

INTRODUCTION

A COMPUTER is an electronic device that can be instructed to carry out an arbitrary set of arithmetic or logical operations automatically.

Characteristics of Computers

Speed: The speed of computation is very high as the signals pass at the speed of light. Thus, millions of calculations can be done in a second.

Accuracy: As computers work on inbuilt software programs, there is no scope for human errors and are hence, highly accurate.

Information and Storage: A computer can store a large amount of data or instructions in its memory which can be retrieved at point of time.

Other characteristics include: Consistency, Automatic Operation, and Flexibility.

History of Computers

Father of Computer: Charles Babbage

Father of Modern Computer Science: Alan Turing

First Un-programmable Electronic Digital Computer: Atanasoff Berry Computer (ABC)

First Purpose Electronic Digital Computer: Electronic Numerical Integrator and Calculator (ENIAC)

GENERATIONS OF COMPUTERS:

First Generation (1946 - 1959)

- Used vacuum tubes & batch processing OS
- Machine & Assembly Languages used
- Examples: ENIAC, EDVAC, UNIVAC, IBM-701, IBM-650

Second Generation (1959 - 1965)

- Used transistors
- OS: Multi-Bag remaining, Time sharing
- Memory: Magnetic cores, magnetic tapes and disks
- Used assembly and high-level languages like FORTRAN, COBOL, Algol
- Examples: IBM 1620, IBM 7094, CDC 1604

Third Generation (1965 - 1971)

- Used ICs
- OS: Remote processing, Time-sharing, Real-time, Multi-programming
- Used High-level languages FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68
- Examples: IBM-360 series, Honeywell-6000 series, PDP, IBM-370/168

Fourth Generation (1971 - 1980)

- VLSI Circuits Used
- Memory: Semiconductor and Winchester disk
- High level Languages: Fortran 77, Pascal, Cobol used
- Examples: DEC 10, STAR 1000, PDP 11, Super Computers (CRAY-1, CRAY-X-MP)

The present generation of computers is the Fifth Generation of computers, i.e. 1980 – till date. The computers use ultra large scale integration (ULSI). High level languages like C++, Java, .NET, etc. are used. Some examples are: laptop, desktop, ultrabook etc.

TYPES OF COMPUTERS

1. Personal Computers :

- Small, inexpensive computer for personal use
- Also called a micro-computers
- Popularly used at homes for playing games and/ or surfing the Internet.
- Used for word processing, desktop publishing, spreadsheet and database management applications

2. Mini Computers

- These were designed for specific tasks but have now lost popularity due to the advent of PCs.

3. Mainframes

- These are expensive and large sized computers
- Are capable of supporting hundreds of users simultaneously
- Used for specific large scale applications

4. Super Computers

- Powerful, expensive and the fastest computers
- Used for applications that require large amounts of mathematical computations
- For example: weather forecasting, fluid dynamics, graphic design etc.

