvard**. It was the **first programmable digital computer.**

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Generation of Computer

First Generation (1940-1956):

Hardware:

The hardware used in the first generation of computers were:

- **Vacuum Tubes**
- **Punch Cards**.

Features:

Following are the features of first generation computers –

- 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.

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 –

  o ENIAC

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- o UNIVACTBM 701
- o IBM-701
- o 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:

The hardware used in the second generation of computers were:

- **Transistors**
- **Magnetic Tapes**

Features

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

Memory

The capacity of the memory was **32,000 bits**.

Data Input

The input was provided through **punched cards**.

Examples

The examples of second generation computers are –

- o Honeywell 400

- o CDC 1604
- o IBM 7030

Third Generation (1964-1971):

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

Hardware:

The hardware used in the third generation of computers were

- ▪ **Integrated Circuits made from semi-conductor materials**
- ▪ **Large capacity disks and magnetic tapes**

Features

The features of the third generation computers are –

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

Memory

The capacity of the memory was **128,000 bits**.

Data Input

The input was provided through keyboards and monitors.

Examples

The examples of third generation computers are –

- o IBM 360/370
- o CDC 6600
- o PDP 8/11

Fourth Generation (1972-2010):

Fourth generation computers have the following components and features –

Hardware

The Hardware used in the fourth generation of computers were –

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

Features

It supports features like –

- 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

The examples of fourth generation computers are –

- o Apple II
- o VAX 9000
- o CRAY 1 (super computers)

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o 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

The Hardware used in the fifth generation of computers are –

- **Integrated Circuits with VLSI and Nano technology**
- **Large capacity hard disk with RAID support**
- **Powerful servers, Internet, Cluster computing**

Features

It supports features like –

- 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

The examples of fifth generation computers are –

- o IBM
- o Pentium
- o PARAM

Computer Hardware and Software

Hardware:

Computer hardware is the **collection of physical parts** of a computer system. This includes the computer case, monitor, keyboard, and mouse. It also includes all the parts inside the computer case, such as the hard disk drive, motherboard, video card, and many others.

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.**

Software:

Software is a **set of instructions, data or programs used to operate computers and execute specific tasks**. Opposite of hardware, which describes the physical aspects of a computer, software is a generic term used to refer to applications, scripts and programs that run on a device.

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

System Software:

System software is the **main software that runs the computer**. When you turn on the computer it **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.**

Four types of system software are the following.

- Operating System
- Utility Programs
- Device drivers
- Language translators.

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 - Linux, Unix, Microsoft Windows XP etc.

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.

Device Drivers - A device driver is designed to **enable interaction with hardware devices**. It controls a device that is **attached** to your computer. Printers, Displays, CDROM readers, Disk drives etc are the examples of the device driver.

Language Translator – Language Translator translates **the high-level language program** (input) into an **equivalent machine language program** (output). It also detects and reports the error during translation. Assembler , Compiler, Interpreter are types of a Language Translator.

Assembler – It converts **assembly language program into machine language**.

Compiler – It converts the program in a **high-level language into low-level language** and reports all the errors of the program along with the line numbers. C, C++ use compilers.

Interpreter – It converts the programs in a **high-level language to low-level language**. It **translates line by line and reports the error once after completing** the translation process. It gives better error diagnostics than a compiler. Python, BASIC, and Ruby use interpreters.

Application Software:

Applications software is **a set of programs designed to perform a specific task**. 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.

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

Hardware	Software
Physical parts of the computer are called hardware.	A set of instructions given to the computer is called software
You can touch, see and feel hardware	You cannot touch and feel software
Hardware is constructed using physical materials or components.	Software is developed by writing instructions in programming language
Computer is hardware, which operates under the control of a software.	The operations of computer are controlled through software
If hardware is damaged, it is replaced with new one	If software is damaged or corrupted, its backup copy can be reinstalled
Hardware is not affected by computer viruses	Software is affected by computer viruses
Hardware cannot be transferred from one place to another electronically through network	Software can be transferred from one place to another electronically through network
User cannot make new duplicate copies of the hardware	User can make many new duplicate copies of the software

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Computer Memory

Memory is the best essential **element of a computer** because computer can't perform simple tasks. 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

Primary Memory:

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. Primary memory is also known as primary storage or main memory

1.RAM(Volatile Memory).
2. ROM(Non Volatile Memory).

Random Access Memory (RAM):
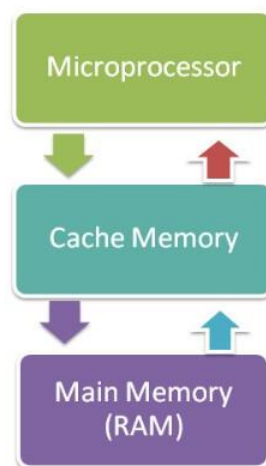
It is a **volatile memory**. It means it does not store data or instructions permanently. It is read/write memory which stores data till the machine is working. When you switch on the computer and perform some task the data and instructions from the hard disk are stored in RAM.

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. DRAM- Dynamic memory must be **constantly refreshed**, or it loses its contents. This type of memory is more economical.

2. SRAM- 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.

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

Read Only Memory (ROM):

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It is a non-volatile memory. It means it does not lose its data or programs that are written on it at the time of manufacture. So it is a permanent memory that contains all important data and instructions needed to perform important tasks like the boot process.

ROM memory has several models such names are following.

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.

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** and it **erases chip** is reprogrammed.

3. EEPROM: Electrically Erasable Programmable Read Only Memory similar to the EPROM but it uses **electrical beam for erase** the data of ROM.

Some other memories are

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.

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.

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.

Secondary Memory:

The storage devices in the computer or connected to the computer are known as secondary memory of the computer. It is **non-volatile in nature so permanently stores** the data even when the computer is turned off. The CPU can't directly access the secondary memory. First the secondary memory data is transferred to primary

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memory then CPU can access it. Common secondary storage devices are the hard disk and optical disks. The hard disk has enormous storage capacity compared to main memory.

There are three main types of secondary storage in a computer system:

o **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.

o **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.

o **Magnetic storage devices**(such as hard disk drives): 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 magnetised section represents a binary '1' and a demagnetised section represents a binary '0'.

Hard 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.

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

• **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

• **DVD:** similar to CD, but with significantly larger storage capacity (4.7GB)

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

Floppy Disk: Floppy disk is composed of a thin, flexible magnetic disk sealed in a square plastic carrier. 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).

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

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

Primary memory	Secondary memory
The primary memory is categorized as volatile & nonvolatile memories.	The secondary memory is always a non-volatile memory.
These memories are also called internal memory.	Secondary memory is known as a Backup memory or Additional memory or Auxiliary memory.

Data is directly accessed by the processing unit.	Data cannot be accessed directly by the processor. It is first copied from secondary memory to primary memory. Only then CPU can access it.
It holds data or information that is currently being used by the processing unit. Capacity is usually in 16 to 32 GB	It stores a substantial amount of data and information. Capacity is generally from 200GB to terabytes.
Primary memory can be accessed by the data bus.	Secondary memory is accessed by I/O channels.
Primary memory is costlier than secondary memory.	Secondary memory is cheaper than primary memory.

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.
Nibble	A group of 4 bits is called nibble.
Byte	A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.
Kilobyte (KB)	1 KB = 1024 Bytes
Megabyte (MB)	1 MB = 1024 KB
GigaByte (GB)	1 GB = 1024 MB
TeraByte (TB)	1 TB = 1024 GB
PetaByte (PB)	1 PB = 1024 TB
Exa Byte	1 EB = 1024 PB
Zetta Byte	1 ZB = 1024 EB
Yotta Byte	1 YB = 1024 ZB

Types of Computer

We can categorize computer by three ways:
- o Based on data handling capabilities
- o Based on size.
- o Based on Utility

On the basis of data handling capabilities, the computer is of three types:
- Analogue Computer
- Digital Computer
- Hybrid Computer

Analogue Computer

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 and mercury thermometer are examples of analogue computers.

Digital Computer

Digital computer is designed to perform calculations and logical operations at high speed. 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.

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. For example, a processor is used in petrol pumps that converts the measurements of fuel flow into quantity and price.

On the basis of size, the computer can be of four types:
- Microcomputer
- Mini Computer
- Mainframe computer
- Supercomputer

Microcomputer

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.

• **Desktop Computer**: a personal or micro-mini computer sufficient to fit on a desk.

• **Laptop Computer**: a portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.

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• **Palmtop Computer/Digital Diary /Notebook /PDAs**: a hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.

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**.

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

Supercomputer

Supercomputers are the biggest and fastest computers. They are designed to process huge amount of data. A supercomputer can process **trillions of instructions in a second**. It has thousands of interconnected processors. Supercomputers are particularly used in scientific and engineering applications such as weather forecasting, scientific simulations and nuclear energy research. First supercomputer was developed by Roger Cray in 1976. Some other computers are:

Miniframe computer

It is a midsize multiprocessing computer. It consists **of two or more processors** and can support **4 to 200 users** at one time. Miniframe computers are used in institutes and departments for the tasks such as billing, accounting and inventory management.

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.

On the basis of Utility, the computer can be of two types:

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, smartphones and tablets are general-purpose devices.

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.

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Input and Output device

Input device:

An input device is a **piece of computer hardware equipment used to provide data and control signals to an information processing system** such as a computer or information appliance. Examples of input devices include keyboards, mouse, scanners, digital cameras, joysticks, and microphones.

Following are some of the important input devices which are used in a computer –

Keyboard: The keyboard is a basic input device that is used to enter data into a computer or any other electronic device by pressing keys. It has different sets of keys for letters, numbers, characters, and functions. Keyboards are connected to a computer through USB or a Bluetooth device for wireless communication.

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. The keys on the keyboard are as follows –

Keys	Description
Typing Keys	These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.
Numeric Keypad	It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
Function Keys	The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
Control keys	These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc)
Special Purpose Keys	Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

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Mouse: The mouse is a hand-held input device which is used to move cursor or pointer across the screen. It is designed to be used on a flat surface and generally has left and right button and a scroll wheel between them. 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. Some mouse comes with integrated features such as extra buttons to perform different buttons.

Common types of the mouse:
- o Trackball Mouse
- o Mechanical Mouse
- o Optical Mouse
- o Cordless or Wireless Mouse

Scanner: The scanner uses the pictures and pages of text as input. It scans the picture or a document. The scanned picture or document then converted into a digital format or file and is displayed on the screen as an output. It uses optical character recognition techniques to convert images into digital ones.

Some of the common types of scanners are as follows:
- o Flatbed Scanner
- o Handheld Scanner
- o Sheetfed Scanner
- o Drum Scanner
- o Photo Scanner

Joystick: A joystick is also a pointing input device like a mouse. It is made up of a stick with a spherical base. The base is fitted in a socket that allows free movement of the stick. The movement of stick controls the cursor or pointer on the screen.

Light Pen: A light pen is a computer input device that looks like a pen. The tip of the light pen contains a light-sensitive detector that enables the user to point to or select objects on the display screen. Its light sensitive tip detects the object location and sends the corresponding signals to the CPU.

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.

Microphone: The microphone is a computer input device that is used to input the sound. It 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.

Magnetic Ink Character Recognition (MICR): MICR computer input device is designed to read the text printed with magnetic ink. MICR is a character recognition technology that makes use of special magnetized ink which is sensitive to magnetic fields. It is widely used in banks to process the cheques and other organizations where security is a major concern.

Optical Character Reader (OCR): OCR computer input device is designed to convert the scanned images of handwritten, typed or printed text into digital text. It is widely used in offices and libraries to convert documents and books into electronic files.

Bar Code Readers: Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner

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.

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

Following are some of the important output devices used in a computer.

- o Monitors
- o Graphic Plotter
- o Printer
- o Projector

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.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor:

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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 –

- o Large in Size
- o 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).

Printer:

A printer produces hard copies of the processed data. It enables the user, to print images, text or any other information onto the paper.

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

1) Impact Printers: They are of two types:
- o Character Printers
  - Dot Matrix printers

- • Daisy Wheel printers
- o Line printers
  - • Drum printers
  - • Chain printers
2) Non-impact printers: They are of two types:
- o Laser printers
- o Inkjet printers

Impact Printer: 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. 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.

Dot Matrix Printer:

Dot Matrix Printer is an impact printer. 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. The print head contains pins that produce a pattern of dots on the paper to form the individual characters. The speed of Dot Matrix printers is around 200-500 characters per second.

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. the speed is very low around 25-50 characters per second

Line Printers: Line printer, which is also as a bar printer, prints one line at a time. It is a high-speed impact printer as it can print 500 to 3000 lines per minute. Drum printer and chain printer are examples of line printers.

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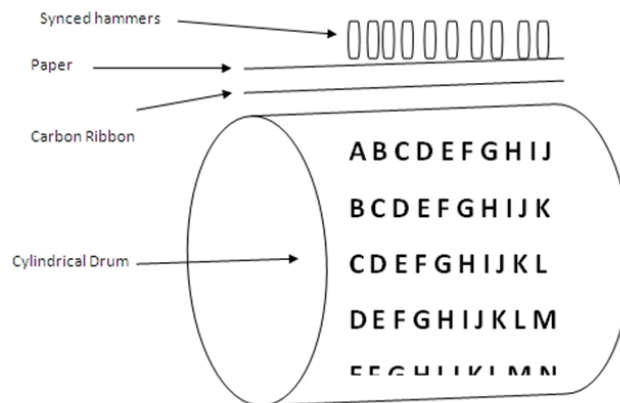
Drum printer is a line printer that is made of a rotating drum to print characters. The drum has circular bands of characters on its surface. It has a separate hammer for each band of characters. When you print, the drum rotates, and when the desired character comes under the hammer, the hammer strikes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

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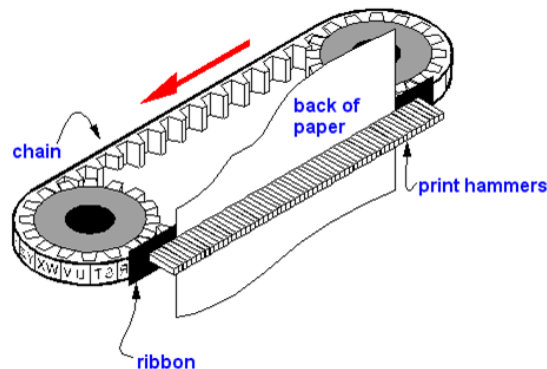
Chain printer is a line printer that uses a rotating chain to print characters. The characters are embossed on the surface of the chain. The chain rotates horizontally around a set of hammers, for each print location one hammer is provided, i.e., the total number of hammers is equal to the total number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

Non-Impact Printer:

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. The common types of non-impact printers are Laser printer and Inkjet printer:

Laser Printer:

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 Printer:

The inkjet printer is a non-impact printer that prints images and characters by spraying fine, ionized drops of ink. 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.

Projector: A projector is an output device that enables the user to project the output onto a large surface such as a big screen or wall. It can be connected to a computer and similar devices to project their output onto a screen. It uses light and lenses to produce magnified texts, images, and videos. So, it is an ideal output device to give presentations or to teach a large number of people.

Computer Architecture and Components

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.
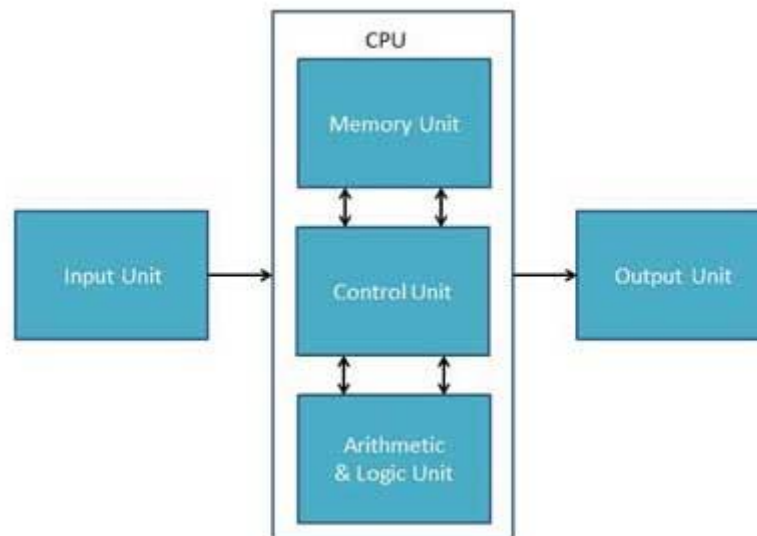
S.No.	Operation	Description
1	Take Input	The process of entering data and instructions into the computer system.
2	Store Data	Saving data and instructions so that they are available for processing as and when required.
3	Processing Data	Performing arithmetic, and logical operations on data in order to 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.

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.

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.

- Central Processing Unit (CPU) consists of the following features –
- 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.