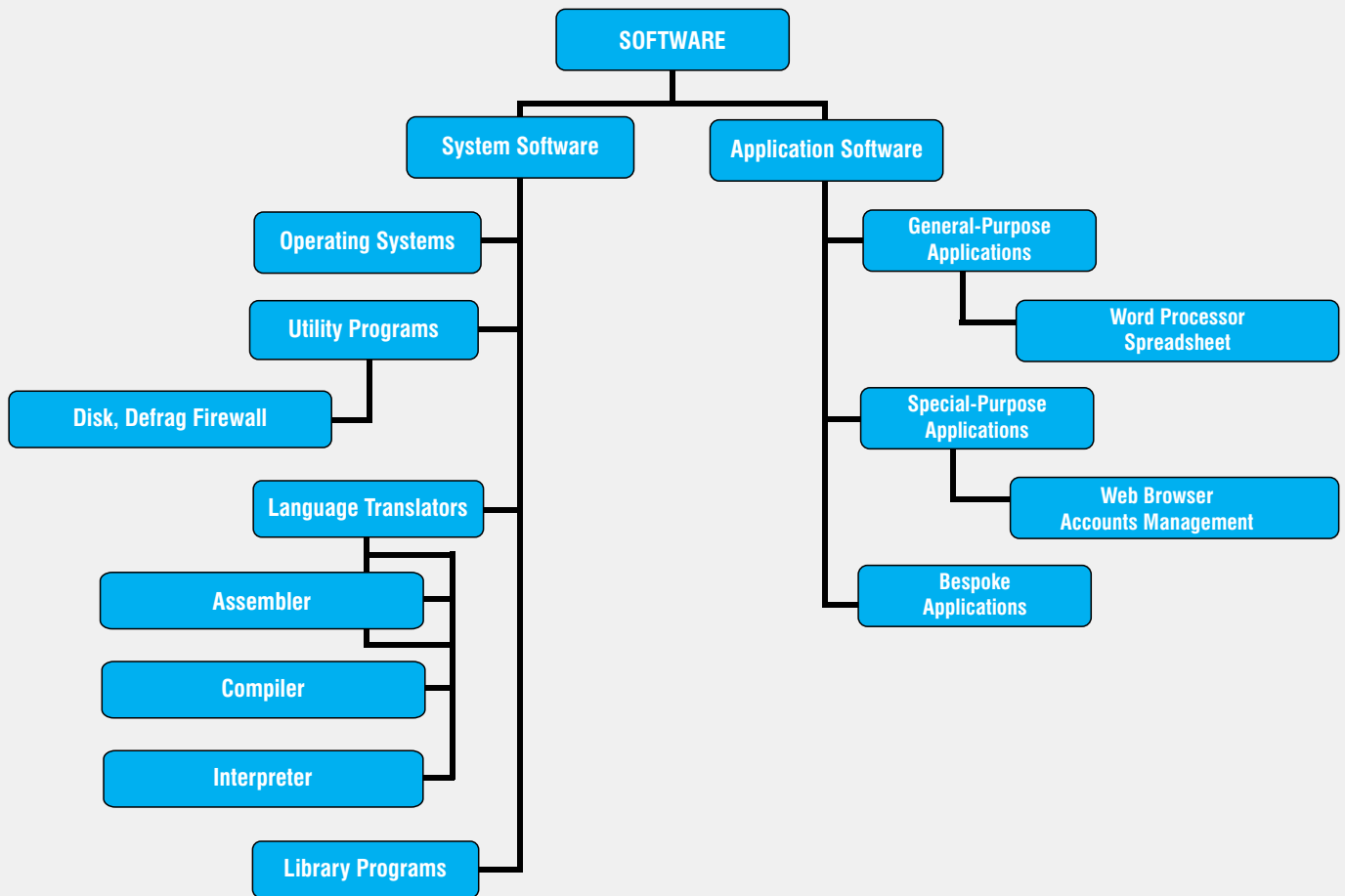
COMPUTER FUNDAMENTALS

A computer system has four basic components.

PARTS OF A COMPUTER SYSTEM

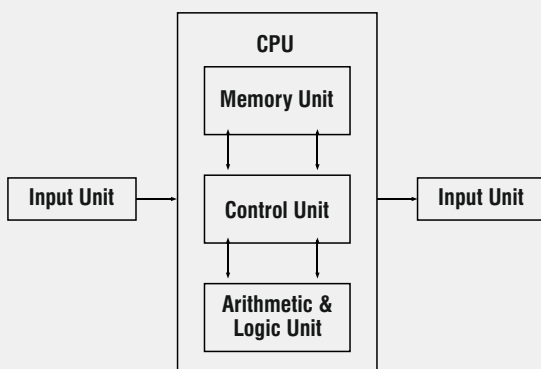
- Hardware: represents the physical and tangible components of the computer (keyboard, mouse, monitor etc.).
- Software: is a set of electronic instructions called programs that make the computer perform tasks.
- Data: the raw facts, which the computer stores and reads in the form of numbers.
- Users: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





DATA PROCESSING CYCLE OF A COMPUTER

A computer's data processing cycle comprises of the following three steps:



1. Input:

It refers to the commands given by a user to the computer using input devices like mouse, keyboard etc.

2. Processing:

In this step, the command given by the user are carried out by the computer. Thus, this step produces a more useful form of data at the end.

3. Output:

The result of the processing that is stored and displayed to the user by means of output devices like monitor, printer etc. is called output.

CENTRAL PROCESSING UNIT (CPU)

The control unit, ALU, and memory are collectively known as a central processing unit (CPU). Early CPUs were composed of many separate components but since the mid-1970s CPUs have typically been constructed on a single integrated circuit called a microprocessor.

Control Unit: The control unit manages the computer's various components; it reads and interprets (decodes) the program instructions, transforming them into control signals that activate other parts of the computer.

Arithmetic Logic Unit: The ALU can perform two classes of operations: arithmetic and logic. The set of arithmetic operations that an ALU supports may be limited to addition and subtraction, or may include more complex mathematical operations. Logic operations involve Boolean logic: AND, OR, XOR, and NOT. These can be useful for creating complicated conditional statements and processing the boolean logic.