CPU itself has the following three components –
  o ALU (Arithmetic Logic Unit)

- o Memory Unit
- o Control Unit

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. Primary memory and secondary memory are two types of memories in the computer.

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.

Control Unit

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

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.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely,

- o Arithmetic Section
- o Logic Section

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.

Logic Section

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

Output Unit

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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.

Types of Operating system and its functions

An Operating System (OS) is an interface between computer user and computer hardware. An operating system is a 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.

Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc.

Structure of a Computer System:
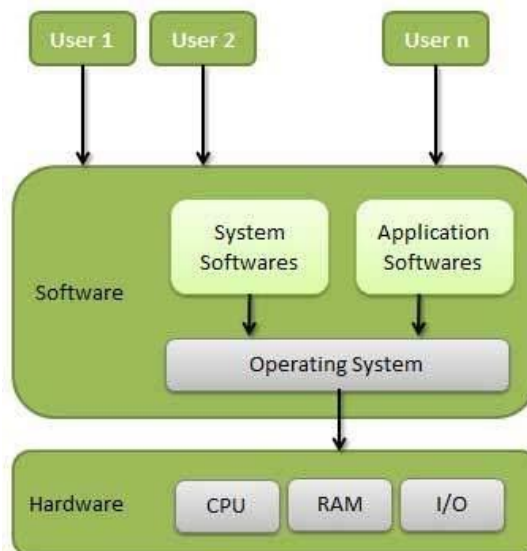
Functions of operating system:

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:

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Memory management 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 in the main memory.

An Operating System does the following activities for memory management –

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

Processor Management:

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 –

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

Device Management:

An Operating System manages device communication via their respective drivers. It does the following activities for device management –

- • Keeps tracks of all devices. Program responsible for this task is known as the I/O controller.
- • Decides which process gets the device when and for how much time.
- • Allocates the device in the efficient way.
- • De-allocates devices.

File Management:

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

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 softwares and users – Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

Types of Operating System:

Batch operating system:

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.

Time-sharing 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.

Multiprogramming Operating System:

Multiprogramming is an extension to the batch processing where the CPU is kept always busy. 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.

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.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.

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.

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.

There are two types of real-time operating systems.
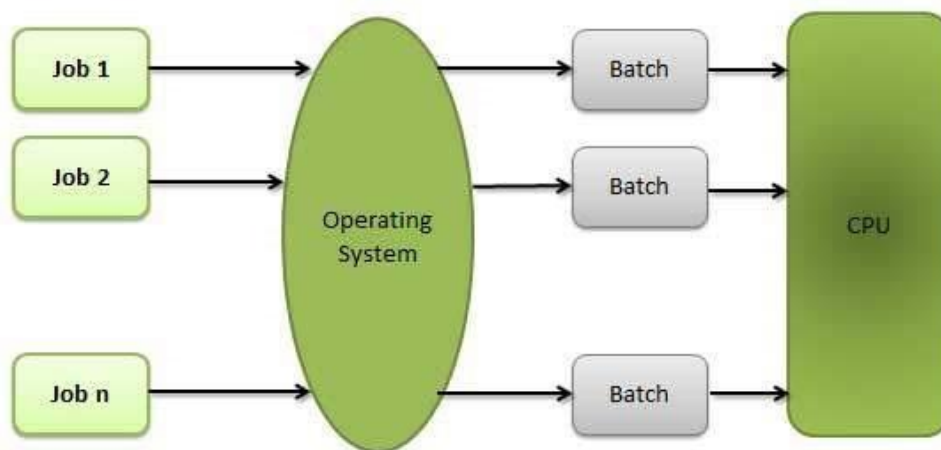
Hard real-time systems:
Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems, secondary storage is limited or missing and the data is stored in ROM. In these systems, virtual memory is almost never found.

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 reality, Advanced Scientific Projects like undersea exploration and planetary rovers, etc.

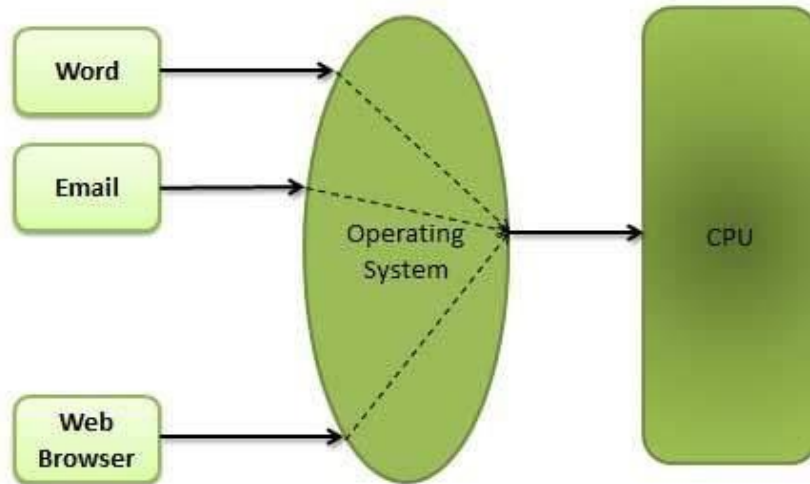**Batch processing:**
Batch processing is a technique in which an Operating System collects the programs and data together in a batch before processing starts

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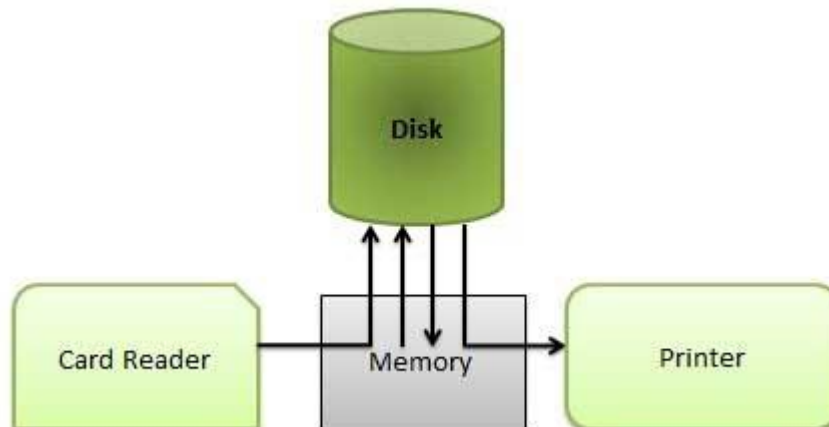
Booting: When the computer starts, the operating system is first loaded (as it is essential for running all other programs), this process is known as booting.

Cold Boot: Turn ON the computer from an OFF position is called Cold Booting.
Warm Boot: A computer system starts up/reset from a complete powerless state is called Warm Booting.
Firmwar: 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.

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, XOR, NOT, NAND, NOR, 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.

AND GATE:

The AND gate is an electronic circuit which gives a high output only if all its inputs are high. The AND operation is represented by a dot (.) sign.

AND Gate:
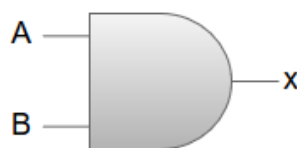
Truth Table:

Algebraic Function: $x = AB$

A	B	x
0	0	0
0	1	0
1	0	0
1	1	1

OR GATE:

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.

OR Gate:

Algebraic Function: $x = A + B$

Truth Table:

A	B	x
0	0	0
0	1	1
1	0	1
1	1	1

NOT GATE:

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.
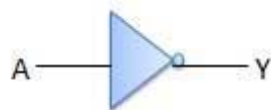
NAND GATE:

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.

NAND Gate:
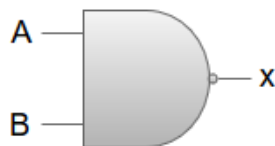
Algebraic Function: $x = (AB)'$

Truth Table:

A	B	x
0	0	1
0	1	1
1	0	1
1	1	0

NOR GATE:

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. The small circle represents inversion.

NOR Gate:

Truth Table:

A	B	x
0	0	1
0	1	0
1	0	0
1	1	0

Algebraic Function: $x = (A+B)'$

Exclusive-OR/ XOR GATE:

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:

Truth Table:

A	B	x
0	0	0
0	1	1
1	0	1
1	1	0

Algebraic Function: $x = A \oplus B$

or

$x = A'B + AB'$

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.

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Exclusive-NOR Gate:

Algebraic Function: $x = (A \oplus B)'$

or

$x = A'B' + AB$

Truth Table:

A	B	x
0	0	1
0	1	0
1	0	0
1	1	1

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.

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 number 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

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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.

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)

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 and 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

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 2^0
- 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 8^0
- 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, 16^0
- Last position in a hexadecimal number represents a x power of the base (16). Example 16^x where x represents the last position – 1

Programming Languages

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 comes with its own set of vocabulary and rules, better known as syntax

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 central processing unit (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.

Database management system

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

Database management system is software which is used to **manage the database**. For example: MySQL, Oracle, etc are a very popular commercial database 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.

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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.
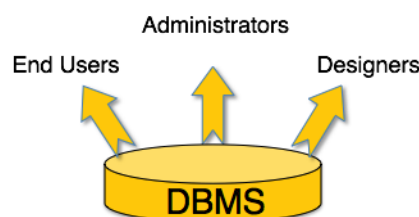
Users

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.
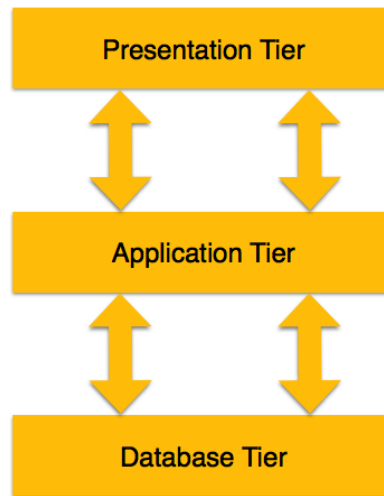
Database (Data) Tier − At this tier, the database resides **along with its query processing** languages. We also have the relations that define the data and their constraints at this level.

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.

Entity-Relationship Model:
ER Model is based on −
- ❖ Entities and their attributes.
- ❖ Relationships among entities.

These concepts are explained below

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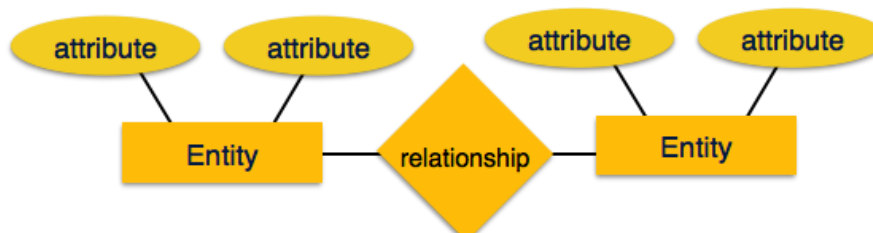
Entity – An entity in an ER Model is a real-world entity having properties called **attributes**. Every attribute is defined by its set of values called **domain**.

Relationship – The logical association among entities is called **relationship**. Relationships are **mapped with entities** in various ways. Mapping cardinalities define the number of association between two entities.

Mapping cardinalities –
- o One to one
- o One to many
- o Many to one
- o Many to many

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.

Computer Network

- ➢ Computer Network is a group of computers connected with each other through **wires, optical fibres 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.
- ➢ In the case of computer network technology, there are several types of networks that vary from simple to complex level.

Computer Network Architecture:

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

Peer-To-Peer network:

- Peer-To-Peer network is a network in which all the computers are linked together with **equal privilege and responsibilities** for processing the data.
- Peer-To-Peer network is useful for small environments, usually up to 10 computers.
- Peer-To-Peer network has no dedicated server.
- 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.
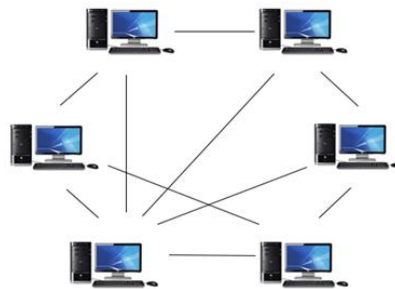
Client/Server Network:

- 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.
- 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.
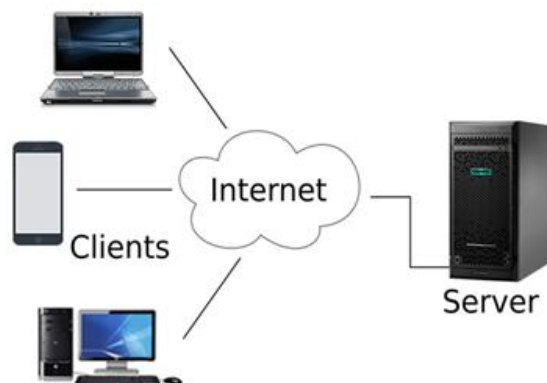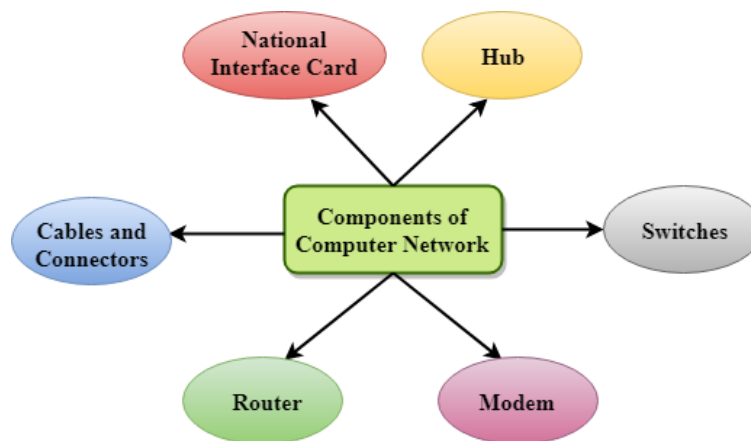

Components of Computer Network:

Computer network components are the major parts which are needed to install the software. Some important network components are NIC, switch, cable, hub, router, and modem. Depending on the type of network that we

need to install, some network components can also be removed. For example, the wireless network does not require a cable.

NIC:

- NIC stands for **network interface card.**
- NIC 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 and wired 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.

Hub:

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.

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.

Cables and connectors:

Cable is a transmission media that transmits the **communication signals**. There are three types of cables:

➢ **Twisted pair cable:** It is a high-speed cable that transmits the data over 1Gbps or more.

➢ **Coaxial cable:** Coaxial cable resembles like a TV installation cable. Coaxial cable is more expensive than twisted pair cable, but it provides the high data transmission speed.

➢ **Fibre optic cable:** Fibre optic cable is a high-speed cable that transmits the data using light beams. It provides high data transmission speed as compared to other cables. It is more expensive as compared to other cables, so it is installed at the government level.

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 forward the incoming packets to another network.

• 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.

Modem:

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.It stands for Modulator/Demodulator. It converts the digital data into an analog signal over the telephone lines.

Some important Uses Of Computer Network:

❖ **Resource sharing:** Resource sharing is the sharing of resources such as programs, printers, and data among the users on the network without the requirement of the physical location of the resource and user.

❖ **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.

❖ **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.

❖ **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, i.e., they are doing their business over the internet.

Computer Network Types

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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.

A computer network can be categorized by their size. A computer network is mainly of four types:

- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)

LAN(Local Area Network):

- Local Area Network is a group of computers connected to each other in a **small area** such as building, office.
- LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- The data is transferred at an extremely faster rate in Local Area Network.

PAN(Personal Area Network):

- Personal Area Network is a network arranged **within an individual person, typically within a range of 10 meters.**
- Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network.
- Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network.
- Personal Area Network covers an area of 30 feet.
- Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.

There are two types of Personal Area Network:

- **Wireless Personal Area Network:** Wireless Personal Area Network is developed by simply using wireless technologies such as WiFi, Bluetooth. It is a low range network.
- **Wired Personal Area Network:** Wired Personal Area Network is created by using the USB

MAN(Metropolitan Area Network):

- A metropolitan area network is a network that covers a **larger geographic area** by interconnecting a different LAN to form a larger network.
- Government agencies use MAN to connect to the citizens and private industries.

WAN(Wide Area Network):

- A Wide Area Network is a network that extends over a large geographical area such as **states or countries.**

- A Wide Area Network is quite bigger network than the LAN.
- A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.

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.

Computer Network Topology

Topology defines the structure of the network of **how all the components are interconnected** to each other.
There are six types of topology
- Bus Topology
- Ring Topology
- Star Topology
- Tree topology
- Mesh topology
- Hybrid Topology

Bus Topology:

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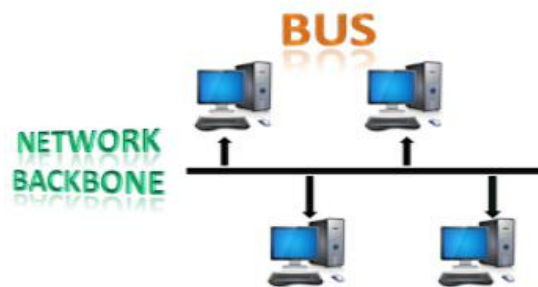
- Data network with bus topology has a linear transmission cable, usually coaxial, to which many network devices and workstations are attached along the length.
- Server is at one end of the bus. When a workstation has to send data, it transmits packets with destination address in its header along the 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.