MEMORY

Computer main memory comes in two principal varieties: primary and secondary memory.

Primary Memory: Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. It is known as the main memory as a computer cannot function without it. It is volatile memory. The two types are: Random Access Memory or RAM & Read Only Memory or ROM.

RAM (Random Access Memory): RAM is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data till the machine is working. Some types of RAMs are: DRAM, SRAM and SDRAM

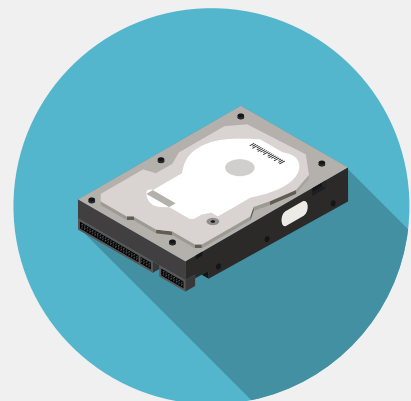
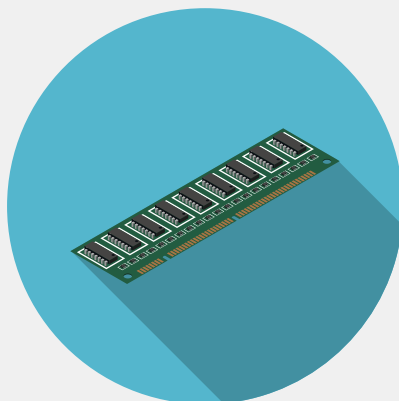
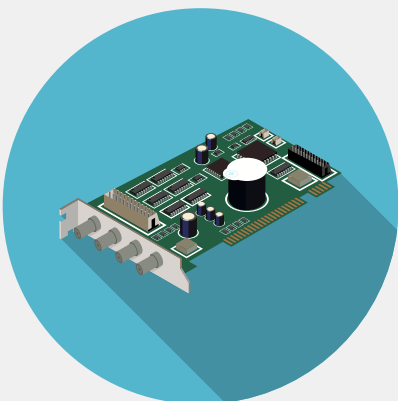
- **Dynamic Random Access Memory (DRAM):** The term dynamic indicates that the memory must be constantly refreshed or it loses its contents. This type of memory is more economical.
- **Static Random Access Memory (SRAM):** memory that is faster and less volatile than DRAM, but requires more power and is more expensive. The term static is derived from the fact that it does not need to be refreshed like DRAM.
- **Synchronous Dynamic Random Access Memory (SDRAM):** A type of DRAM that can run at much higher clock speeds.

ROM (Read Only Memory): RAM is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data till the machine is working. Some types of RAMs are: DRAM, SRAM and SDRAM

- **MROM (Masked ROM):** The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kinds of ROMs are known as masked ROMs which are inexpensive.
- **PROM (Programmable Read Only Memory):** PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program
- **EPROM (Erasable and Programmable Read Only Memory):** The EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function.
- **EEPROM (Electrically Erasable and Programmable Read Only Memory):** The EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 milliseconds.

Secondary Memory: RAM is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data till the machine is working. Some types of RAMs are: DRAM, SRAM and SDRAM

Cache Memory: It is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory.
Example: Register



MEMORY STORAGE UNITS

| S.No. | Unit | Description |
|-------|-----------------------|--|
| 1 | 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. |
| 2 | Nibble | A group of 4 bits is called nibble. |
| 3 | Byte | A group of 8 bits is called byte. A byte is the smallest unit which can represent a data item or a character. (1 byte = 8 bits) |
| 4 | Word | A computer word, like a byte, is a group of fixed number of bits processed as a unit which varies from computer to computer but is fixed for each computer. The length of a computer word is called word-size or word length and it may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words. |

Memory Capacity Conversion Chart

| Term (Abbreviation) | Approximate Size |
|---------------------|---------------------------|
| Byte (B) | 8 bits |
| Kilobyte (KB) | 1024 bytes / 10^3 bytes |
| Megabyte (MB) | 1024 KB / 10^6 bytes |
| Gigabyte (GB) | 1024 MB / 10^9 bytes |
| Terabyte (TB) | 1024 GB / 10^{12} bytes |
| Petabyte (PB) | 1024 TB / 10^{15} bytes |
| Exabyte (EB) | 1024 PB / 10^{18} bytes |
| Zetta byte (ZB) | 1024 EB / 10^{21} bytes |
| Yotta byte (YB) | 1024 ZB / 10^{24} bytes |

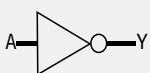
Logic Gates

These are the building blocks of any digital circuit. The basic logic gates and their functioning (truth table) are mentioned in the following figure.