Ring Topology

- 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.
- 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 raverses 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.

Star Topology:
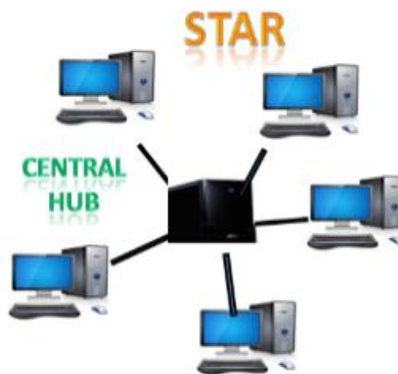
- In star topology, server is connected to each node individually.
- Server is also called the **central node.**
- Any exchange of data between two nodes must take place through the server.
- It is the most popular topology for information and voice networks as central node can process data received from source node before sending it to the destination node.

Tree Topology:

- Tree topology has a group of star networks connected to **a linear bus backbone cable.**
- It incorporates features of both star and bus topologies.
- Tree topology is also called hierarchical topology.

Mesh topology:

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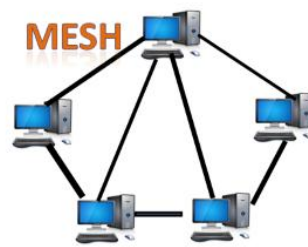
- Mesh technology is an arrangement of the network in which computers are interconnected with each other through **various redundant connections**.
- There are multiple paths from one computer to another computer.
- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- The Internet is an example of the mesh topology.

Hybrid Topology:
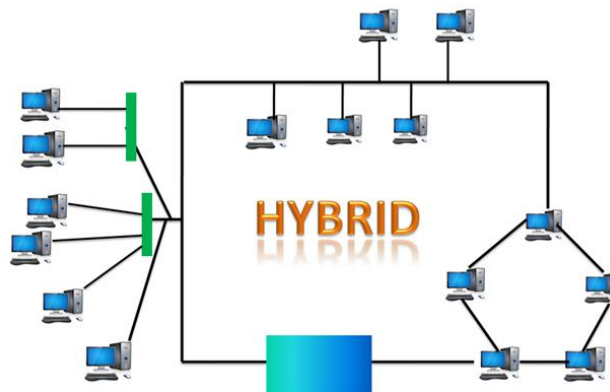
- The combination of various **different topologies** is known as Hybrid topology.
- A Hybrid topology is a connection between different links and nodes to transfer the data.
- When two or more different topologies are combined together is termed as Hybrid topology and if similar topologies are connected 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.

Transmission modes

The way in which data is transmitted from **one device to another device** is known as transmission mode.The transmission mode is also known as the communication mode.

The Transmission mode is divided into three categories:

- ➢ Simplex mode
- ➢ Half-duplex mode
- ➢ Full-duplex mode

Simplex mode:

Transmission in only one direction
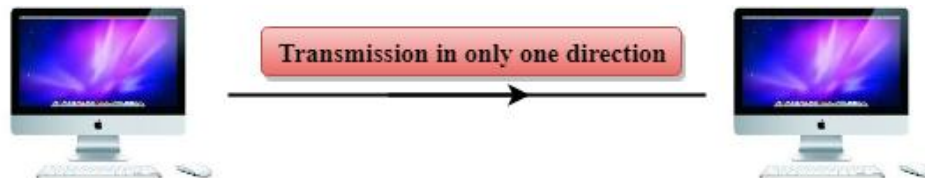
- In Simplex mode, the communication is **unidirectional**, i.e., the data flow in one direction.
- A device can only send the data but cannot receive it or it can receive the data but cannot send the data.
- The radio station is a simplex channel as it transmits the signal to the listeners but never allows them to transmit back.
- Keyboard and Monitor are the examples of the simplex mode as a 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.

Half-Duplex mode:

Transmission in either direction, but not simultaneously
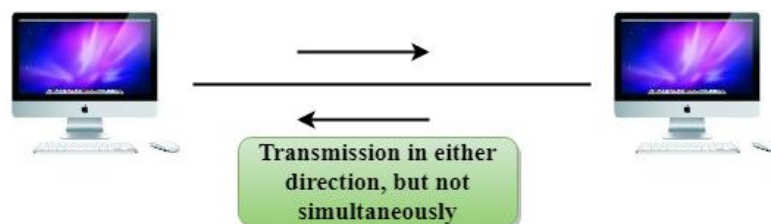
- In a Half-duplex channel, direction can be **reversed**, i.e., the station can transmit and receive the data as well.
- Messages flow in both the directions, but not at the same time.
- The entire bandwidth of the communication channel is utilized in one direction at a time.
- In half-duplex mode, it is possible to perform the error detection, and if any error occurs, then the receiver requests the sender to retransmit the data.
- A Walkie-talkie is an example of the Half-duplex mode.

Full-duplex mode:

Transmission in both the directions simultaneously.
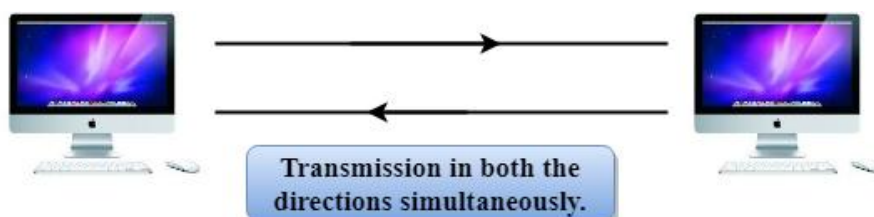
- In Full duplex mode, the communication is **bi-directional**, i.e., the data flow in both the directions.
- Both the stations can send and receive the message simultaneously.

- 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.
- The most common example of the full-duplex mode is a telephone network.

OSI Model

OSI stands for **Open System Interconnection** 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 was developed by the International Organization for Standardization (ISO) in 1984, and it is now considered as an architectural model for the inter-computer communications.
OSI consists of seven layers, and each layer performs a particular network function.
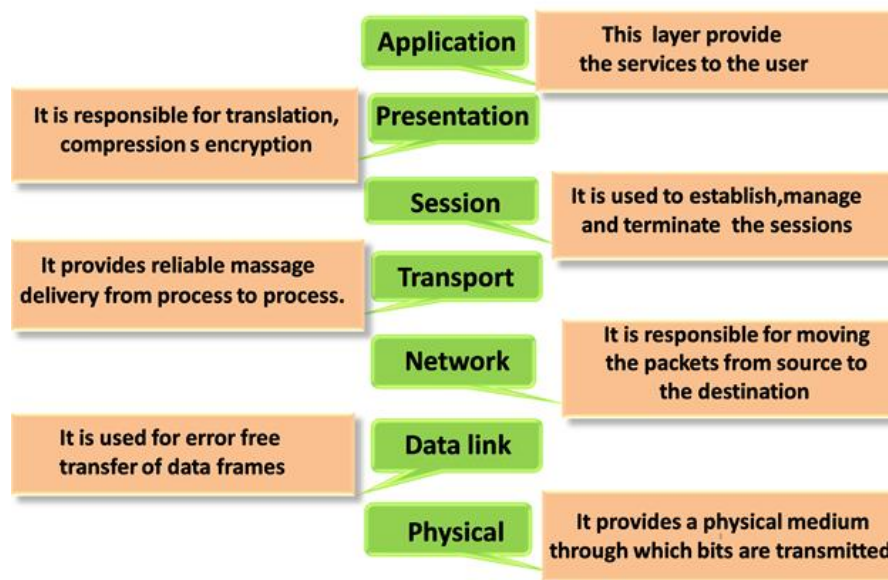
- **Physical layer:**It is the first layer that physically **connects the two systems** that need to communicate. It transmits data in bits and manages simplex or duplex transmission by **modem**. It also manages Network Interface Card's hardware interface to the network, like cabling, cable terminators, topography, voltage levels, etc.
- **Data link layer:**It is the firmware layer of Network Interface Card. It assembles datagrams into frames and adds **start and stop flags** to each frame. It also resolves problems caused by damaged, lost or duplicate frames.
- **Network layer:** It is concerned with **routing, switching and controlling** flow of information between the workstations. It also breaks down transport layer datagrams into smaller datagrams.
- **Transport 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. Transport layer isolates the upper layers from network hardware.

- **Session layer:** This layer is responsible for establishing a session between two workstations that want to exchange data.
- **Presentation layer:** 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.
- **Application layer:** 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.

TCP/IP
TCP/IP stands for **Transmission Control Protocol/Internet Protocol.** TCP/IP is a set of layered protocols used for communication over the Internet. The communication model of this suite is client-server model. A computer that sends a request is the client and a computer to which the request is sent is the server.

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 SECURITY

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 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:

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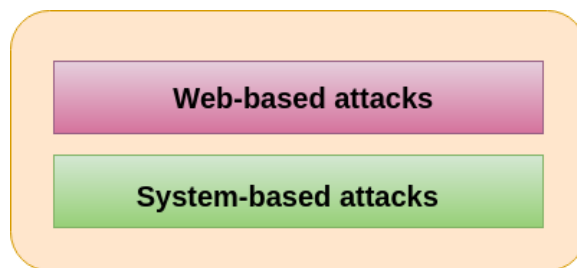
Classification of Cyber attacks

Web-based attacks

These are the 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**

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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

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-

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.

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.

Ripper, Stuxnet, Petya, Wanna cry, Code red, Melissa, Sasser, Zeus, Mydoom, Crypto Locker, Flashback are some example of Viruses.

2. Computer Worm:

A computer worm is a malicious, **self-replicating** software program (malware) which affects the functions of software and hardware programs.

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."

3. Trojan horse:

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.

4. Malware:

Short for **mal**icious soft**ware**, 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.

5. Ransomware:

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

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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.

7. Adware:

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 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:

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.

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.

IMPORTANT TERMS:

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.
2. **Firewall** is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules

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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. 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".

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.

Fathers and Inventers 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 Engelbart
Key board	Herman Hollerith
Transistor	John Bardeen, Walter Brattain &Wiliam 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	BjarneStroustrup
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	KonradZuse
First fully electronic digital computer- ABC computer	John Vincent Atanasoff& Clifford Berry

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

MICROSOFT WORD

Shortcut	Description

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Ctrl+0	Toggles 6pts of spacing before a paragraph.
Ctrl+A	Select all contents of the page.
Ctrl+B	Bold highlighted selection.
Ctrl+C	Copy selected text.
Ctrl+D	Open the font preferences window.
Ctrl+E	Aligns the line or selected text to the center of the screen.
Ctrl+F	Open find box.
Ctrl+I	Italic highlighted selection.
Ctrl+J	Aligns the selected text or line to justify the screen.
Ctrl+K	Insert a hyperlink.
Ctrl+L	Aligns the line or selected text to the left of the screen.
Ctrl+M	Indent the paragraph.
Ctrl+N	Opens new, blank document window.
Ctrl+O	Opens the dialog box or page for selecting a file to open.
Ctrl+P	Open the print window.
Ctrl+R	Aligns the line or selected text to the right of the screen.
Ctrl+S	Save the open document. Like Shift+F12.
Alt, F, A	Save the document under a different file name.
Ctrl+T	Create a hanging indent.
Ctrl+U	Underline the selected text.
Ctrl+V	Paste.
Ctrl+W	Close the currently open document.
Ctrl+X	Cut selected text.
Ctrl+Y	Redo the last action performed.
Ctrl+Z	Undo last action.
Ctrl+Shift+L	Quickly create a bullet point.
Ctrl+Shift+F	Change the font.
Ctrl+Shift+>	Increase selected font +1pts up to 12pt and then increase font +2pts.
Ctrl+]	Increase selected font +1pts.
Ctrl+Shift+<	Decrease selected font -1pts if 12pt or lower; if above 12, decreases font by +2pt.
Ctrl+[	Decrease selected font -1pts.
Ctrl+/+c	Insert a cent sign (¢).
Ctrl+'+<char>	Insert a character with an accent (grave) mark, where <char> is the character you want. For example, if you wanted an accented è you would use **Ctrl+'+e** as your shortcut key. To reverse the accent mark use the opposite accent mark, often on the tilde key.

Ctrl+Shift+*	View or hide non printing characters.
Ctrl+<left arrow>	Moves one word to the left.
Ctrl+<right arrow>	Moves one word to the right.
Ctrl+<up arrow>	Moves to the beginning of the line or paragraph.
Ctrl+<down arrow>	Moves to the end of the paragraph.
Ctrl+Del	Deletes word to right of cursor.
Ctrl+Backspace	Deletes word to left of cursor.
Ctrl+End	Moves the cursor to the end of the document.
Ctrl+Home	Moves the cursor to the beginning of the document.
Ctrl+Spacebar	Reset highlighted text to the default font.
Ctrl+1	Single-space lines.
Ctrl+2	Double-space lines.
Ctrl+5	1.5-line spacing.
Ctrl+Alt+1	Changes text to heading 1.
Ctrl+Alt+2	Changes text to heading 2.
Ctrl+Alt+3	Changes text to heading 3.
Alt+Ctrl+F2	Open new document.
Ctrl+F1	Open the Task Pane.
Ctrl+F2	Display the print preview.
Ctrl+Shift+>	Increases the selected text size by one font size.
Ctrl+Shift+<	Decreases the selected text size by one font size.
Ctrl+Shift+F6	Switches to another open Microsoft Word document.
Ctrl+Shift+F12	Prints the document.
F1	Open help.
F4	Repeat the last action performed (Word 2000+).
F5	Open the *Find*, *Replace*, and *Go To* window in Microsoft Word.
F7	Spellcheck and grammar check selected text or document.
F12	Save As.
Shift+F3	Change the text in Microsoft Word from uppercase to lowercase or a capital letter at the beginning of every word.
Shift+F7	Runs a Thesaurus check on the selected word.
Shift+F12	Save the open document. Like Ctrl+S.
Shift+Enter	Create a soft break instead of a new paragraph.
Shift+Insert	Paste.
Shift+Alt+D	Insert the current date.

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Shift+Alt+T	Insert the current time.

EXCEL:

Shortcut	Description
Tab	Move to the next cell, to the right of the currently selected cell.
Ctrl+A	Select all contents of a worksheet.
Ctrl+B	Bold all cells in the highlighted section.
Ctrl+C	Copy all cells in the highlighted section.
Ctrl+D	Fill down. Fills the cell beneath with the contents of the selected cell. To fill more than one cell, select the source cell and press **Ctrl+Shift+Down**to select multiple cells. Then press **Ctrl+D** to fill them with the contents of the original cell.
Ctrl+F	Search current sheet.
Ctrl+G	Go to a certain area.
Ctrl+H	Find and replace.
Ctrl+I	Puts italics on all cells in the highlighted section.
Ctrl+K	Inserts a hyperlink.
Ctrl+N	Creates a new workbook.
Ctrl+O	Opens a workbook.
Ctrl+P	Print the current sheet.
Ctrl+R	Fill right. Fills the cell to the right with the contents of the selected cell. To fill more than one cell, select the source cell and press **Ctrl+Shift+Right**to select multiple cells. Then press **Ctrl+R** to fill them with the contents of the original cell.
Ctrl+S	Saves the open worksheet.
Ctrl+U	Underlines all cells in the highlighted section.
Ctrl+V	Pastes everything copied onto the clipboard.
Ctrl+W	Closes the current workbook.
Ctrl+X	Cuts all cells in the highlighted section.
Ctrl+Y	Repeats the last entry.
Ctrl+Z	Undo the last action.
Ctrl+1	Changes the format of the selected cells.
Ctrl+2	Bolds all cells in the highlighted section.
Ctrl+3	Puts italics all cells in the highlighted section.
Ctrl+4	Underlines all cells in highlighted section.
Ctrl+5	Puts a strikethrough all cells in the highlighted section.
Ctrl+6	Shows or hides objects.