LOGIC GATE EXAMPLES

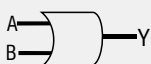
Key: Input = A and B, Output = Y

Not Gate



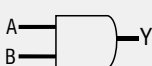
If A = 0 Then Y = 1
If A = 1 Then Y = 0

Or Gate



If A = 0 and B = 0 Then Y = 0
If A = 1 and B = 0 Then Y = 1
If A = 0 and B = 1 Then Y = 1
If A = 1 and B = 1 Then Y = 1

And Gate



If A = 0 and B = 0 Then Y = 0
If A = 0 and B = 1 Then Y = 0
If A = 1 and B = 0 Then Y = 0
If A = 1 and B = 1 Then Y = 1

Key: Input = A and B, Output = Y

Nand Gate



If A = 0 and B = 0 Then Y = 1
If A = 0 and B = 1 Then Y = 1
If A = 1 and B = 0 Then Y = 1
If A = 1 and B = 1 Then Y = 0

Nor Gate



If A = 0 and B = 0 Then Y = 1
If A = 0 and B = 1 Then Y = 0
If A = 1 and B = 0 Then Y = 0
If A = 1 and B = 1 Then Y = 0

COMPUTER LANGUAGES

There are two major types of programming languages: Low Level and High Level Languages

Low Level languages: These are machine oriented languages and require an extensive knowledge of computer hardware and its configuration. It is further divided in to: Machine and Assembly languages.

Machine Language (First Generation): directly understood by the computer as it written in strings of 0s and 1s. It does not need a translator program. It is also called the machine code. For example, a program instruction may look like this: 1011000111101. It is efficient but difficult to learn.

- **Advantages:**
 - Programs run fast because no translation program is required.
- **Disadvantages:**
 - Difficult to program
 - Bebugging is also an issue

Assembly Language (Second Generation): the language uses a combination of letters and numbers to code. This set of symbols and letters forms the Assembly Language and a translator program is required to translate to the machine language. This translator program is called 'Assembler'.

- **Advantages:**
 - Easier to understand and minimizes effort.
 - Similar efficiency of execution as the machine level language
- **Disadvantages:**
 - It is machine dependent (program written for one computer might not run in other computers with different hardware configuration)

High Level languages: In higher level languages, only the instructions in English words and logic of the problem irrespective of the type of computer should be known.

- Higher level languages are simple languages that use English and mathematical symbols like +, -, %, / for its program construction.
- These are problem-oriented languages because the instructions are suitable for solving a problem.

For example: COBOL (Common Business Oriented Language) is mostly suitable for business oriented language where there is very little processing and huge output; FORTRAN (for formula translation) and BASIC for large processing requirements.

- **Advantages:**
 - Easy to learn and use

Language Assemblers

Assembler: converts assembly language program into machine language.

Cache Memory: converts a HLL (High Level Language) program into machine language by converting and executing it line by line.

Compiler: converts the HLL program into machine language in one go and reports all the errors of the program along with the line numbers.

Computer PERIPHERALS

Input Devices: These devices serve as a link between a user and the computer. These input devices translate the information into a form that is understandable by the computer. Some input devices are:

Keyboard: inputting data to the computer in both alpha and numeric forms

- *Some important keys in a keyboard are:*

1. Toggle Keys- These toggle the input from a group of keys on a keyboard between two different input modes.

Keys: Caps Lock, Num Lock, Scroll Lock.

2. Insert Modifier Keys - It is a special key (or a key combination) that temporarily modifies the normal action of another key when pressed together.

Keys: Shift, Alt, Ctrl, Fn.

3. Function Keys- A key on a computer keyboard, distinct from the main alphanumeric keys, to which software can assign a function.

Keys: F1 through F12 keys are known as function keys and each key performs a different function.

Mouse: it is a pointing and cursor-control device. A round ball at its base senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Joy Stick: To move cursor position on a monitor screen. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

Light Pen: It is used to select a displayed menu item or draw pictures on the monitor screen.

Track Ball: Mostly used in notebooks or laptops. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved.

Scanner: scans printed material and converts it into a file format that may be used within the PC.

Magnetic Ink Character Recognition (MICR), Optical character recognition (OCR) etc.