Ctrl+7	Shows or hides the toolbar.
Ctrl+8	Toggles the outline symbols.
Ctrl+9	Hides rows.
Ctrl+0	Hides columns.
Ctrl+Shift+:	Enters the current time.
Ctrl+;	Enters the current date.
Ctrl+`	Changes between displaying cell values or formulas in the worksheet.
Ctrl+'	Copies a formula from the cell above.
Ctrl+Shift+"	Copies value from cell above.
Ctrl+-	Deletes the selected column or row.
Ctrl+Shift+=	Inserts a new column or row.
Ctrl+Shift+~	Switches between showing Excel formulas or their values in cells.
Ctrl+Shift+@	Applies time formatting.
Ctrl+Shift+!	Applies comma formatting.
Ctrl+Shift+$	Applies currency formatting.
Ctrl+Shift+#	Applies date formatting.
Ctrl+Shift+%	Applies percentage formatting.
Ctrl+Shift+^	Applies exponential formatting.
Ctrl+Shift+*	Selects the current region around the active cell.
Ctrl+Shift+&	Places border around selected cells.
Ctrl+Shift+_	Removes a border.
Ctrl++	Insert.
Ctrl+-	Delete.
Ctrl+Shift+(	Unhide rows.
Ctrl+Shift+)	Unhide columns.
Ctrl+/	Selects the array containing the active cell.
Ctrl+	Selects the cells that have a static value or don't match the formula in the active cell.
Ctrl+[	Selects all cells referenced by formulas in the highlighted section.
Ctrl+]	Selects cells that contain formulas that reference the active cell.
Ctrl+Shift+{	Selects all cells directly or indirectly referenced by formulas in the highlighted section.
Ctrl+Shift+}	Selects cells which contain formulas that directly or indirectly reference the active cell.
Ctrl+Shift+| (pipe)	Selects the cells within a column that don't match the formula or static value in the active cell.

Ctrl+Enter	Fills the selected cells with the current entry.
Ctrl+Spacebar	Selects the entire column.
Ctrl+Shift+Spacebar	Selects the entire worksheet.
Ctrl+Home	Move to cell A1.
Ctrl+End	Move to last cell on worksheet.
Ctrl+Tab	Move between Two or more open Excel files.
Ctrl+Shift+Tab	Activates the previous workbook.
Ctrl+Shift+A	Inserts argument names into a formula.
Ctrl+Shift+F	Opens the drop-down menu for fonts.
Ctrl+Shift+O	Selects all of the cells that contain comments.
Ctrl+Shift+P	Opens the drop-down menu for point size.
Shift+Insert	Pastes what is stored on the clipboard.
Shift+Page Up	In a single column, highlights all cells above that are selected.
Shift+Page Down	In a single column, highlights all cells above that are selected.
Shift+Home	Highlights all text to the left of the cursor.
Shift+End	Highlights all text to the right of the cursor.
Shift+Up Arrow	Extends the highlighted area up one cell.
Shift+Down Arrow	Extends the highlighted area down one cell.
Shift+Left Arrow	Extends the highlighted area left one character.
Shift +Right Arrow	Extends the highlighted area right one character.
Alt+Tab	Cycles through applications.
Alt+Spacebar	Opens the system menu.
Alt+Backspace	Undo.
Alt+Enter	While typing text in a cell, pressing Alt+Enter moves to the next line, allowing for multiple lines of text in one cell.
Alt+=	Creates a formula to sum all of the above cells.
Alt+'	Allows formatting on a dialog box.
F1	Opens the help menu.
F2	Edits the selected cell.
F3	After a name is created, F3 will paste names.
F4	Repeats last action. For example, if you changed the color of text in another cell, pressing F4 will change the text in cell to the same color.
F5	Goes to a specific cell. For example, C6.
F6	Move to the next pane.
F7	Spell check selected text or document.
F8	Enters Extend Mode.

F9	Recalculates every workbook.
F10	Activates the menu bar.
F11	Creates a chart from selected data.
F12	Save As option.
Shift+F1	Opens the "What's This?" window.
Shift+F2	Allows the user to edit a cell comment.
Shift+F3	Opens the Excel formula window.
Shift+F5	Brings up a search box.
Shift+F6	Move to previous pane.
Shift+F8	Add to selection.
Shift+F9	Performs calculate function on active sheet.
Ctrl+F3	Open Excel Name Manager.
Ctrl+F4	Closes current Window.
Ctrl+F5	Restores window size.
Ctrl+F6	Next workbook.
Ctrl+Shift+F6	Previous workbook.
Ctrl+F7	Moves the window.
Ctrl+F8	Resizes the window.
Ctrl+F9	Minimize current window.
Ctrl+F10	Maximize currently selected window.
Ctrl+F11	Inserts a macro sheet.
Ctrl+F12	Opens a file.
Ctrl+Shift+F3	Creates names by using those of either row or column labels.
Ctrl+Shift+F6	Moves to the previous worksheet window.
Ctrl+Shift+F12	Prints the current worksheet.
Alt+F1	Inserts a chart.
Alt+F2	Save As option.
Alt+F4	Exits Excel.
Alt+F8	Opens the macro dialog box.
Alt+F11	Opens the Visual Basic editor.
Alt+Shift+F1	Creates a new worksheet.
Alt+Shift+F2	Saves the current worksheet.

POWER POINT:

Shortcut keys	Description
Alt + W	View Tab
Alt + G	Design Tab

Alt + R	Review Tab
Alt + Q	Search
Ctrl + F5	Restore window to previous Size
Shift + F10	Display context menu
Shift + F6	Move anticlockwise among Pane
Ctrl + Shift + Z	Normal/Plain Text
Shift + F3	Toggle cases
Ctrl + Shift + F	Change Font Style
Ctrl + D	Duplicate slide
Alt + F10	Maximize window
Alt + N, W	Insert word art
Alt + N, X	Insert textbox
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
Alt + N, P	Insert a picture
Alt + H	Home Tab
Alt + N	Insert tab
Alt + S, B	Start Slideshow
Alt + F, X	Close PowerPoint
Esc	End the slideshow
Alt + T	Transitions Tab
Alt + A	Animation Tab
F5	Slide Show

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, !elevisions 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 3omputer 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.

Archieve: 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.

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 is 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 the 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 'erects 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 who 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.

Digitise - 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 authorised users can access it.

End User: Any individual who uses the information verified 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 execute 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 join 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. Thereby 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 llf 11°

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.

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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.

Synchronisation: This method ensures that the receiving end can recognise 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 ofsurge 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, whenclicked, 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.

EXTENSION

Audio file formats by file extensions	Compressed file extensions
.aif - AIF audio file	.7z - 7-Zip compressed file
.cda - CD audio track file	.arj - ARJ compressed file
.mid or .midi - MIDI audio file.	.deb - Debian software package file
.mp3 - MP3 audio file	.pkg - Package file
.mpa - MPEG-2 audio file	.rar - RAR file
.ogg - OggVorbis audio file	.rpm - Red Hat Package Manager
.wav - WAV file	.tar.gz - Tarball compressed file
.wma - WMA audio file	.z - Z compressed file
.wpl - Windows Media Player playlist	.zip - Zip compressed file
Disc and media file extensions	**Data and database file extensions**
.bin - Binary disc image	.csv - Comma separated value file
.dmg - macOS X disk image	.dat - Data file
.iso - ISO disc image	.db or .dbf - Database file
.toast - Toast disc image	.log - Log file
.vcd - Virtual CD	.mdb - Microsoft Access database file
	.sav - Save file (e.g., game save file)
	.sql - SQL database file
	.tar - Linux / Unix tarball file archive
	.xml - XML file
Executable file extensions	**Font file extensions**
.apk - Android package file	.fnt - Windows font file
.bat - Batch file	.fon - Generic font file
.bin - Binary file	.otf - Open type font file
.cgi or .pl - Perl script file	.ttf - TrueType font file
.com - MS-DOS command file	

.exe - Executable file .gadget - Windows gadget .jar - Java Archive file .py - Python file .wsf - Windows Script File	
Image file formats by file extension .ai - Adobe Illustrator file .bmp - Bitmap image .gif - GIF image .ico - Icon file .jpeg or .jpg - JPEG image .png - PNG image .ps - PostScript file .psd - PSD image .svg - Scalable Vector Graphics file .tif or .tiff - TIFF image	**Internet related file extensions** .asp and .aspx - Active Server Page file .cer - Internet security certificate .cfm - ColdFusion Markup file .cgi or .pl - Perl script file .css - Cascading Style Sheet file .htm and .html - HTML file .js - JavaScript file .jsp - Java Server Page file .part - Partially downloaded file .php - PHP file .py - Python file .rss - RSS file .xhtml - XHTML file
Presentation file formats by file extension .key - Keynote presentation .odp - OpenOffice Impress presentation file .pps - PowerPoint slide show .ppt - PowerPoint presentation .pptx - PowerPoint Open XML presentation	**Programming files by file extensions** .c - C and C++ source code file .class - Java class file .cpp - C++ source code file .cs - Visual C# source code file .h - C, C++, and Objective-C header file .java - Java Source code file .sh - Bash shell script .swift - Swift source code file .vb - Visual Basic file
Spreadsheet file formats by file extension .ods - OpenOfficeCalc spreadsheet file .xlr - Microsoft Works spreadsheet file .xls - Microsoft Excel file .xlsx - Microsoft Excel Open XML spreadsheet file	**System related file formats and file extensions** .bak - Backup file .cab - Windows Cabinet file .cfg - Configuration file .cpl - Windows Control panel file .cur - Windows cursor file .dll - DLL file