Output Devices: Output devices translate the computer's output into a form understandable by the users. Few common output devices are as follows:

Monitors: also called Visual Display Units (VDU), these 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 screens used for monitors.*

1. *Cathode-Ray Tube (CRT):* The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution

2. *Flat- Panel Display:* - The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT.

Printer: It is used to print information on paper.

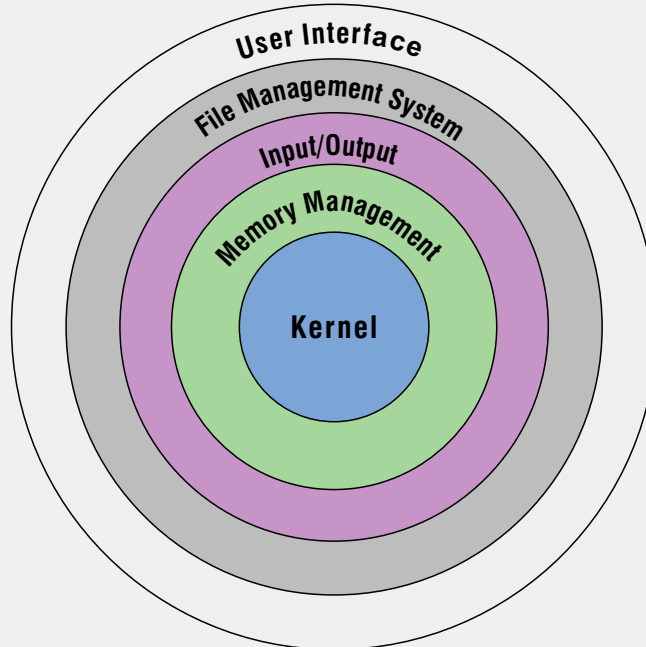
Impact Printers: The impact printers print the characters by striking them on the ribbon which is then pressed on the paper.

Non-Impact Printers: Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as page printers. Example: Laser Printers, Inkjet Printers etc.

OPERATING SYSTEMS

An operating system acts as an interface between a user and the computer. It is the software that manages the hardware of the computer.

The layered structure of an operating system is as follows:



The three objectives of an operating system are as follows:

Convenience

Efficiency

Ability to evolve with time and technology

CHARACTERISTICS OF OPERATING SYSTEM

Memory Management: keeps tracks of primary and allocates the memory when a process requests.

Processor Management: allocates and de-allocates the processor(CPU) to a process

Device Management: keeps track of all devices. This is called I/O controller and decides which process gets the device, when, and for how long.

File Management: allocates and de-allocates the resources

Security: prevents unauthorized access to programs and data by means of passwords etc.

Job Accounting: keeps track of time and resources used by various users.

Controls system performance: records delays between request for a service and from the system.

Interaction with operators

Error-detecting aids: Production of dumps, traces, error messages and other debugging and other error-detecting methods.

Coordination between other software and users: Coordinates and assigns compilers, interpreters, assemblers and other software to the various users of the computer systems.

TYPES OF OPERATING SYSTEMS

Batch Operating System: The users of 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.

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

Single User Operating System: It is a type of operating system (OS) that is developed and intended for use on a computer or similar machine that will only have a single user at any given time.

Multuser Operating System: It is a computer operating system (OS) that allows multiple users on different computers or terminals to access a single system with one OS on it.

Real Time Operating System: It 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. It is always on line whereas on line system need not be real time.

SOME IMPORTANT TERMS:

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

Cold Boot: When you turn the computer ON from an OFF position.

Warm Boot: When you reset the computer that is already ON.

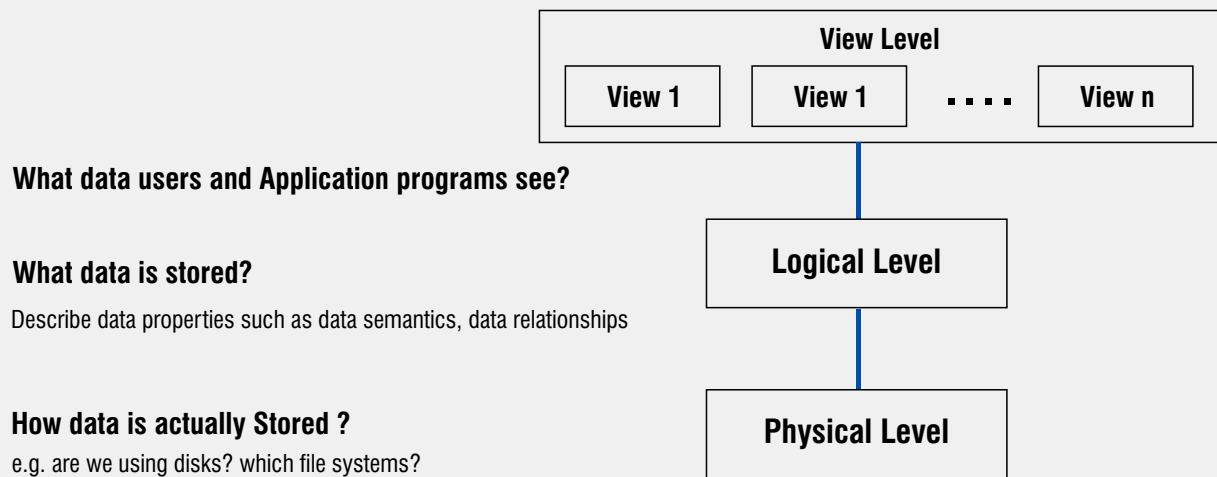
DATABASE MANAGEMENT SYSTEMS

Definition

A database management system (DBMS) is a computer program (or more typically, a suite of them) designed to manage a database, a large set of structured data, and run operations on the data requested by numerous users. Typical examples of DBMS use include accounting, human resources and customer support systems.

Architecture (Levels of Data Abstraction in DBMS)

Data Abstraction



Physical Level: It is lowest level of abstraction. It describes how the data is stored in detail.

Logical Level: It is the level of abstraction and describes what data is stored and what is the relationship among that data. At the logical level, each such record is described by a type definition and the interrelationship of these record types. Database administrators work at this level of abstraction.

View Level: It is the highest level of abstraction and is defined by the user. It describes only a part of the entire database and hides the details of the logical level.

KEYS IN DBMS

Super Key

It is a set of one or more attributes whose values uniquely determine each entity.

Candidate Key

It is a set of fields from which primary key can be selected. It is a set of attributes that can act as a primary key for a table to uniquely identify each record.

Primary Key

It is a key that uniquely identifies each record in the table.

Microsoft Office

It is an office suite of inter-related desktop applications, servers and services for the Windows operating systems introduced by Microsoft in 1989. Some important application software of the MS Office are:

MS Word

It is a word processor and offers a variety of features such as speed, editing and formatting options. Some other features include spell check, mail merge and link embedding. Another feature is word wrapping, which means that the processor automatically adjusts all text within the specified margins.

MS Exce

It is a spreadsheet program which is used to present and organise copious amounts of data in a systematic manner. It also includes performs basics arithmetic operations on data and creates graphs and charts based on the same

MS Power-point

It is a popular presentation program and is used to create slideshows which comprises of text, graphics, sounds and other animated media. Features such as wordart, autosshapes etc. can also be added to the presentation. It is convenient for both school and office level work.

KEYBOARD SHORTCUTS

Computer

| Shortcut keys | Description |
|----------------|--|
| Alt + F | File menu options in current program |
| Alt + E | Edit options in current program |
| F1 | Universal help (for all programs) |
| Ctrl + A | Select all text |
| Ctrl + F | Find |
| Ctrl + X | Cut selected item |
| Shift + Del | Cut selected item |
| 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 |

File Extensions

| File Types | Extension |
|---------------|----------------------|
| Notepad | *.txt |
| Database | *.mdb |
| Executable | *.exe |
| Word Document | *.doc / *.docx |
| Spreadsheet | *.xls |
| Powerpoint | *.ppt |
| Image | *.png/ *.jpg/ *.jpeg |

MS Office

| What you want to do | What you press |
|---|---------------------|
| Bold | [Ctrl][B] |
| Change case | [Shift][F3] |
| Center Align | [Ctrl][E] |
| Copy | [Ctrl][C] |
| Cut | [Ctrl][X] |
| Delete a word | [Ctrl][Backspace] |
| Find and replace | [Ctrl][F] |
| Go to page, section, line, etc. | [Ctrl][G] |
| Go to the beginning of the document | [Ctrl][Home] |
| Go to the end of the document | [Ctrl][End] |
| Insert a hyperlink | [Ctrl][K] |
| Italicize | [Ctrl][I] |
| Left Align | [Ctrl][L] |
| New Document | [Ctrl][N] |
| Open | [Ctrl][O] |
| Open the thesaurus | [Shift][F7] |
| Paste | [Ctrl][V] |
| Print | [Ctrl][P] |
| Repeat your last action | [F4] or [Ctrl][Y] |
| Save | [Ctrl][S] |
| Select all | [Ctrl][A] |
| Select to the beginning of the document | [Ctrl][Shift][Home] |
| Select to the end of the document | [Ctrl][Shift][End] |
| Spell check | [F7] |
| Undo | [Ctrl][Z] |