	.dmp - Dump file
	.drv - Device driver file
	.icns - macOS X icon resource file
	.ico - Icon file
	.ini - Initialization file
	.lnk - Windows shortcut file
	.msi - Windows installer package
	.sys - Windows system file
	.tmp - Temporary file
Video file formats by file extension	**Word processor and text file formats by file extension**
.3g2 - 3GPP2 multimedia file	.doc and .docx - Microsoft Word file
.3gp - 3GPP multimedia file	.odt - OpenOffice Writer document file
.avi - AVI file	.pdf - PDF file
.flv - Adobe Flash file	.rtf - Rich Text Format
.h264 - H.264 video file	.tex - A LaTeX document file
.m4v - Apple MP4 video file	.txt - Plain text file
.mkv - Matroska Multimedia Container	.wks and .wps- Microsoft Works file
.mov - Apple QuickTime movie file	.wpd - WordPerfect document
.mp4 - MPEG4 video file	
.mpg or .mpeg - MPEG video file	
.rm - RealMedia file	
.swf - Shockwave flash file	
.vob - DVD Video Object	
.wmv - Windows Media Video file	

Abbreviations

A	B
AI – Artificial intelligence	BINAC - Binary Automatic Computer
ALGOL – Algorithmic Language	BCC – Blind Carbon Copy
ARP – Address resolution Protocol	Bin – Binary
ASP- Active Server Pages	BASIC - Beginner's All-purpose Symbolic
ASCII – American Standard Code for	Instruction Code
Information Interchange	BIOS – Basic Input Output System
AMR - Adaptive Multi-Rate Codec	BCD - Binary Coded Decimal
AAC - Advanced Audio Coding	BHTML - Broadcast Hyper Text Markup
ATA – Advanced Technology Attachment	Language
ABR – Average Bit rate	BIU - Bus Interface Unit
AMOLED – Active-Matrix Organic Light-	BMP – Bitmap

Emitting Diode	BPS - Bytes Per Second
AMD – Advanced Micro Devices	BBP – Base band Processor
AVI – Audio Video Interleaved	BPM – Business Process Modeling
ATM – Asynchronous Transfer Mode	BGP - Border Gateway Protocol
ANSI - American National Standard Institute	BIPS - Billion Instruction Per Second
ARPANET- Advanced Research Projects Agency Network	BCR - Bar Code Reader
ADSL -Asymmetric Digital Subscriber Line	BRD - Blu Ray Disc
API -Application Program Interface	
ACID- Atomicity Consistency Isolation Durability	

C	**D**
CAD - Computer Aided Design	DBA – Data Base Administrator
CC – Carbon Copy	DBMS – Data Base Management System
COBOL – Common Business Oriented Language	DNS – Domain Name System
CD – Compact Disc	DPI – Dots Per Inch
CRT – Cathode Ray Tube	DRAM – Dynamic Random Access Memory
CDR – Compact Disc Recordable	DVD – Digital Video Disc/Digital Versatile Disc
CDROM – Compact Disc Read Only Memory	DVDR – DVD Recordable
CDRW – Compact Disc Rewritable	DVDROM – DVD Read Only Memory
CDR/W – Compact Disk Read/Write	DVDRW – DVD Rewritable
CUI - Character User Interface	DVR – Digital Video Recorder
CDMA- Code Division Multiple Access	DOS – Disk Operating System
CAN - Campus Area Network	DHCP - Dynamic Host Configuration Protocol
CNM- Circulatory Network Mode	DSL- Digital Subscriber Line
	DHTML Dynamic Hyper Text Markup Language

E	**F**
EBCDIC – Extended Binary Coded Decimal Interchange Code	FAX - Far Away Xerox/ facsimile
e-Commerce – Electronic Commerce	FDC - Floppy Disk Controller
EDP – Electronic Data Processing	FDD - Floppy Disk Drive
EEPROM – Electrically Erasable Programmable Read Only Memory	FORTRAN - Formula Translation
ELM/e-Mail – Electronic Mail	FS - File System
ENIAC - Electronic Numerical Integrator and Computer	FTP - File Transfer Protocol
EOF - End Of File	FIFO - First In First Out
EPROM - Erasable Programmable Read Only	FAT - File Allocation Table

Memory EDI - Electronic Data Interchange	
G GPRS - General Packet Radio Service GPS - Global Positioning System GUI - Graphical User Interface Gb - Gigabit GB - Gigabyte GIF - Graphics Interchange Format GSM - Global System for Mobile Communication GIGO - Garbage in Garbage Out	**H** HDD - Hard Disk Drive HP - Hewlett Packard HTML - Hyper Text Markup Language HTTP - Hyper Text Transfer Protocol HTTPS - Hyper Text Transfer Protocol Secure HDMI - High Definition Multimedia Interface HDTV - High Definition Television HVD- Holographic Versatile Disc
I INTEL - Integrated Electronics IP - Internet Protocol. ISP - Internet Service Provider. IMAP- Internet Message Access Protocol IVR- Interactive Voice Response ICANN - Internet Corporation of Assign Names &Numbers ISDN - Integrated Servers Digital Network ISO- International Standard Organization/ International Org for Standardization	**J** JAD - Java Application Descriptor JPEG - Joint Photographic Expert Group
K Kb - Kilobit KB - Kilobyte KHz - Kilohertz Kbps - Kilobit Per Second	**L** LED - Light Emitting Diode LCD – Liquid Crystal Display LIFO- Last In First Out
M Mb – Megabit MB – Megabyte MPEG – Moving Picture Experts Group MMS – Multimedia Message Service MICR – Magnetic Ink Character reader MIPS – Million Instructions Per Second MIME - Multipurpose Internet Mail Extension MIDI - Musical Instrument Digital Interface	**N** NAT - Network Address Translation NIC – Network Interface Card NOS – Network Operating System NTP - Network Time Protocol

MANET - Mobile Ad-Hoc Network MAC- Media Access Control MODEM- Modulator Demodulator	
O OMR – Optical Mark Reader OOP – Object Oriented Programming OSS – Open Source Software OCR -Optical Character Reader / Recognition	**P** P2P - Peer-to-peer PDA - Personal digital assistant. PDF - Portable Document Format PNG - Portable Network Graphics POS – Point Of Sale PPP – Point-to-Point Protocol PROM – Programmable Read Only Memory PSTN – Public Switched Telephone Network PING – Packet Internet Gopher PAN- Personal Area Network PCB -Printer Circuit Board PCB - Printer Circuit Board
R RAM – Random Access Memory ROM -Read Only Memory RDBMS – Relational Data Base Management System RIP – Routing Information Protocol RTF – Rich Text Format RARP - Reverse Address Resolution Protocol	**S** SMTP – Simple Mail Transfer Protocol SQL – Structured Query Language SRAM – Static Random Access Memory SNMP – Simple Network Management Protocol SIM – Subscriber Identification Module SMPS - Switch Mode Power Supply SFTP Secure File Transfer Protocol SSH - Secure Shell SIP - Session Initiation Protocol SAN -Storage Area Network
T TCP – Transmission Control Protocol TB – Tera Bytes TFTP --Trivial File Transfer Protocol Tel Net - Telecommunication Networking TIPS -Trillion Instruction Per Second	**U** UPS – Uninterrupted Power Supply URI – Uniform Resource Identifier URL – Uniform Resource Locator USB - Universal Serial Bus ULSI - Ultra Large Scale Integration UNIVAC - Universal Automatic Computer UMTS - Universal Mobile Telecommunication System. UDP -User Datagram Protocol

V	W
VIRUS - Vital Information Resource Under Seized VOIP - Voice Over Internet Protocol VAR – Variable VGA – Video Graphics Array VSNL – Videsh Sanchar Nigam Limited VDU – Visual Display Unit VAN - Value Added Network	WAIS - Wide-Area Information Server. Wi-Fi – Wireless Fidelity WLAN – Wireless Local Area Network WPA – Wi-Fi Protected Access WWW – World Wide Web WORM – Write Once Read Many WBMP - Wireless Bitmap Image WMA - Windows Media Audio WMV - Windows Media Video WIMAX- Worldwide Interoperability for Microwave Access
X	Z
XHTML – eXtensible Hypertext Markup Language XML - eXtensible Markup language	ZB – Zeta Byte

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