NETWORKING AND INTERNET

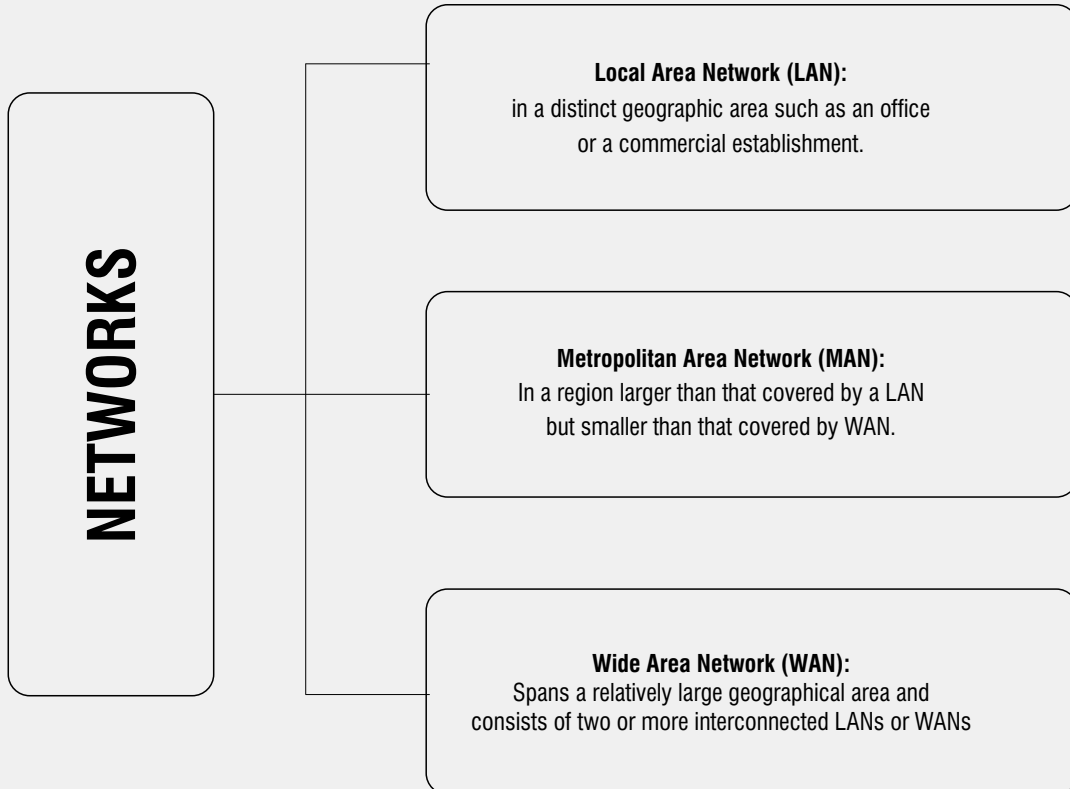
Network

A computer network or data network is a telecommunications network which allows computers to exchange data. In computer networks, networked computing devices exchange data with each other using a data link. The connections between nodes are established using either cable media or wireless media. The five components of a computer network are:

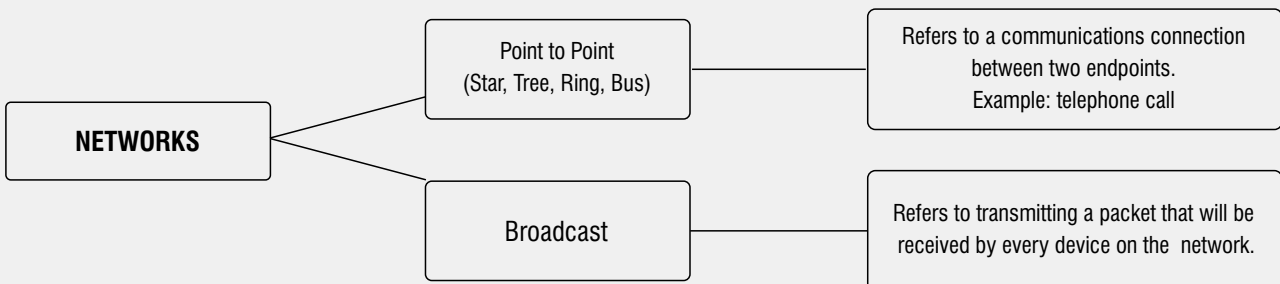
- Sender (Device)
- Sender Equipment (Modem)
- Communication Channel (Cables, Wireless)
- Receiver Equipment (Modem)
- Receiver (Device)

CLASSIFICATION OF NETWORKS

Based on Coverage Area



Based on Topology



Open Systems Interconnection Model (OSI Model)

The Open System Interconnection (OSI) model defines a networking framework to implement protocols in seven layers.

OSI Networking Model

| | Data unit | Layer | Function | Protocols |
|-------------|-----------------|-----------------|--|--|
| Host Layers | Data | 7. Application | Network process to application | NNTP, SIP, SSI, DNS,FTP, Gopher, HTTP, NTP, NFS, DHCP, SMPP, SMTP, SNMP, Telnet, |
| | | 6. Presentation | Data representation, encryption and decryption, convert machine dependent data to machine independent data | MIME, SSL, TLS, XDR |
| | | 5. Session | Inter host communication, managing sessions between applications | Sockets. Session establishment in TCP,RTP, PPTP |
| | Segments | 4. Transport | Reliable delivery of packets between points on a network. | TCP, UDP, SCTP,DCCP |
| Media Laves | Packet/Datagram | 3. Network | Addressing, routing and (not necessarily reliable) delivery of datagrams between points on a network. | IP, IPsec, ICMP, IGMP, OSPF, RIP |
| | Bill/Frame | 2. Data link | A reliable direct point-to-point data connection. | PPP, SBTv, SLIP |
| | Bit | 1. Physical | A (not necessarily reliable) direct point-to-point data connection. | X.2.5 (X.21bis, EIA/TIA-232, EIA/TIA-449, EIA-530,G.703)[9] |

Transmission Media

- 1. Network Cables:** These are used to connect computers. Most commonly used cable is RJ-45.
- 2. Distributors:** These are used to manage and distribute traffic in networks with multiple computers.
- 3. Repeaters:** Amplify and resend a received signal to maintain signal strength for transmission over large distances.
- 4. Bridge:** Connects one LAN to another
- 5. Routers:** forwards data packets along networks. Routers are placed at the interconnection of two or more networks.
- 6. Network Interface Cards (NIC):** It is a network adapter that usually comes built in the computer and without which a device cannot be connected over a network.
- 7. Universal Bus Controller (USB):** It is a type of external NIC.
- 8. Modem:** It converts digital signals to analogue and vice versa for transmission and is connected to computers.

INTERNET

It is the global computer network providing a variety of information and communication facilities, consisting of interconnected networks using standardized communication protocols (TCP/ IP).

Some applications of the internet are:

- *Instant communication (Emails, Chats etc.)*
- *File and software transfer and/ or sharing*
- *Search various databases for information (government sites, company websites etc.)*
- *Setup one's own website for commercial and/ or non-commercial purposes*

The World Wide Web commonly known as the Web or www was developed by Tim Berners – Lee in 1989 and is a system of interlinked hypertext documents that are accessed via the Internet. These multimedia pages are everchanging. Information on the Internet can be accessed using web browser (commonly referred to as a browser). It is a software application for retrieving, presenting and traversing information resources on the World Wide Web. An Internet Protocol address (also known as an IP address) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network. It acts as an identifier for a computer. It is a unique address for every computer.

COMPUTER VIRUSES

- **Cluster Viruses:** This type of virus creates the illusion that the virus has infected every program on the disk.
- **Worms:** Its purpose is to duplicate itself in the host.
- **Bombs:** It hides in the user's disk and is triggered by a specific event.
- **Trojan Horses:** It is a malicious program that appears harmless. These do not duplicate themselves on the host disk.
- **Stealth Viruses:** These viruses reside in the computer's memory and are hard to detect.
- **Macro Viruses:** It is designed to infect a specific file type.

IMPORTANT ABBREVIATIONS

1. ANSI – American National Standards Institute
2. ASCII – American Standard Code for Information Interchange
3. CGA - Colour Graphics Adapter
4. DOS – Disk Operating System
5. DVD – Digital Versatile (Video) Disk
6. EDP – Electronic Data Processing
7. HTML – Hyper Text Markup Language
8. IBM – International Business Machines
9. IDE – Integrated Device Electronics
10. MIPS – Million Instructions Per Second
11. SCSI – Small Computer System Interface
12. TCP/ IP – Transmission Control Protocol/ Internet Protocol
13. UPS – Uninterrupted Power Supply



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